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*Battle Planning and Execution*

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**Bryan W. Hallmark ♦ James C. Crowley**

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## PREFACE

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This document provides analysis results from an Arroyo Center research project investigating company-level command and control (C2) factors related to effective direct fire control at the Army's National Training Center (NTC).

This study analyzes possible problems with company-level direct fire control, terrain and enemy analysis, and command and control planning and preparation, explores how these problems affect combat effectiveness at NTC, and discusses implications for current training methods and policies. It is the third part of a RAND NTC research project that investigated battalion-level C2 issues and brigade and battalion reconnaissance issues. This research was sponsored by the Commanding General, U.S. Army Armor Center, and was conducted within the Arroyo Center's Manpower and Training Program. The Arroyo Center is a federally funded research and development center sponsored by the United States Army.

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## SUMMARY

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Success in a modern battle results from a number of different activities that coalesce within a relatively short period. One of the most crucial elements influencing the outcome of battles at the company level is how well the unit executes direct fire, that is, how well it identifies and brings to bear the effects of its direct fire weapons on enemy targets while avoiding engagement of friendly forces. Successful direct fire engagements result from more than the skill of the individual crew. The company commander has to visualize the battlefield and accordingly locate his unit so it is in a position to detect and decisively engage the enemy while itself avoiding detection and destruction. The Army leadership has been concerned about how well companies and company commanders are performing these critical skills and asked RAND's Arroyo Center to study the issue.

### WHAT WE LOOKED AT

To carry out this analysis, we examined the performance of tank and Bradley companies during training at the National Training Center (NTC) at Fort Irwin. Observations included a year of rotations, some 330 battles involving 74 companies. We designed a survey instrument to be completed by the observer/controllers (O/Cs)<sup>1</sup> who accompany the units undergoing training. The O/Cs rated companies during two major phases: (1) battle planning and preparation and

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<sup>1</sup>The Tables of Distribution and Allowance (TDA) define this position as combat trainer; however, the more common title used is "observer/controller" (O/C), and we use it throughout this report.

(2) battle execution. The items in the survey instrument were designed with an eye to answering three research questions:

- How well do units carry out planning, preparation, and execution activities that affect direct fire?
- Do direct fire control and command and control improve during the course of NTC rotations?
- What is the relationship between planning and preparation performance versus execution performance?

We also drew on other sources. We observed first-hand a considerable amount of training, accompanying company and platoon trainers or, in some cases, the OPFOR during battles. These first-hand observations provided a context for the observations recorded on the survey cards. And we interviewed a number of people, including the company commanders who were doing the training and the O/Cs who were evaluating them. We extended our interviews to former O/Cs who were serving as instructors or doctrine writers at the Infantry and Armor Schools. Much of the discussion in the interviews focused on the relation between pre-NTC training and direct fire performance at the NTC.

## WHAT WE FOUND OUT

### How Companies Plan, Prepare, and Execute

The analysis led to four major conclusions. First, companies can perform basic planning activities adequately but not complex ones. Second, companies plan better than they execute. Third, they maneuver better than they control direct fires. Finally, overall execution, particularly direct fire control, is generally inadequate.

**Planning and preparing.** Most companies performed basic activities adequately. The O/Cs rated over 60 percent of the commanders in our sample as effective at disseminating information during the operation and at positioning themselves to see the battlefield and to survive. Additionally, most company commanders appeared to possess basic planning skills, that is, those needed to produce a generally complete, timely, and clear OPORD.

However, most companies were not good at the complex planning activities associated with being able to visualize the way battles develop or those necessary to manage available preparation time adequately. Possibly the most difficult aspect of predicting the way a battle will develop is being able to visualize the result of actions with the enemy. While slightly over half of the commanders were able to adjust their company's plans because of a change in overall METT-T, far fewer reacted well to enemy fires and movement. During planning and preparation phases, few commanders appeared able to integrate terrain, enemy, and friendly factors into a vision of how the battle would flow to form an effective tactical plan. Also, few performed the more complex activities associated with effectively managing available time to prepare fully for operations or conduct the rehearsals required by doctrine.

**Execution.** Comparing planning with execution, we found that companies plan better than they execute. Overall, half of the company commanders prepared an effective plan, but only about a third were rated as effective at plan execution and mission accomplishment. Additionally, more commanders effectively planned the use of terrain than actually used it well during execution, and more company commanders effectively planned fire control measures than were able to use them effectively during operations.

**Maneuver.** Companies did better at movement and positioning than direct fire. During planning and preparation, most company commanders effectively planned for the use of terrain to facilitate protection, movement, and position (61 percent); however, ratings of effective performance on the direct fire planning activities we studied ranged from 19 percent to 48 percent. A similar pattern was apparent for execution. During the execution phase, movement and positioning activities were performed adequately by 44 to 69 percent of the companies; however, with one important exception (avoiding engagement of friendly forces), tasks associated with direct fire control were performed adequately by 25 percent or fewer of the companies. These findings suggest that commanders were more likely to emphasize, or were more adept at, skills related to movement and positioning than at controlling direct fires.

**Overall execution.** Most companies did not perform execution activities adequately. We arrive at this conclusion fully understanding

that the NTC is designed to be difficult and that the inherent difficulty will expose training weaknesses. That said, the data show that many important activities are not done or, if done, are done inadequately by most companies. In three of the most significant outcome measures in the observation instrument—execution of direct fires, plan execution, and mission accomplishment—the highest percentage of companies performing adequately was 37 percent. Execution of direct fire control had the lowest ratings of any activity category and showed the least improvement. Additionally, performance of most other execution activities was rated quite low (fire control planning, complex planning, and time management were all performed adequately by less than one-third of company commanders).

### **Improvement During Rotations**

However, units did improve during the rotation. Companies improved in 32 of the 44 items we studied, and a large majority reached a rating of “moderately adequate” or better for 32 of 44 items.

The exception to the general improvement trend is direct fire control execution. There, companies and their commanders did not attain moderately adequate levels of performance in 8 of the 12 items measured. Moreover, companies did not improve in 4 of the 9 items related to direct fire execution. Companies improved at the three overall measures of execution success; yet approximately 25 percent of the companies never rose above an inadequate level of performance for these measures.

### **Relationship Between Planning and Preparation and Execution**

Turning to the third research question, we found a strong, positive correlation between effectiveness of planning and preparation versus success at execution. The companies that executed adequately were those that conducted better planning and preparation. It is not surprising that planning and preparation relate to execution performance or that execution performance is lower than planning and preparation performance. Effective prebattle activities would be expected to give the company a good start on execution, but many fac-

tors could prevent success, even with effective planning and preparation.

## **IMPLICATIONS OF WHAT WE FOUND OUT AND RECOMMENDATIONS**

Our results point to the need to improve pre-NTC company training—that is, the training that takes place in Army schools and at home station. Pointing out a need for improvement is of limited helpfulness. More important is to determine affordable and effective ways to make improvements.

Some of the data suggest that affordable improvement is possible. Many performance ratings are reasonably good, and performance in weak areas improves during the rotation. Also, we found a positive relationship between better planning and preparation and execution. Although our data do not allow a direct conclusion in this area, we infer that improvement may be possible with revised training methods, especially better leader training.

Because the data provide limited direct information about pre-NTC training, we discussed our findings with several groups of experienced Army trainers to get their views on how areas of weakness could be improved. These experts pointed to several potential approaches for cost-effective improvement. Although doctrinal publications were viewed as generally adequate, most of the trainers believed that company- and battalion-level doctrinal publications could have improved coverage of direct fire control and complex battle planning. Many felt that the institutional training courses for company commanders were not able to train critical skills, because there was insufficient opportunity for multiple iterations in which officers could actually implement a plan and learn from mistakes.

All of the trainers pointed to home station leader and collective unit training as the area most needing improvement. In their view, home station leader training is seldom conducted, and collective field training exercises are rarely sufficiently demanding and often not fully effective. Many believe a possible fix to this problem is to have institutional courses for company, battalion, and brigade commanders include more coverage in how to conduct home station training exercises, thus improving pre-NTC training at home station.

Based on our data and the views of those we interviewed, we make the following recommendations. Most important is implementing a more structured program for training commanders to plan and execute more effective home station leader and unit training. We believe simulations could be better used to train company commanders in fire control and battle visualization skills, both in institutions and at home stations. We also see a need to improve doctrine in the area of fire control and battle visualization. Finally, home station training needs re-evaluation to determine how to improve the tactical proficiency of companies and their commanders.

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## ABBREVIATIONS

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AAR	After Action Review
AOAC	Armor Officers Advanced Course
AOBC	Armor Officers Basic Course
ARTEP	Army Training and Evaluation Program
BCTC	Battle Command Training Center
BFV	Bradley Fighting Vehicle
BLUEFOR	Blue Forces (friendly forces)
CGSC	Command and General Staff College
C2	Command and Control
CAS3	Combined Arms and Services Staff School
CMTC	Combat Maneuver Training Center
Co	Company
CTC	Combat Training Center
DF	Direct Fire
EA	Engagement Area
FIST	Fire Support Team
FM	Field Manual
IOAC	Infantry Officers Advanced Course
IOBC	Infantry Officers Basic Course

IPB	Intelligence Preparation of the Battlefield
IV	Intervisibility
JRTC	Joint Readiness Training Center
LD	Line of Departure
LOS	Line of Sight
METT-T	Mission, Enemy, Terrain, Troops Available - Time
MILES	Multiple Integrated Laser Engagement Simulations
MTP	Mission Training Plan
NTC	National Training Center
O/C	Observer-Controller
OPFOR	Opposing Force
OPORD	Operations Order
POM	Program Objective Memorandum
SOP	Standard Operating Procedure
TAF	Tactical Analysis Facility
TDA	Tables of Distribution and Allowance
TF	Task Force
TRP	Target Reference Point

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**INTRODUCTION**

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**BACKGROUND**

In combat, a company commander's main responsibility is to maneuver his unit to accomplish its mission as determined by the battalion task force commander, thus improving the likelihood of task force success. Many factors can affect the company commander's ability to achieve his mission; these include, for example, the quality of the task force (TF) plan, the number of combat systems available to the company, the training level of his subordinates, and the availability of supplies. One factor that significantly affects a company's success is the quality of command and control.

Command and control involves the company commander directing the shooting, moving, and reporting of his company. At the most basic level, land combat operations involve direct fire engagements between small units. Although higher echelons set the conditions to ensure success in these engagements, the ability of small units to win them is a basic measure of an army's combat skill, and the ability of small units to win engagements depends on their capability to engage their enemy with their own weapons while avoiding enemy fires.

It follows, then, that control of direct fires, or the process of directing the acquisition and engagement of targets by direct fire systems, is critical. Numerous sources have highlighted direct fire control as an

area in which Army units have to improve.<sup>1</sup> For armor and infantry maneuver companies, the execution of direct fires may be the most critical function in accomplishing their mission. If maneuver companies execute direct fires ineffectively, the overall effectiveness of the combined arms effort is jeopardized.

So because direct fire control is a demonstrated weakness and critical to the success of many types of Army missions, we explore direct fire planning and execution in depth in this study. We first examine information pertaining to direct fire control, enemy position, terrain analysis, and general command and control that a company commander cognitively processes and then disseminates to his subordinates. We then explore the relationship of this information to company success by examining the performance of the Army's most basic combined arms unit, the tank and mechanized infantry company team, at the Army's National Training Center (NTC) at Fort Irwin, California.<sup>2</sup>

### COMPANY TEAM ORGANIZATION<sup>3</sup>

Company teams are the smallest combined arms and services organizations normally formed during the course of combat operations. Tank and mechanized infantry companies are each composed of three organic tank or mechanized infantry platoons and a headquarters.<sup>4</sup> During combat operations, company teams are normally formed by exchanging tank and mechanized platoons between companies to form small units with a mix of tank and infantry capabili-

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<sup>1</sup>Infantry School, Handbook SH-7-45, *Fire Planning Handbook*, Fort Benning, GA, June 1993, pp. ii; Center for Army Lessons Learned, *CTC Trends: NTC 4QFY94*, Fort Leavenworth, KS, 1994, p. 5; Center for Army Lessons Learned, *CTC Quarterly Bulletin: 3d QTR, FY98, No. 95-8*, Fort Leavenworth, KS, June 1995, p. 21.

<sup>2</sup>The company team is an organization commanded by a captain. It has a flexible mix of tank and mechanized infantry platoons but generally has a strength of from 50–120 soldiers and 10–20 fighting vehicles. The document that describes the methods by which company teams perform combat operations is Army Field Manual (FM) 71-1.

<sup>3</sup>The following three sections of this chapter summarize basic information on company team operations and direct fires that is familiar to armor and mechanized infantry officers but may be unfamiliar to other readers.

<sup>4</sup>A mechanized infantry platoon is led by a lieutenant and has two Bradley Fighting Vehicle (BFV) sections, each with two BFVs and two infantry squads of nine dismounted soldiers. A tank platoon is also led by a lieutenant and has four tanks.

ties. The company headquarters has attached medical and maintenance support and evacuation teams. Additionally, each company team is assigned a Fire Support Team (FIST) responsible for coordinating and directing artillery and mortar fires to support the company team operation.

Company teams can be given a variety of offensive, defensive, and other tactical missions, but all generally involve movement or positioning of tanks and Bradley Fighting Vehicles (BFVs) to locations where their firepower can be used to destroy the enemy or prevent his movement.<sup>5</sup> With regard to mission execution, the Army's principal publication to guide the conduct of company team operations, FM 71-1, *Tank and Mechanized Company Team*, describes the company team's ability to fight and perform assigned missions as a combination of four elements of combat power. These elements are

- Maneuver, the movement of forces supported by fire to gain a position of advantage from which to destroy or to threaten the destruction of an enemy;
- Firepower, the destructive force to defeat an enemy's ability and will to fight;
- Protection, the conservation of a force's fighting potential; and
- Leadership, the skill to combine the first three elements.

The difference between winning and losing company team engagements does not depend only on the ability to perform a prescribed set of tasks correctly but also on the ability to combine the above combat elements, maximizing the likelihood of success.

## COMMAND AND CONTROL

Command and control is defined as the process through which the activities of military forces are directed, coordinated, and controlled

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<sup>5</sup>Direct fires are those aimed along a line of sight (LOS) by crews who directly see the target. Fires may also be indirect, such as those provided by mortars and field artillery. The crews of indirect fire weapons do not aim their weapons at a target they can see. Instead they place fires on a location based on instructions from a fire direction center. They lay the weapon at a direction and elevation and adjust the amount of propellant used per orders of the fire direction center.

to accomplish the mission.<sup>6</sup> Experienced observers agree that command and control of company team operations during combat is extremely difficult. The task itself is complex. It involves planning and preparation activities as well as direction and control during the operation. The requirements of the company team's mission, the enemy's capabilities, the effect of terrain and weather, the capabilities of the company teams and other friendly elements, and the impact of time are all important factors, and they provide a multitude of combinations to be considered.

Furthermore, the conditions under which combat command and control is executed can be described as chaotic. Combat is characterized by a "fog and friction" that is hard to appreciate fully without actual experience. Leaders can be tired, there may be some level of fear among company members, reports can be inaccurate or late, mistakes can be made, activities can take far longer than anticipated, and so forth, as is to be expected whenever humans operate in a complex and dangerous situation. Additionally, the tactical effects of terrain may not be readily apparent from a map, and the enemy will do his best to hide and deceive.

According to tactical doctrine, company team command and control processes include planned activities as expressed in the commander's operations order (OPORD), normally given before the start of the operation. The OPORD is the plan for the company's battle, and the company commander creates it by incorporating the orders received from the task force, information from the task force (e.g., reconnaissance information), and his experience and skill regarding all aspects of METT-T and weapon systems.<sup>7</sup> In addition, command and control includes preparation activities such as rehearsals conducted after the OPORD but before the start of the operation, standardized activities as outlined in written or understood standard operating procedures (SOP), and directions given during the conduct of the operation (e.g., via a voice radio, hand signals, or digitally transmitted information).

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<sup>6</sup>FM 101-1-5, *Operational Terms and Symbols*, pp. 1-16.

<sup>7</sup>METT-T means Mission, Enemy, Terrain, Troops available, and Time. The term METT-T thus defines the basic factors of the tactical situation the commander is expected to convey to his subordinates.

Effective command and control is decisively important in direct fire engagements, because it provides for increased reaction, better arrangement of forces, and more effective use of terrain and other battlefield efficiencies that are so important to company success.

### **COMPONENTS OF DIRECT FIRE CONTROL**

Fire control is a subset of the overall process of command and control. Its purpose is to control when and where to shoot as well as to place restrictions on engagements to protect friendly elements or noncombatants. The principles for fire control as well as methods for controlling fires are outlined in Army doctrine and training publications. A necessary step is to define the function of direct fire control, because although this function is discussed in doctrinal and training publications, it is not specifically defined. For the purposes of this study, we define direct fire control as “the process of directing the acquisition and engagement of targets by direct fire systems.” The use of direct fires is more than an enabler for the company to accomplish its tactical mission; it is a primary reason for company employment on the battlefield. The tactical influence of a company team is not simply where it is located, but where and when it can place its direct fires.

This research defined two basic components of both the command and control process and of the direct fire control process during company-level training at NTC. The two components correspond to two broad phases of the operation—planning and execution. During the planning phase, the commander assigns tasks and missions for subordinate elements, which include responsibilities for acquisition and engagement of enemy weapon systems, the company commander’s intent, and the company’s mission as defined by the task force. Units prepare to execute the mission, the plan is refined, and rehearsals are conducted to ensure understanding of the plan and how it will be executed by all members of the company. Also, specific preparation activities such as boresighting, maintenance, and other troop-leading procedures are conducted.

The second component, execution, covers the activities during the battle. During this phase the commander must monitor the operation for changes to the battlefield and determine their number and impact, including changes to METT-T. These changes, in most bat-

tles, will require the plan to be slightly or heavily modified. At company level and below, the need for adjustment or change is normal, especially during offensive operations, and will occur even when planning was well done, given the dynamic nature of battle. Adjustments such as formation changes, platoon moves to alternate or supplementary positions, shifts in sectors of fires or engagement priorities, compensation for casualties, and many other similar actions are in most cases necessary for the company.

## RESEARCH QUESTIONS

This research focuses on the planning and execution of direct fires. That is, what critical pieces of information or activities are most closely associated with proper placement of direct fires on the enemy? If a company commander provides his subordinates with good direct fire control measures, prepares good plans for battlefield command and control, and conducts and disseminates a good terrain and enemy analysis, the company should be better able to execute its assigned tasks and mission.

To study the area of direct fire control, we formulated three research questions.

- What is the overall performance of tank and mechanized infantry company teams in planning and executing direct fire engagements at NTC? This analysis aims to identify which activities at company level are being performed well and to collect quantitative evidence suggesting areas for company-level improvement.
- Do companies improve in fire control and command and control required for effective placement of fires during the course of an NTC rotation?
- What is the relationship of various planning and preparation activities to company mission accomplishment and direct fire execution? Specifically, does the quality with which companies plan and prepare covary with ratings of execution?

## REPORT ORGANIZATION

The remainder of this document is divided into three chapters. Chapter Two describes the research methodology and the NTC training environment as it applies to the study of company team operations. Chapter Three details the analysis and results from the data. Finally, Chapter Four summarizes key findings and their implications for training company commanders and company teams. The report has several appendixes:

- Appendix A presents the offense and defense survey instrument.
- Appendix B chronicles company performance by battle.
- Appendix C presents results about the quality of planning, preparation, and execution performance by company.
- Appendix D shows the improvement trends in planning and execution.
- Appendix E shows the relationship between planning and preparation factors and execution items.

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**STUDY METHODOLOGY**

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This chapter describes the rationale for using the NTC as a source of data, how the observation instrument was generated, how observations were made, during what time frame, and how many companies were observed.

**USING THE NATIONAL TRAINING CENTER (NTC) AS A SOURCE OF DATA**

The NTC, as one of the Army's Combat Training Centers (CTC), plays a critical role in training strategy for heavy forces stationed in the United States. Located in California's Mojave Desert, the NTC has the mission of providing battalion- and brigade-level force-on-force maneuver and live fire training exercises for units. The objectives of this training are to increase unit readiness, train leaders, embed doctrine throughout the Army, provide feedback to the Army, and provide a data source for lessons learned.<sup>1</sup>

During the period of our observations (1993–1994), each heavy maneuver battalion in the United States went to the NTC about once every two years or once during its commander's tour. During a rotation, a battalion moved to the NTC and drew equipment as if arriving overseas with prepositioned equipment in place. The actual maneuver and live fire training exercises were conducted over 14 days divided into three training periods. While the exact scenario differs somewhat for each unit, a typical rotation would be divided as fol-

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<sup>1</sup>Army Regulation 350-50, *Combat Training Center Program (CTC)*, 24 May 1995.

lows.<sup>2</sup> One period (either the first or second for each battalion) is five days of live fire training involving three battles: a day defense, a night defense, and a day offensive mission. A second period consists of six days of battalion force-on-force training executed under the control of the parent brigade. During this period, the battalion has two offensive and one defensive mission. The final period is a three-day deliberate attack with both battalions operating under control of their parent brigade. The first day is a preparation day, and the second and third days are the execution of the attack and its continuation.<sup>3</sup>

To support this mission the NTC has a large maneuver area that is almost unrestricted by maneuver limitations, a dedicated and highly proficient opposing force (OPFOR) composed of an active Army regiment trained to fight combat missions using doctrine based on doctrine of the former Soviet Union, and a dedicated training organization, the NTC Operations Group, with a strength of approximately 750.

During their assignments at the NTC, the observer-controllers (O/Cs) who accompany the units being trained have a unique opportunity to study doctrine, observe many different units participating in training events, and discuss issues with other O/Cs and leaders of the Blue Force (BLUEFOR) units. These O/Cs are able to capture many aspects of a training unit's activities that are not or cannot be captured by the NTC's instrumentation system. In addition, the O/Cs are expert observers, with experience at the positions of the staff, leaders, or commanders they accompany. This experience can provide O/Cs with considerable insight on what and how well tactical functions are accomplished by companies. Because the NTC is the best peacetime environment to study direct fire planning and execution, and because the O/Cs are able to observe events that others and

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<sup>2</sup>This description was true while data for this study were being collected. Later the sequence was changed. Currently all maneuver and live fire exercises are conducted under brigade control and include the full brigade.

<sup>3</sup>Additional discussion of conducting studies at the NTC can be found in Jon Grossman, *Conducting Warfighting Experiments at the National Training Center*, Santa Monica, CA: RAND, DB-133-A, 1995.

instrumentation cannot, our main data-collection effort was a direct fire observation instrument for O/Cs to complete.<sup>4</sup>

### DEVELOPMENT OF THE DIRECT FIRE OBSERVATION INSTRUMENT

We designed the items on the survey to measure aspects of company-level planning, preparation, and execution that O/Cs can observe; thus we anticipate that the surveys will be able to provide reliable and valid data. The planning and preparation section of the survey was designed to gather information on how well the company commander develops his plan and provides his subordinates with information on terrain and enemy analysis, direct fire control measures, and general command and control measures that are required to visualize the battle. It also rates how well the company plans and prepares for battle in general. We constructed the execution section of the survey to gather information on a company's use of terrain, reactions to the enemy, command and control, direct fires placement, and overall mission success. The survey instrument had to meet several criteria: it had to contain items that were meaningful to this study and that the O/Cs could readily observe in their normal duties, and it had to be succinct enough to not overly burden the O/Cs.

The survey uses a six-point scale, with these scale values: 1 = none, 2 = inadequate, 3 = moderately adequate, 4 = adequate, 5 = superior, and 6 = N/A, not appropriate. The O/Cs were asked to complete the rating scales according to the following guidelines.<sup>5</sup>

- **1—none.** The action or activity was *not done* but should have been done.

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<sup>4</sup>There are limitations to the study of direct fire control at the NTC. Most involve the inability of Multiple Integrated Laser Engagement Simulations (MILES) to fully portray the combat effects of direct and indirect fires. However, we designed this study so that these limitations would not affect our findings. Specifically, the study does not use MILES-dependent data but instead relies on investigating tactical skills and procedures that would be causally linked to battle success that O/Cs could observe.

<sup>5</sup>In all our discussions with O/Cs representing the three O/C training teams that participated in the study, they uniformly agreed that these scale definitions were used.

- **2—inadequate.** The action or activity was accomplished but was *so incomplete* or poorly done as to be ineffective.
- **3—moderately adequate.** The action or activity was accomplished and was *partially* complete and/or done in a partially effective manner.
- **4—adequate.** The action or activity was done in a *generally* effective and complete manner.
- **5—superior.** The action or activity was completely performed in a *fully* effective manner.
- **6—N/A, not appropriate.** The action or activity was not appropriate (i.e., not necessary) for this operation.

We developed our survey instrument in the following way. First, based on our observations of NTC exercises, discussions with O/Cs, and a review of doctrine, we generated a list of critical elements and included them in a test version of the survey. We then asked various members of the NTC Operations Group to comment on this test version. A revised version was also filled out by the Mechanized Infantry O/C group for one rotation. We then met with the O/Cs who used the test version and, based on their comments, made some minor adjustments to the instrument. Finally, we inspected the completed test versions to see that O/Cs had completed all items and that no unusual response patterns existed. (Appendix B contains the final versions of the survey for defensive and offensive exercises.)

#### **HOW OBSERVATION INSTRUMENTS WERE COMPLETED, WHEN, AND THE COMPLETENESS OF THE DATA COLLECTION**

O/Cs were able to provide the information on our survey as part of their normal duties. Because it is part of a company O/C's duties to observe a company commander's planning process and his company's preparation activities as well as to monitor the company's execution of its plan, no further instructions on how to complete the survey were required. While the ratings that O/Cs provide could be considered "subjective" evaluations of companies, a number of conditions surrounding the evaluations make them more objective than they might first appear. First, O/Cs spend much time observing

actual planning, preparation, and execution activities of the companies, so the ratings are not simply evaluations, but recordings of observed behaviors. Second, the O/C teams frequently discuss among themselves and with other O/C teams what they observe, and how they observe their counterparts. Third, most of the items on the survey were designed so that they were directly observable by an O/C. Last, for items not directly observable (e.g., Did the subordinates understand the company commander's plan?), the O/Cs would take special actions to answer them, such as asking the commander's subordinates details about the plan to assess how well they understood it.

Data were collected from November 1993 through November 1994. During this time, 22 heavy battalions and/or cavalry squadrons went through rotational training at the NTC, which equates to 82 companies or troops and 656 company-size battles. We collected 338 surveys, i.e., 338 company-level battles. Of these original 338 surveys, 8 were not included in any analysis because they were more than 50 percent incomplete, yielding a total of 330 surveys. These 330 surveys included data from 20 task forces and 74 companies.

### **Observation Visits**

During the study we made numerous visits to the NTC to observe training. Our general practice was to "ride" with company or platoon O/Cs for 2-4 days observing 1 to 3 battles. On several occasions we accompanied the OPFOR to observe training from their perspective and discuss command and control and fire control topics with their leaders. We also observed several battles from the Tactical Analysis Facility (TAF) at the NTC. In total, we accompanied O/Cs to observe 21 different BLUEFOR company teams and were able to ride with O/Cs from each of the heavy maneuver training teams (Tank, Mechanized Infantry, and Live Fire). We observed each type of offensive and defensive battle at least once, both in live fire and force-on-force. We accompanied the OPFOR six times and observed battles from the TAF five times.

Although these visits were not part of the formal data-collection effort, they provided us with two opportunities. First, our visits allowed us to ensure that the surveys were completed accurately and to answer any O/C questions. Second, we were better able to under-

stand the nature of the training conducted at the NTC and in turn have richer insight for interpreting the data analysis results. Specifically, we were able to observe multiple company- and platoon-level orders, battles, and formal after-action reviews (AAR). In addition, we were able to view informal coaching/teaching sessions among O/Cs, companies, and their commanders. We also utilized our field time at NTC to observe training methods in general and to discuss training and tactical topics with the O/Cs, OPFOR leaders, and company commanders.

In this chapter we present the results of the analyses designed to address the three research questions. First, we provide the findings for the general levels of performance observed at the NTC, dividing these between two categories: (1) planning and preparation and (2) execution. These two categories are further subdivided as shown in Table 3.1.

Following the results from the planning and preparation and execution analyses, we detail results of the analysis used to determine whether companies improve their performance during the rotation. Last, we present the analysis of the relationships of the planning and preparation activities to those of execution.

### **GENERAL PERFORMANCE**

To assess the level at which companies and their commanders are now performing direct fire planning and preparation and execution, we asked: What is the general performance level of direct fire and related skills for mechanized infantry and tank companies in the active Army at present? The analysis determines the percentage of companies that performed adequately or inadequately for each activity on the observation instrument.

To ensure that the average scores are fairly stable estimates (i.e., a proper representation) of each company's performance, the analysis includes only the scores from companies with data for three or more

battles.<sup>1</sup> This procedure yielded a sample of 52 company commanders from which to establish the performance levels of companies.<sup>2</sup> This analysis does not discriminate between the defense or offense.<sup>3</sup> (An additional analysis in Appendix B shows the results by offense and defense.)

The values reported are the average of all battles for a company. These averaged values are then placed into the following categories: an activity was scored “performed inadequately” if its averaged value was less than or equal to 2.499; it was scored “performed adequately” if the averaged score was equal to or greater than 2.5. “Performed well,” a subset of the “performed adequately” category, was given when the averaged values were greater than 3.<sup>4</sup> All the average values across the three categories for each item appear in Appendix C

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<sup>1</sup>We conducted analyses to determine if there were significant differences in ratings of companies that could be explained by observations from live fire or force-on-force training. For more than 95 percent of the items there were no statistically significant differences explainable by differences due to these two types of training events. Also, in follow-up discussions with O/Cs from both live-fire and force-on-force training teams, the O/Cs agreed that their teams do have varied means of gathering and reporting data about their counterparts in general, but when rating company commanders on our survey they used similar scales of judgment.

<sup>2</sup> A total of 96 companies participated in the 12 rotations examined. However, as discussed in Chapter Two, we did not get survey instruments from all O/Cs.

<sup>3</sup>For most of the analyses in this report we do not discuss differences in results for offensive and defensive battles. Because of the training structure at NTC, we usually observed units in only one force-on-force defense but in multiple offenses. Because of the confounding nature of having just one defense observation, there could appear to be differences between offenses and defenses even though the apparent difference is seen only because units have the chance to practice and score better for offenses than for defenses. The reverse could also be true: Defenses might look better because we sample them only once, so errors that could manifest over multiple battles (as could occur in the offenses) do not emerge. For example, if we were to find that units performed better in the offense than the defense (or vice versa) for certain items, we could not definitively state that the difference came about because (1) offensive and defensive missions are different or (2) units received only one opportunity to plan, prepare, and execute a defense. Differences could not be attributed to battle type. Often we do include results for both offenses and defenses in tables for interested readers; however, we *strongly caution* against making any assumptions that apparent differences are due to battle type.

<sup>4</sup>This grouping is a fairly liberal interpretation of “performed adequately,” in that a unit or commander only needed to have an average value between inadequate and moderately adequate or better. We chose this strategy to ensure that reported performance levels would not be underestimated if a unit or commander had good performance overall but one poor battle performance that could lower the average.

Table 3.1

**Activities and Tasks Included in Planning and Preparation and Execution**

Category and Subcategory	Activities and Tasks
Planning and preparation	
Task force activities	Sufficiency and timeliness of the task force operations order.
Basic planning tasks	Lower-level, basic planning tasks of issuing the order, conveying METT-T, and so forth.
Complex planning tasks	The more complicated planning tasks of integrating two or more elements such as terrain analysis to determine locations of obstacles, fire sacks, etc.
Movement and positioning	How well the scheme of maneuver uses terrain to protect the unit and facilitate direct fire.
Direct fire planning	Use of direct fire control measures such as engagement areas and target reference points.
Preparation	Rehearsals, use of time available.
Execution	
Command and control	Updating platoons, how well they work together, reporting.
Move and position	Company commander's directing movement of platoons and positioning himself where he could observe battlefield.
Reaction and adjustment	Company reaction to changes in METT-T and movement of fires or position.
Direct fire control	Company employment of direct fire control measures.
Overall	Effectiveness of execution.

for planning and preparation and execution. For the remainder of this general performance section we report the percentages of companies and commanders who on average exhibited adequate levels of performance.

It is possible to analyze the data over all battles rather than by company; however, an over-battle analysis could bias the results. The results generated from an over-battle analysis do not take into account that some companies perform consistently better than others; therefore, if some companies are overrepresented in our data, then the results of general performance are skewed because there are either more low-performing or high-performing companies in the

data. To account for this overrepresentation effect, we look at the level of performance by company. Company-level analysis has the additional benefit of providing the percentage of companies and company commanders who performed well at the NTC, as opposed to the over-battle percentages. For those readers interested in a by-battle analysis, it appears in Appendix B.

### **Planning and Preparation Activities**

**Task force activities.** In considering the quality with which a company plans, prepares, and executes a mission, we must first take into account the timeliness and sufficiency of the task force (TF) OPORD. If a task force does not provide a plan with sufficient detail for a company to plan, or the if order is received by the company too late, the quality of a company's planning and preparation could suffer. The orders arrived in time to allow the companies to prepare (81 percent of the companies received timely TF orders) and contained adequate information to enable the company commander to plan, prepare, and execute his mission (60 percent of the companies consistently received adequate or better TF OPORDs).<sup>5</sup> This means that although most companies received complete, timely OPORDs, 20 percent of companies always received their orders late and 40 percent received orders with less than adequate information. For these units, their capability to plan and execute was degraded.

**Basic planning activities.** Figure 3.1 displays the results of the activities associated with basic planning. Most companies performed the four basic tasks in this category adequately.

Seventy-three percent of company commanders consistently issued their orders in time so that the company could plan, prepare, and execute. If the OPORDs are issued in a timely manner at the company level, the next question is, Do the company commander's subordinates understand the plan? If we found that subordinate elements of the company did not understand a plan, then the quality of the plan may not have a large effect on company success. Looking at Figure

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<sup>5</sup>An important distinction to point out is that the TF OPORD detail and sufficiency item does not measure the overall quality of the TF OPORD. It determines whether the TF OPORD had sufficient detail to enable a company commander to plan, prepare, and execute a company-level mission, not whether the TF OPORD was a winning plan.

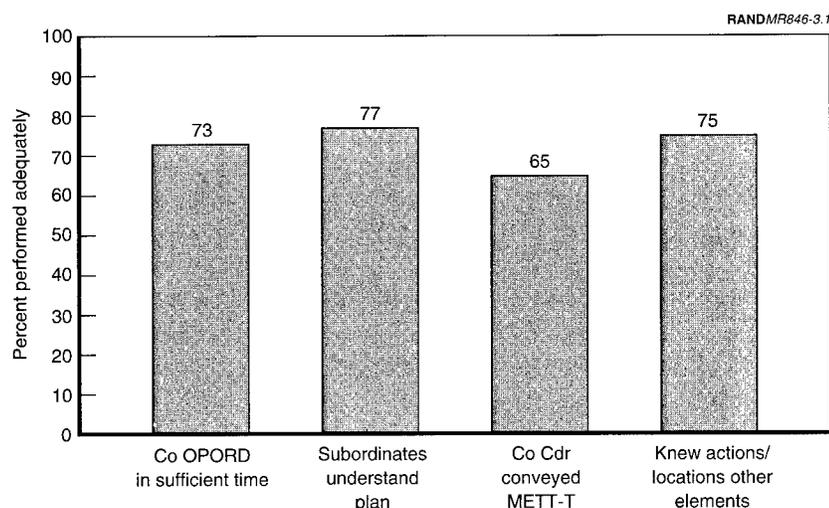


Figure 3.1—Basic Planning Activities

3.1, we see that in most companies (77 percent), the subordinates on average understood the commander's purpose, task, and concept. Further, the majority of company commanders satisfactorily conveyed METT-T to subordinates (65 percent), and a large number (75 percent) did a good job incorporating the position and activities of other elements of the TF into their plans. Thus, the majority of company commanders issued reasonably complete orders in a timely manner, and most company subordinates understood the plan.

**Complex planning activities.** Although the companies generally did the basic planning activities well, that is not the case for a second set of planning activities in Figure 3.2. We call this second set *complex planning activities* because they demand more of the commander than the set of planning activities examined previously. To be done well, they require the commander to visualize the way the battle can develop and oblige him to integrate two or more elements of METT-T to do this. Moreover, five of these activities ("discuss likely contingencies," "actions on contact," "review reporting requirements," "possible events synchronized with control measures," and "procedures for reorganization/consolidation and shifting of fire") require the commander not only to visualize the way the battle can

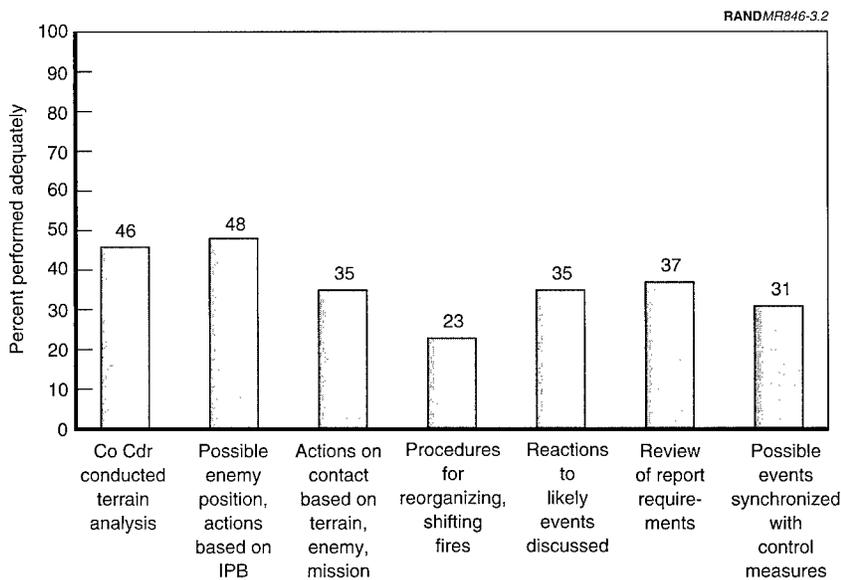


Figure 3.2—Results of Complex Planning Activities

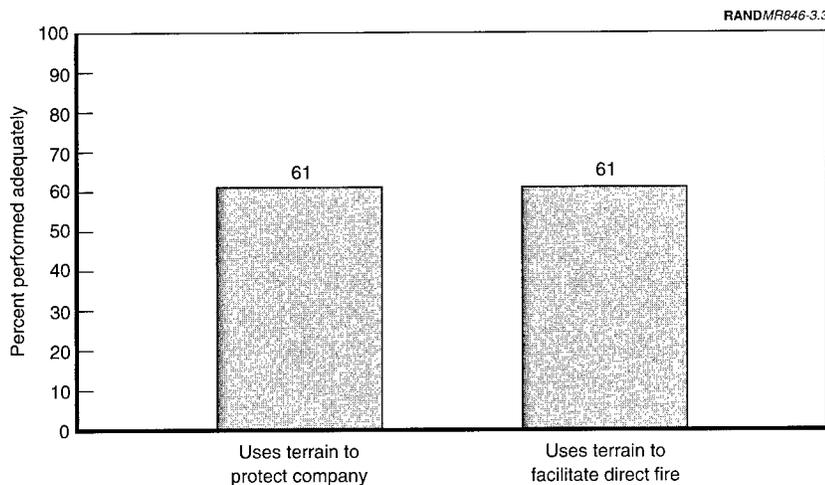
develop but also to plan reactions for these developments. Doing them well takes a higher level of proficiency than those in Figure 3.1.

As would be expected, the percentage of commanders performing these activities adequately is far lower than for the basic planning activities. For most of these measures, less than half of the company commanders were rated as planning these activities adequately. This indicates that most pre-NTC training, while sufficient to train more basic planning tasks, is not adequate to train these more difficult activities. Only one-third of the company commanders were rated as planning their reactions adequately. Based on the observed correlation between these activities, the same company commanders who did one activity well were the ones who did the others well.<sup>6</sup> That is, only one-third of the commanders observed consistently produced good plans to react on the battlefield.

<sup>6</sup>The correlation coefficients among these items ranged from .50 to .75, and were all significant at  $p < .05$ .

**Movement and position.** Commanders seem to be reasonably skilled at planning movement and positioning, that is, the use of terrain to protect the company and facilitate its direct fire activities. As the results depicted in Figure 3.3 show, 61 percent of the companies performed both of these activities well.

**Direct fire planning.** Figure 3.4 contains the results for the direct fire planning measures. These activities are not crew- or platoon-level skills, but result from the commander's cognitive skill in processing direct fire planning elements. Seven of the nine activities pertain to direct fire control measures during the planning and preparation phase. Not taking these measures shows a lack of direct fire planning skills because these measures are used to communicate to subordinates the overall concept for using direct fires and when, what, and where to shoot. Thus, adequate use of direct fire control measures shows the overall degree to which the plan outlines employment of direct fires.<sup>7</sup> Out of the nine measures in Figure 3.4, all were per-



**Figure 3.3—Results of Movement and Position**

<sup>7</sup>It is not necessary for a commander to use all fire control measures shown on Figure 3.4, as long as a sufficient number are used to outline a concept for the use of fires and to tell subordinate units when and where to shoot. Our observation instrument provided an option for the O/C to mark "not appropriate" or "N/A." We verified that the O/C would give an N/A rating when a fire control measure was not used, but not necessary to use, because of the overall adequacy of fire control measure usage.

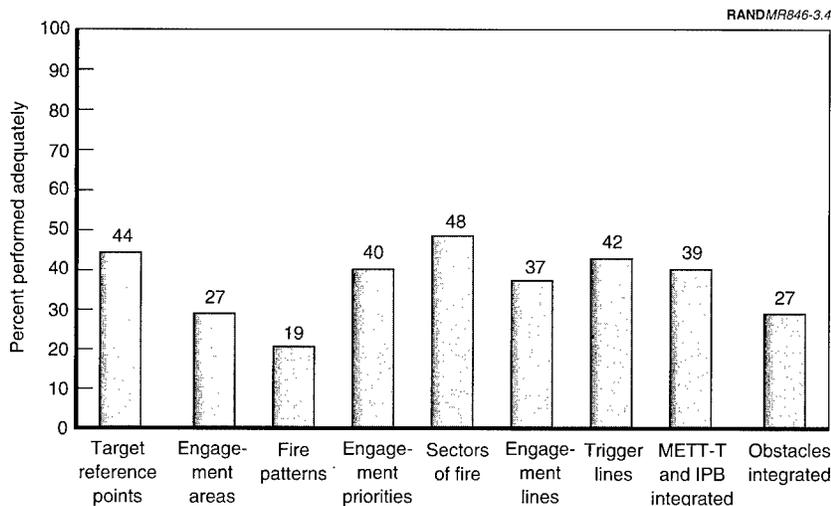


Figure 3.4—Results of Direct Fire Planning

formed inadequately by half or more of the companies in this study. Many of the skills related to producing a direct fire control plan were not done adequately by many of the company commanders observed. Only 19 percent of the company commanders did a good job of including fire patterns in their plans, and 27 percent effectively integrated obstacles with their direct fire plan. Thus, commanders were less proficient at planning direct fires than at basic planning and planning for positioning and movement.

**Preparation.** As can be seen in Figure 3.5, except for “boresighting relative to expected engagement areas,” less than half of the companies performed preparation activities adequately. Overall, most companies did not regularly maximize the available preparation time (40 percent managed time well).<sup>8</sup> For example, only 21 percent of companies consistently conducted good rehearsals. While many

<sup>8</sup>This is not a measure of whether companies were given a sufficient amount of time to plan and prepare, but instead whether, given the amount of time units had to plan and prepare, they best used the time. With respect to having had enough time to plan and prepare, it should be remembered that 81 percent were issued an OPORD with sufficient time to plan, prepare, and execute.

units on average were boresighting with respect to engagement area ranges, fewer consistently checked their weapon systems' line of sight and placement. Only 46 percent of companies observed performed consistently good inspections to determine if they had a good line of sight between their weapon or battle positions and engagement areas. Related to this finding is the fact that less than half of the companies (48 percent) consistently developed good weapon positions with respect to the physical specifications and terrain placement of the positions.

Why did more companies do a better job boresighting to expected engagement areas (EAs) than the other preparation activities? One possible reason is that boresighting is a crew-level activity, less dependent upon the company commander's plan, whereas weapon placement, line of sight, maximizing time, and conducting rehearsals depend more upon the commander's plan and effective use of time than on crew-level skills. Thus we find that, like fire planning and complex planning, management of preparation activities is a general area of company weakness.

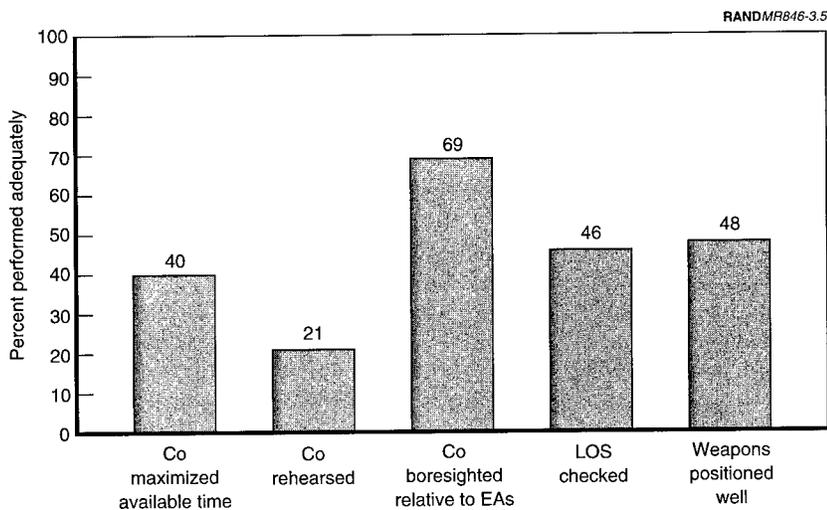


Figure 3.5—Results of Preparation

### Execution Activities

The results reported thus far pertain to planning and preparation activities. We now turn to the execution categories.

**Command and control.** Figure 3.6 contains the results of the analysis of items related to basic command and control activities. Activities in this category pertain to how well the platoons were kept up to date with important information, how well they worked together, and how well the platoons reported to the company.

By and large, the reporting results are positive, with over 60 percent of companies doing these activities adequately or better. The platoons were updated with important information (77 percent), and they worked well together.<sup>9</sup> They also did a good job of commu-

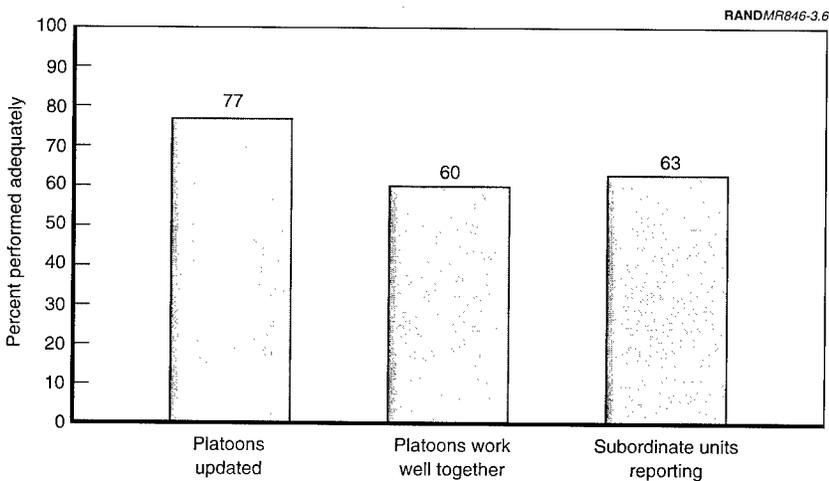


Figure 3.6—Results of Command and Control

<sup>9</sup>Some may question how an O/C was able both to observe and to attend to the radio communications. All the O/Cs we spoke with before and after data collection agreed with respect to how they gather data about unit reporting. In most cases, a company O/C listens to his counterpart's radio communications with his platoons as well as with the TF. In addition, as a secondary observer or backup of the company radio net, the company O/C assigns one or more of the platoon O/Cs who work for him to listen to the company net communications during execution.

nicating information to the commanders during execution (63 percent).

These high numbers of companies showing good reporting during execution are interesting when we consider that only 37 percent of them consistently did a good job of reviewing reporting requirements (Figure 3.2). The most likely explanation for this pattern of findings is that companies may not need to review reporting procedures because they are well ingrained into the SOP, or that the platoons are well trained in reporting.

**Move and position.** Several items on the survey were designed to assess how well companies maneuvered, in particular how they used terrain and engaged the enemy. The results for these items are found in Figure 3.7. As can be seen in this figure, the majority of company commanders consistently exhibited good control of movement (69 percent) and positioned themselves on the battlefield to see and survive (65 percent) during execution. The other two items in Figure 3.7 relate to how well company commanders used the terrain to assist in the companies' maneuver. The results show that 44 percent of the companies on average were good at using the terrain both to protect

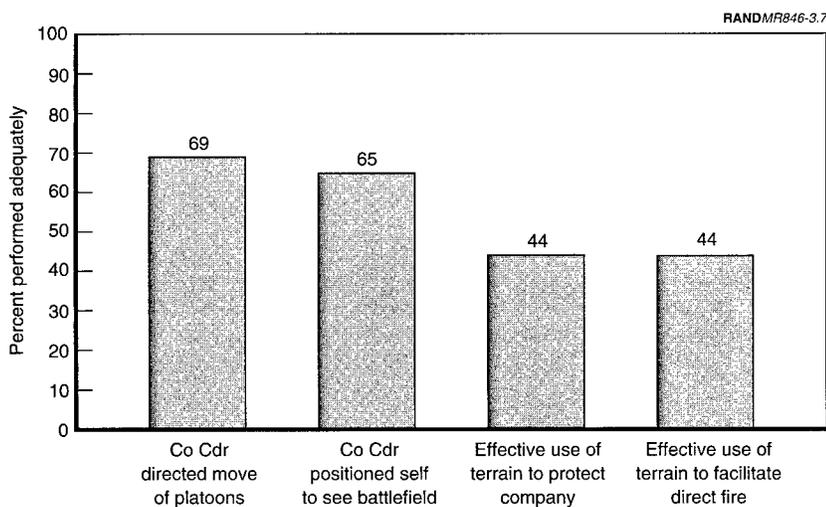


Figure 3.7—Results of Move and Position

the company (cover and concealment) and to facilitate direct fires and movement (observation and fields of fire).<sup>10</sup>

**Reaction and adjustment.** Figure 3.8 contains the results showing how commanders react to changes on the battlefield. A review of the ratings of these activities compared with those in the more basic command-and-control execution category shows a pattern similar to the comparison between basic and complex planning categories. That is, ratings for reaction to METT-T and enemy changes are far lower than the basic command and control execution activities. Again, this is to be expected because the ability to react to change during an operation is inherently more difficult than simply exchanging information. Within this category, we see that the ability to adjust the company to overall METT-T (48 percent) was better than the ability to adjust to the enemy, a subset of METT-T indicating that the ability to react to the enemy is an especially difficult part of METT-T reaction. We also see that the ability to perform overall

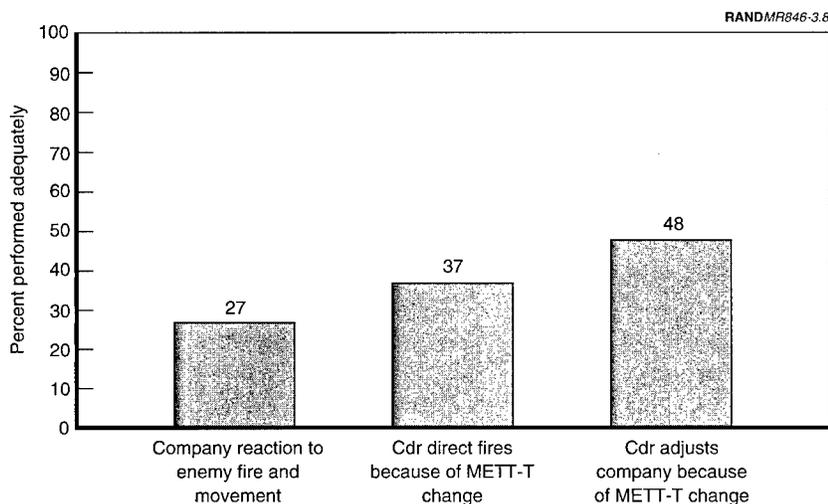


Figure 3.8—Results of Reaction and Adjustment

<sup>10</sup>In fact, company commanders' performance on these two items is highly related with the correlation of these two items equal to .76,  $p < .05$ .

METT-T adjustments is greater than the ability to adjust direct fires (37 percent), a subset of overall adjustment functions. This indicates that commanders are less adept at controlling direct fires during execution than at controlling movement.

**Direct fire control.** The results of direct fire control during execution appear in Figures 3.9 and 3.10. One of the most important findings—shown in Figure 3.10—is that only one out of every four companies executes direct fire adequately or better. Moreover, none of the direct fire control measures are above 24 percent. Averaging across all of the direct fire control measures from the survey, only 22 percent (item percentages ranged from 12 to 24) of the company commanders were proficient at executing direct fire control measures. Recall that the planning scores for these activities are also low, with no activity performed adequately by half the companies.

However, almost all units regularly did well at avoiding engagement of friendly forces (92 percent). This figure is more impressive than it may appear at first glance. Recall that the data are reported by company, not by battle. Thus, when we report that 92 percent of the companies avoided engaging friendly forces, it does not mean that 8

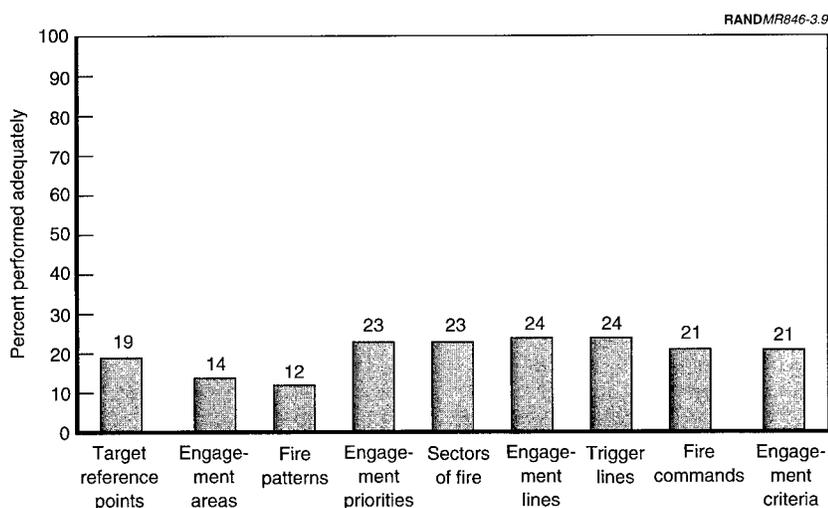


Figure 3.9—Results of Direct Fire Control Measures

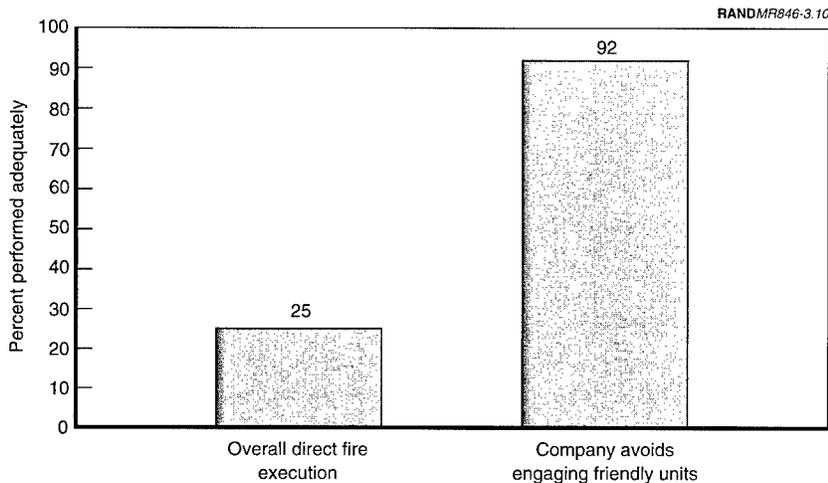


Figure 3.10—Direct Fire Control Execution

percent engaged them. Put another way, it certainly does *not* mean that 8 percent of the friendly casualties resulted from fratricide. It means that for 92 percent of the companies throughout all of the battles, no system ever took an action likely to result in a friendly engagement, e.g., fired in the direction of friendly forces. The remaining 8 percent may have taken action that could result in a friendly engagement, but any instance of firing on a friendly combat vehicle would be far lower than that (and may not have occurred at all). As may be recalled from Figure 3.1, 75 percent of the company commanders proficiently explained the positions of other TF elements during planning. In fact, this planning item and units avoiding firing at friendly forces are strongly related ( $r = .68, p < .05$ ).

**Overall effectiveness ratings.** The data in Figure 3.11 report on the overall effectiveness of the companies. The first bar relates to the effectiveness of the plan, regardless of how well it was executed. It shows that half the companies had an effective plan going into the battle. A little more than one-third (37 percent) executed the plan adequately, and a little less than one-third (31 percent) accomplished the mission.

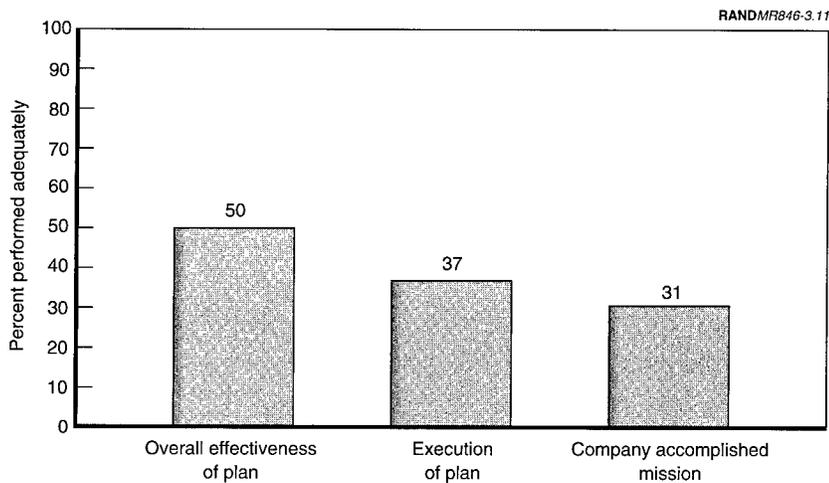


Figure 3.11—Overall Effectiveness Results

It could be argued that a company's ability to accomplish its mission is due to more factors than appear on our survey, such as events on the battlefield beyond the control of the commander and his company. However, the data on the effectiveness of the plan suggest that this may not be the case. With only half of the plans judged as good, a likely explanation is that the poor plans produced poor performance.

#### OBSERVED RATINGS THAT SHOW IMPROVEMENT DURING A UNIT'S ROTATION

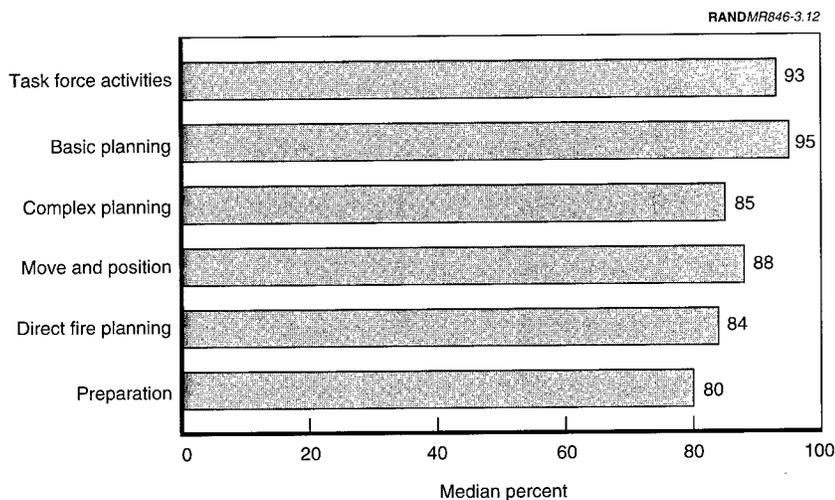
While the previous section investigated the percentage of companies that consistently performed at adequate levels, this section focuses on discovering whether units improve during the course of a rotation and, if so, for what specific items. In determining whether and how much improvement occurs, we address two points. First, we can show *quantitatively* whether companies and their commanders improve their warfighting skills at the NTC. Second, by determining areas of improvement or lack of improvement, we are able to provide some direction to the Army for revising current training methods.

The following analysis is divided into two parts. First we investigate the proportion of companies and commanders who performed adequately. That is, for each item from the survey, what percentage of companies or their commanders performed at a moderately adequate or better level by the conclusion of their NTC rotation? Second we determine which ratings from the survey units improve, and the degree of improvement. Specifically, does statistically reliable change in performance occur during a rotation, and if so, how large is the change?

### **General Levels of Performance Obtained by Companies**

The first section of this chapter detailed the average level of performance of companies throughout an NTC rotation, that is, the percentage of companies that performed adequately for any given battle on average. From that, we now have some estimates of what to expect in the way of company performance. This section addresses a more fundamental question: What percentage of companies observed ever performed moderately adequate or better during their NTC rotation? If we were to find that a large majority of companies and their commanders were not performing at a moderately adequate or better level, we would have broad concerns about the effectiveness of the current training program. As may be recalled from Chapter Two, we defined moderately adequate performance as “The action or activity was accomplished and was partially complete and/or in a partially effective manner.” Thus, in this section we focus on the percentage of units who during their NTC training reached the ability to perform mission essential skills at a level that would enable them, and in turn their battalions, to be successful. First we look at the results for the planning and preparation items, then at the results for the execution items.

**Planning and preparation.** The results for all the planning and preparation items are contained in Appendix D, Table D.1, and are summarized in Figure 3.12. The most important finding of this analysis is that a large majority of the companies obtain at least one moderately adequate or better score for almost all of the planning and preparation items measured. In fact, for only three items measured did fewer than 75 percent of companies not reach a moderately adequate or better level of performance.



**Figure 3.12—Median Percent of Companies Obtaining Moderate or Better Performance Rating by Planning and Preparation Category**

Paralleling our previous findings, better performance was seen at basic planning and movement activities than at complex and direct fire planning activities. Generally, we see a greater number of units and commanders obtaining a moderately adequate or better level of performance in basic planning tasks (92 to 96 percent) than in complex planning (64 to 88 percent) or in direct fire planning (74 to 90 percent). Overall, these results suggest that a large majority of companies conclude their NTC rotation able to perform most activities measured in this study at a satisfactory level.

**Execution.** The results for all of the execution items are contained in Appendix D, Table D.2. Unlike the findings for the planning and preparation measures and similar to the results in figures 3.9 and 3.10, many execution items are not done at a moderately adequate level by as many companies. For eight of the 22 items measured, less than 75 percent of the companies reached a moderately adequate or better level of execution. The most striking pattern found is for the direct fire control execution items. Except for avoiding engagement of friendly units, none of these items was ever done at a moderately adequate level by better than 75 percent of companies in the study.

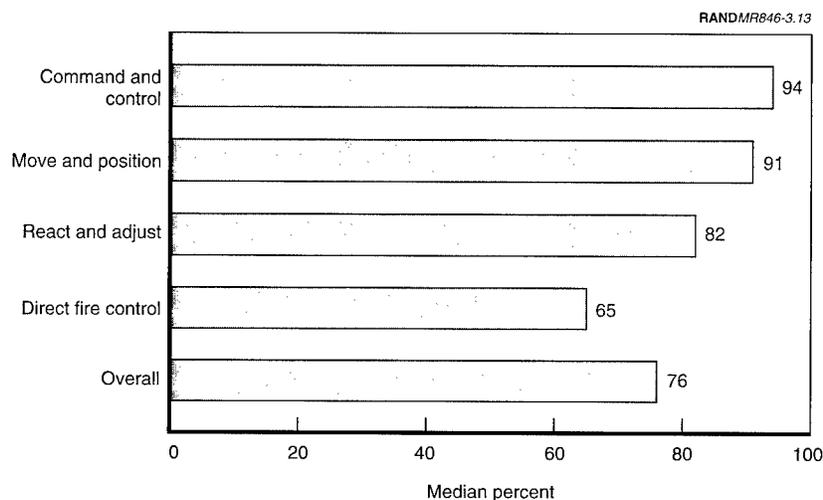


Figure 3.13—Median Percent of Companies Obtaining Moderate or Better Performance Rating by Execution Category

### Overall Levels of Improvement Observed During an NTC Rotation

The section above reported on whether companies obtained a specific level of performance during their rotations at the NTC. This section summarizes and discusses the results addressing the question, Do we see statistically significant degrees of improvement when we look at the average of all companies across multiple NTC rotations, and if so, how large is the average improvement? Appendix D contains details of the analyses, Table D.3 contains the detailed results for the planning and preparation items, and Table D.4 contains the execution results.

**Planning and preparation improvements.** The planning and preparation results in Table 3.2 indicate that units and commanders do improve on some items during the rotation. Recall from Chapter Two that we used a five-point scale with 1 = none, 2 = inadequate, through 5 = superior. The values in Table 3.2 are derived from the multivariate analysis in Appendix D. The table lists the items that showed a statistically significant improvement; for each item listed,

**Table 3.2**  
**Summary of Planning and Preparation Items That Show Statistically Significant Improvement During Rotations**

Item	Average of Battle 1	Highest Average Battle	Amount of Improvement
Complex planning			
Actions on contact	2.00	2.69	.69
Procedures to reorganize/consolidate/shift	2.06	2.67	.61
Reactions to likely contingencies	2.15	2.61	.46
Possible enemy positions and/or actions	2.18	2.74	.56
Movement and position			
Use terrain to protect company	2.48	2.86	.38
Direct fire measures			
TRPs	1.79	2.70	.91
Engagement areas	1.70	2.35	.65
Fire patterns	1.73	2.40	.67
Engagement criteria	2.12	2.80	.68
Sectors of fire	2.00	2.59	.59
Integration of IPB/METT-T with the direct fire plan	2.17	2.71	.54
Preparation			
Time management during preparation	2.36	2.92	.56
Boresighting to expected engagement areas	2.75	3.27	.52

the table shows the average value for battle 1 (an indicator of entry-level performance), the highest average battle value obtained, and the difference between battle 1 and the highest battle (a measure of the amount of improvement).<sup>11</sup>

<sup>11</sup>Specifically, the values in Tables 3.2 and 3.3 are derived in the following manner. The "average of battle 1" values are the simple arithmetic means obtained across companies for the first battle. The "amount of improvement" column contains the estimated regression coefficients for the single battle with the largest coefficient for all battles 2-7. The "highest average battle" column contains the sum of columns 1 and 3 from the table, that is, the largest-scale change relative to battle 1.

Although units do not improve in all areas investigated, several items show improvement.<sup>12</sup> In particular, we see units improving on planning and preparing for three critical skill categories: complex planning, direct fire control planning, and battle preparation. Company commanders improve at how they do four complex planning skills related to the development of courses of action. Specifically, significant improvement of planning for (1) actions on contact, (2) procedures for reorganization, (3) reactions to likely contingencies, and (4) possible enemy positions and actions occurs across all NTC rotations in this study. These skills would all relate to a commander's ability to plan for various scenarios that could arise throughout the course of a battle.

As can be seen in Table 3.2, company commanders also improved at their planning of several of the direct fire control measures. This improvement is very encouraging, considering the fact that entry-level (battle 1) performance is very poor. The range of the entry-level averages for the direct fire skills was 1.70–2.17; thus, commanders either did not plan or inadequately planned these measures for their first battles. Also, companies appear to improve in how they manage the time available to prepare, with significant improvements in the boresighting and time management measures.

**Improvements in execution.** The execution results in Table 3.3 indicate that units and commanders improve on many items during the rotation (Table D.3 in Appendix D contains detailed results). Table 3.3 is derived in a similar manner as Table 3.2, and it lists the items that showed a statistically significant improvement, giving for each item the average value for battle 1, the highest average battle value obtained, and the difference between battle 1 and the highest battle.

Units and commanders show improvement on most of the execution measures. Companies show improvement at command and control.

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<sup>12</sup>Only two items in both the planning and preparation and the execution analysis showed apparent negative learning. As can be seen in Table D.3, the speed with which the task force and companies issued OPORDs seems to decline. We believe that this decline does not result from reduced performance, but instead that a task force has more time available to plan before the first battle than before any subsequent battles. In addition, because companies received the TF OPORD sooner on battle 1 than on subsequent battles, company commanders had more time to plan and so issued their orders more quickly on battle 1 than on the others.

The platoons and subordinate elements of the company show improvements in their synchronization, and the results for both reporting measures show improvements. The companies and their commanders improve how they react and adjust to changes on the battlefield. We see that commanders improve their ability both to adjust the company and company fires when changes in METT-T dictate the need for adjustment. In addition, companies improve their performance in reacting to the enemy during battle.

**Table 3.3**  
**Summary of Execution Items That Show Statistically Significant Improvement During Rotations**

	Average of Battle 1	Highest Average Battle	Amount of Improve- ment
Command and control			
Platoons work together (e.g., synchronization)	2.32	2.99	.67
Platoons' and subordinate element's reporting	2.46	2.91	.45
Commander updates platoons	2.43	2.98	.55
Movement and position			
Commander positions himself	2.72	3.18	.46
Use terrain to protect company	2.46	2.89	.43
Use terrain to facilitate fires	2.41	2.86	.45
Direct fire measures			
Engagement areas	1.47	2.12	.65
Sectors of fires	2.11	2.65	.54
Fire commands	1.78	2.22	.44
Direct fires overall	2.10	2.69	.59
Avoid friendly unit engagement	3.29	3.84	.55
Reaction and adjustment			
Direct fire because of METT-T changes	2.20	2.89	.69
Company commander adjusts company because of METT-T changes	2.35	2.72	.37
Reactions to enemy fires and movement	2.15	2.69	.54
Overall measures of company success			
Accomplishment of mission	2.19	2.94	.75
Execution of plan	2.35	2.70	.35

Improvements were found in the execution of three direct fire control measures: engagement priorities, sectors of fire, and fire commands. In addition, the companies' overall execution of direct fires improved. Most important, two items designed to measure overall company success showed improvement during the rotation: how well the plan was executed and the quality with which the company accomplished the mission.

### **RELATIONSHIPS AMONG THE PLANNING AND PREPARATION ITEMS AND EXECUTION ITEMS**

From the analyses in the previous sections, it appears that there is room for improving the quality with which companies plan, prepare, and execute direct fire plans and other important activities in a battle. To help provide direction for how instructors, doctrine writers, or observer/controllers could improve the level of company direct fire and overall performance, we investigated the relationships among elements of planning and preparation and execution. For example, if we find that some items in planning are more strongly related to successful execution, doctrine writers would want to ensure that these areas are included in future Army doctrine.

Those familiar with the skills listed on the observation instrument will not be surprised that many of the items are highly correlated with others. In fact, as we stated in Chapter Two, the elements of combat power rarely occur independently but need to be properly combined by a leader. Indeed, this interrelationship occurs in our data; in fact, the correlations among company planning and preparation items ranged from .29 to .71. Because of the highly intercorrelated nature of these items, we were unable to use each planning and preparation item as a predictor of execution in a regression equation.<sup>13</sup> Instead, we used an item-clustering strategy to create factor scores that represented summed totals of particular substantive planning and preparation activities.

For both the offense and defense planning and preparation items, we performed an item-clustering strategy (i.e., reduce many items into a

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<sup>13</sup>Predictor variables that are highly intercorrelated in a regression equation will generate coefficients that are unstable and often misleading.

**Table 3.4**  
**Defensive Planning and Preparation Factors**

- 
1. (TIME) Company effective use of time
    - 1a. Company OPORD was given in sufficient time for platoons to plan, prepare, and execute.
    - 1b. The company rehearsed.
    - 1c. The company maximized the time available to prepare the offense {defense}.
  2. (TF) Task force OPORD time and quality
    - 2a. TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission.
    - 2b. TF order was received in sufficient time for the Co Cdr to plan, prepare, and execute.
  3. (P&E) Co Cdr's plan quality and explanation of plan to his subordinates
    - 3a. Co Cdr conducted a terrain analysis to determine possible obstacles, fire sacks, EAs, and enemy positions {Co Cdr conducted a terrain analysis/IPB}.
    - 3b. The Co Cdr conveyed METT-T to subordinates.
    - 3c. METT-T/IPB is integrated with the direct fire plan.
    - 3d. Actions/locations of other elements of the task force.
    - 3e. Reactions to likely contingencies are discussed.
    - 3f. Possible enemy positions and actions based on IPB {possible enemy actions/avenues of approach based on IPB}.
    - 3g. Actions on contact based on terrain, enemy, and mission.
    - 3h. Review of reporting requirements/procedures.
    - 3i. Subordinates understood the Co Cdr's plan (purpose, task, IPB)
  4. (WPP) Placement of weapon systems
    - 4a. Procedures for reorganization/consolidation and shifting fires.
    - 4b. Line of sight between weapon or battle positions and EAs checked.
    - 4c. The weapon positions (terrain placement and physical specifications).
    - 4d. The company maximized the time available to prepare the offense {defense}.
    - 4e. The scheme of maneuver makes effective use of terrain to protect the company (cover and concealment).
    - 4f. The scheme of maneuver makes effective use of terrain to facilitate direct fire and movement (observation and fields of fire).
    - 4g. Company boresighted relative to expected EAs.
  5. (DFC) Direct fire control measures
    - 5a. TRPs
    - 5b. EAs
    - 5c. Fire patterns
    - 5d. Engagement priorities
    - 5e. Sectors of fire
    - 5f. Engagement lines
    - 5g. Trigger lines
    - 5h. Engagement criteria
-

**Table 3.5**  
**Offensive Planning and Preparation Factors**

- 
1. (TIME) Company effective use of time
    - 1a. Company OPORD was given in sufficient time for platoons to plan, prepare, and execute.
    - 1b. The company rehearsed.
    - 1c. The company maximized the time available to prepare the offense {defense}.
  2. (TF) Task Force OPORD time and quality
    - 2a. TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission.
    - 2b. TF order was received in sufficient time for the Co Cdr to plan, prepare, and execute.
  3. (P&E) Co Cdr's plan quality and explanation of plan to his subordinates
    - 3a. Co Cdr conducted a terrain analysis to determine possible obstacles, fire sacks, EAs, and enemy positions {Co Cdr conducted a terrain analysis/IPB}.
    - 3b. The Co Cdr conveyed METT-T to subordinates.
    - 3c. METT-T/IPB is integrated with the direct fire plan.
    - 3d. Actions/locations of other elements of the task force.
    - 3e. Reactions to likely contingencies are discussed.
    - 3f. Possible enemy positions and actions based on IPB
    - 3g. Actions on contact based on terrain, enemy, and mission.
    - 3h. Review of reporting requirements/procedures.
    - 3i. Procedures for reorganization/consolidation and shifting fires.
    - 3j. Subordinates understood the Co Cdr's plan (purpose, task, IPB).
    - 3k. To facilitate direct fire and movement (observation and fields of fire).
  4. (DFC) Direct fire control measures
    - 4a. TRPs
    - 4b. EAs
    - 4c. Fire patterns
    - 4d. Engagement priorities
    - 4e. Sectors of fire
    - 4f. Company boresighted relative to expected EAs?
- 

few). This strategy incorporated both substantive and correlational groupings.<sup>14</sup> The groupings we selected and will use for the analyses

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<sup>14</sup>This strategy was as follows. We first grouped items in substantive groupings (i.e., those listed in Table 3.1), ignoring any actual correlations among items. That is, we grouped all the items based on subjective judgment of which should relate to each other. Next we compared our substantive grouping with the items that actually correlated or did not correlate with each other. When discrepancies occurred between

in this section are found in Table 3.4 for the defense and Table 3.5 for the offense.

### General Regression Model Used to Assess Relationships Among Planning and Preparation Factors and Execution Items

To assess the relationship between the planning and preparation factors shown in Tables 3.4 and 3.5 and the execution items, we estimated separate regression equations for each execution item. In each regression equation we tried to predict one execution item from a set of planning and preparation factors. The regression equation we used to predict each execution item for *defensive* battles is the following:

$$\text{Execution item}_{\text{defense}} = \text{P\&E} + \text{DFC} + \text{WPP} + \text{TF} + \text{TIME} .$$

In the equation, P&E represents a company's summed score for all of the items in the planning and explanation factor, DFC represents the summed score for all of the items of the direct fire control factor, WPP represents the summed score for the weapon planning and position factor, TF represents the sum of the task force items, and TIME represents the summed values for the items of the TIME factor.

The regression equation used to predict each execution item for *offensive* battles observed is the following:

$$\text{Execution item}_{\text{offense}} = \text{P\&E} + \text{DFC} + \text{TF} + \text{TIME} .$$

In the equation, P&E represents a company's summed score for all of the items in the planning and explanation factor, DFC represents the summed score for all of the items of the direct fire control factor, TF represents the sum of the task force items, TIME represents the summed values for the items of the TIME factor, and boresighting is the value a unit received on the boresighting item.

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the substantive grouping and actual correlations, we made the final placement based on the more objective mathematical correlations.

## Results for the Regression Analyses

The results for all of the defensive and offensive execution items are in Appendix E. The coefficients of each factor were tested to determine if that factor is a significant predictor of each execution item.<sup>15</sup> If a planning and preparation factor was a significant predictor of an execution item controlling for the other factors in the regression equation, that factor is marked with a “+” for positive and “-” for negative relationships between it and the execution item in Appendix E.

Table 3.6 contains the relationships between the planning and preparation factors and five critical execution items. We display these five items for two reasons. First, from the pool of execution items, these five are the ones that would be most closely associated with a company winning a battle. Second, these five items were not the same as an item that was included in a planning and preparation factor. As can be noticed, many items were verbatim for both planning and preparation and execution.

This table shows which groupings have a strong correlation with each of the six critical factors. To interpret the results of these regression analyses, one must realize that if a planning and preparation factor does not significantly predict an execution item (and thus is not reported in Table 3.6), this does not necessarily imply that they are not related. What it means is that once other factors in the equation are taken into account, that factor is not as important. For example, looking at the results for direct fire execution in Table 3.6 for the offense, the only consistently significant predictor is P&E. This does not mean that DFC is not related to direct fire execution, but rather that the quality with which P&E was done was a more direct predictor of units that would direct fires well or not well—even after accounting for DFC. When a second item emerges as significant, we list it as well, e.g., P&E and TF correlate strongly with “avoid engagement of friendly units” in offensive battles.

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<sup>15</sup>In a standard multiple regression equation in which all of the predictor variables are entered simultaneously, the significance of a predictor variable is a function of the other predictor variables in the equation. Specifically, the statistical significance of each factor predicting an execution item in our regression is evaluated for the predictor variable's unique contribution in predicting the execution item.

**Table 3.6****Relationship of Critical Execution Items to Planning and Preparation Factors**

Execution Item	Defensive Battles		Offensive Battles	
	Planning and Preparation Factors		Planning and Preparation Factors	
Reaction to enemy fire	WPP		P&E	
Direct fire execution	WPP	DFC	P&E	
Avoid engagement of friendly units	WPP	DFC	P&E	TF
Execution of plan	WPP		P&E	
Mission accomplishment	WPP	DFC	P&E	DFC

WPP = placement of weapon systems; DFC = direct fire control measures; P&E = plan quality and explanation of plan; TF = task force OPORD time and quality.

Table 3.6 shows several interesting relationships. First, for both offensive and defensive missions, a single planning and preparation factor strongly relates to critical execution items. In the case of offensive battles, P&E—for example, conducting terrain and enemy analysis—relates more strongly than any other factor to execution. For defensive battles, the WPP factor most strongly relates to the critical execution items.

Second, the timeliness and sufficiency of a task force OPORD (TF factor) relates strongly to only one execution item—avoiding engagement of friendly units. This does not mean that the TF OPORD is not an important variable affecting other areas of company success, but that in comparison, the quality of a company's plan is much more important in explaining a company's success. The relationship between the TF factor and avoiding engagement of friendly units is not too surprising. Most likely, the TF OPORD provides to company commanders the necessary detail on the position and timing of friendly forces.

Third, the fact that the WPP factor has the strongest relationship with execution items is also interesting. Intuition would suggest that the P&E or DFC factors would have a stronger relationship here. However, it may be that the items composing the WPP factor (e.g., line of sight and boresighting to engagement areas, and other preparation activities) emerge out of the company's planning and preparation

(e.g., P&E and DFC items), and these WPP items have a more direct relationship to the outcome of the execution measures.

Fourth, the correlations of planning and preparation skills to critical measures of performance (i.e., mission accomplishment, plan execution, and direct fire execution) were positive, large, and statistically significant (correlations ranged from .48 to .75). In addition, the correlation of overall plan quality and mission accomplishment was positive ( $r = .52, p < .05$ ). Figure 3.14 graphically shows this relationship for all battles observed in this study. The figure displays levels of mission accomplishment along the horizontal axis and the quality of the plan along the vertical. It shows that successful units, e.g., those rated superior, were more likely to have a quality plan. The average plan score for units rated superior is 4.0 compared with 2.3 for those rated inadequate.

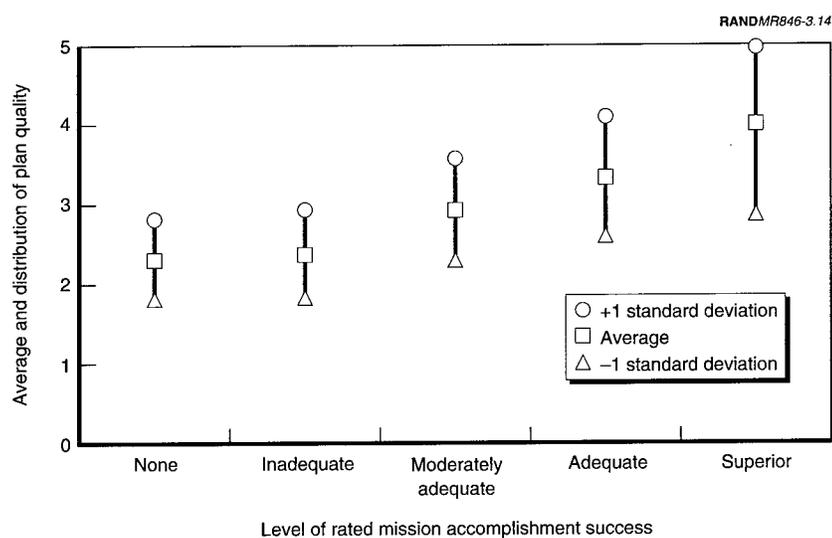
From an overall perspective, the relationship of planning and preparation to execution success can be summarized as follows:

- In a defense, weapon placement planning and preparation had the strongest relationship to critical execution skills.
- For offenses, quality planning and dissemination of the plan to subordinate elements had the strongest relationship to good execution.
- Planning and preparation quality is strongly and positively correlated with execution success.

While some planning and preparation activities predict execution success more directly than others do, the high internal relationships among the planning and preparation activities indicate that as a group they relate to execution success. We conclude that adequate planning and preparation is necessary for execution success and that many of the skills necessary for planning and preparation are also necessary for execution or vice versa.

## Overall

For many items we investigated, the entry level for many of the measures was quite low, in particular the direct fire control measures for both the planning and preparation and execution phases. However,



**Figure 3.14—Relationship of Plan Quality to Mission Accomplishment**

companies and their commanders improved upon their entry levels during their NTC rotations, although the amount of improvement for many measures was not necessarily large. Low entry-level performances combined with small degrees of improvement suggest that there is much room for improvement. The next chapter summarizes our results and details implications and recommendations for improving company performance.

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**CONCLUSIONS, IMPLICATIONS, AND  
RECOMMENDATIONS**

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In this chapter we first present the five major conclusions of this study. Next we discuss those conclusions, drawing in part on a series of interviews conducted with company commanders who completed the observed rotations, the observer/controllers at the NTC, and cadre at the infantry and armor schools, all of whom had been observer/controllers at the NTC. These interviews provide insight into the perspectives of those who are being trained and those who are doing the training, both at the NTC and in the institutional training base. Next, we discuss the implications of these conclusions in terms of home station training and leader training. We conclude with our recommendations.

**CONCLUSIONS**

Many factors can affect the company commander's ability to achieve his mission; these include the difficulty of the mission, the competency of the enemy, the quality of the task force plan, the number of combat systems available to the company at line of departure, the training level of his subordinates, the warfighting skill of the commander himself, the quality of command and control prior to and during battle, and many others. For this study we focused on how skills of the company and their commander could affect company performance. Specifically, we investigated (1) overall performance, (2) direct fire control, and (3) company commanders' planning skills related to visualizing a battle. Five conclusions emerge from our study:

- Overall execution performance, especially direct fire control, is poor.
- Direct fire control is not performed as well as movement and positioning.
- Companies are better at planning activities than execution activities.
- Basic planning activities are performed adequately by most companies, complex planning activities are not.
- All categories of activities, except direct fire execution improve.

The following paragraphs expand on these conclusions.

### **Overall Execution Performance, Especially Direct Fire Control, Is Poor**

Overall, most companies did not perform execution activities adequately. We arrive at this conclusion fully understanding that the NTC is a difficult training environment, that it is deliberately set up to be demanding, and that this demanding environment will expose any training shortcomings. That said, the data show that many important activities are not done or, if done, are done inadequately by most companies. In three of the most significant activities in the observation instrument—execution of direct fires, plan execution, and mission accomplishment—the highest score was 37 percent. Direct fire control execution had the lowest ratings of any activity category and showed the least improvement.

### **Companies Do Not Perform Direct Fire Activities As Well As They Do Movement and Positioning Activities**

Maneuver includes both movement (which includes positioning) and use of fires. Our data show that more companies performed movement and positioning activities adequately than performed direct fire items adequately. During planning and preparation, most company commanders effectively planned for the use of terrain to facilitate protection, movement, and position (61 percent); however, effective performance on the ten direct fire planning activities ranged from 19 percent to 48 percent. Execution reflects a similar

trend. During execution phases, movement and positioning activities were performed adequately by 44 to 69 percent of the companies, while (with one important exception that will be discussed below) items associated with direct fire control were performed adequately by 25 percent or less of the companies. These findings suggest that commanders were more likely to emphasize, or were more adept at, skills related to movement and positioning than at controlling direct fires.

The positive exception noted above relates to avoiding fratricide. A large percentage of company commanders adequately disseminated the position/locations of other elements of the TF (75 percent) during the planning and preparation phase of the battle. Correspondingly, 92 percent of the companies consistently avoided taking action likely to result in engagement of friendly elements in the execution phase of the battle. This finding is very encouraging. The Army has emphasized avoiding fratricide in its training, and this result shows that a complex skill such as avoiding fratricide that is emphasized during training can be performed proficiently by most companies.

### **Companies Plan Better Than They Execute**

Contrasting company performance during execution with planning and preparation performance, it appears that more companies and their commanders adequately performed planning and preparation than performed execution skills. Overall, half of the company commanders prepared an effective plan, whereas only about a third were rated as effective at plan execution (37 percent) and mission accomplishment (31 percent). Additionally, more commanders effectively planned the use of terrain (61 percent) than actually used it well during execution (44 percent), and more company commanders effectively planned fire control measures (a range of 19 to 48 percent) than were able to use them effectively during operations (a range of 12 to 24 percent).

Our data also show a strong, positive correlation between effectiveness of planning and preparation and execution success.<sup>1</sup> The com-

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<sup>1</sup>Correlations of mission accomplishment, plan execution, and direct fire execution to planning and preparation factors ranged from .62 to .75 and all were statistically significant at or above  $p < .01$ .

panies that executed adequately had commanders who planned adequately and companies that prepared adequately. It is not surprising that planning and preparation relates to execution performance or that execution performance is lower than planning and preparation performance. Effective prebattle activities would be expected to give the company a good start on execution, but many factors could prevent success, even with effective planning and preparation. Successful planning and preparation indicate the company and its commander have some of the skills necessary to carry out the plan; however, additional leader and collective skills are necessary to execute successfully.

### **Although Basic Activities Are Performed Adequately by Most Companies, Complex Planning Activities Are Not**

Most companies performed many basic activities adequately. Over 60 percent of the commanders in our sample were rated as effective at disseminating information during the operation and at positioning themselves to see the battlefield and to survive. Additionally most company commanders appeared to possess basic planning skills, that is, those needed to produce a generally complete, timely, and clear OPORD (71 percent for the four items that asked about these qualities). Likewise, most companies performed many basic execution activities adequately, for example most companies have platoons that work together well (60 percent) and report well (63 percent).

Most companies did not perform complex planning activities associated with visualizing the way battles develop, nor were they able to manage available preparation time adequately. Possibly the most difficult aspect of predicting the way a battle will develop is being able to visualize the result of actions with the enemy. While slightly over half of the commanders were able to adjust their company's plans because of a change in overall METT-T (52 percent), far fewer reacted well to enemy fires and movement (27 percent). During planning and preparation phases, few commanders appeared able to integrate terrain, enemy, and friendly factors (a range of 23–48 percent for the seven activities in this category) into a vision of how the battle would flow well enough to form a tactical plan that would succeed. Likewise, while basic planning activities were performed ade-

quately by most company commanders, few performed the more complex activities associated with effectively managing available time to prepare fully for operations (40 percent) or conduct the rehearsals required by doctrine (21 percent).

### **All Categories of Activities, Except Direct Fire Execution, Had Overall Patterns of Improvement During NTC Rotations**

One measure of NTC success is unit and leader improvement. Our data show that companies improved their performance on most items. Companies improved in 32 of 44 items, and a large majority reached a moderately adequate level or better for 32 of 44 items. Eight of the twelve items in which companies and their commanders did not obtain moderately adequate levels of performance were in one category: direct fire control measure execution. Moreover, companies did not improve in four of the nine direct fire control execution items. Also, companies improved at the three overall measures of execution success; yet approximately 25 percent of the companies never rose above an inadequate level of performance. We find the overall improvement encouraging; however, the lack of significant improvement combined with low NTC entry-level performance for direct fire execution items suggests a need for improvement in how the training system addresses this area.

The next section discusses how the conclusions drawn from this study can be applied to improving the training of company commanders in the Army.

## **DISCUSSION**

We believe that improvement of pre-NTC training is needed for several reasons. First, a large proportion of companies and their commanders were unable to consistently perform at adequate levels for most of the skills/activities we investigated. Thus, pre-NTC proficiency, and consequently pre-NTC training, need to be improved. Second, many armor and mechanized infantry captains (approximately one-fourth to one-third) never get a chance to participate in an NTC, or similar CTC, experience as a company commander, so home station and institutional are their major training experiences. Therefore, even though our data show commanders do improve

during their NTC rotations, at least one-fourth of the captains never get this opportunity. Third, in the event of conflict that requires immediate deployment, even fewer company commanders would have CTC experience because deployment would occur before many commanders' scheduled CTC dates. Thus, while CTCs are a vital part of the Army's strategy for unit readiness and career development, home station training stands central to the preparation of company leaders for combat.

Simply pointing out areas of training weakness is of limited helpfulness. More important is to determine affordable ways to improve these areas. Affordability is key. The Army has been deliberately underfunding many quality-of-life and sustainment functions to maintain acceptable levels of training readiness.<sup>2</sup> In the post-Cold War era, additional funding to increase the amount of training is unlikely; budgetary pressures probably will not abate. The need for affordable, effective improvement guides the rest of this report. If methods that can generate improvements are identified and are incorporated, or better incorporated, into pre-NTC training activities, improvements could result. Such improvements would be seen in entry-level NTC performance (which would improve the quality of training at the NTC), and in the overall warfighting readiness of the force. Moreover, if these methods involved improved training processes and procedures, and not necessarily additional training time, then improvements could be gained within currently programmed training resources.

Below we explore the Army training environment via a general training model to identify changes or improvements that could increase the number of successful company commanders.

### **Potential Routes for Improvement**

During the course of our research we presented our findings to three different groups: O/Cs at the NTC, BLUEFOR company commanders at the NTC after their last operation, and advanced course instructors at the Infantry and Armor Schools' Advanced Officers Courses who

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<sup>2</sup>See Program Objective Memorandum POM 97-02.

were former O/Cs. These presentations had two objectives. The first was to determine the reasonableness of our findings. The findings accorded with the groups' previous impressions and experiences. Our second objective was to canvass all three groups to get their input on reasonable ways to make improvements. These audiences provided perspectives from trainers, trainees and the institution.

To provide a framework for gathering input on training improvements, we showed them the notional model of training displayed in Figure 4.1.<sup>3</sup> We use it here as a way of framing their responses to the many training issues we raised.

The quality of company teams' battlefield planning, preparation, and execution activities is a function of the effectiveness of the training system or strategy for these organizations and their leaders. The notional model depicted in Figure 4.1 is a means to conceptualize the Army's training system. The model has four main components: tac-

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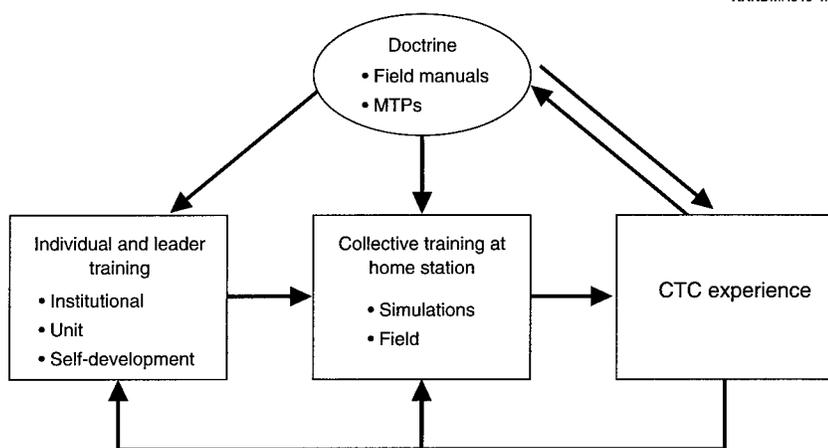


Figure 4.1—Notional Training Model

<sup>3</sup>We did not discuss the model as such with the company commanders at the NTC. However, we did ask them about possible improvements in each of the areas described in the model.

tical and training doctrine, leader training, home station collective training, and CTC training.<sup>4</sup>

**Tactical and training doctrine.** Doctrinal publications describe both the basic approaches to the way the Army fights and trains as well as specific tactics, techniques, procedures, and methods for fighting and training.<sup>5</sup> Doctrinal publications include field manuals and Army Training and Evaluation Program (ARTEP) publications. Doctrinal publications, as can be seen in the model, are important because they establish the basis and provide direction for the other components involved in training companies. If doctrine is not adequate, it would be difficult for the other parts of the training system to be effective.

**Leader training.** Leader training takes place in institutions, formal school courses, and in units. It also includes the leader's own efforts for self-development. For training company-level command and control, the most important schoolhouse instruction occurs at the Armor and Infantry Schools. The Armor and Infantry Officer Basic Courses (AOBC and IOBC) train new lieutenants to be platoon leaders. The Officers Advanced Course (AOAC and IOAC) prepares senior lieutenants and junior captains for company command. Leader training programs in units include classes and conferences for leaders, one-on-one training and mentoring, and leader training exercises. Leader training exercises are normally conducted with leaders and selected portions of the organization, with the purpose of ensuring that leader skills are developed before the entire organization trains in the field.

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<sup>4</sup>There are four CTCs. The Joint Readiness Training Center (JRTC) located at Fort Polk, Louisiana has the mission of training the Army's light battalions and brigades. The Combat Maneuver Training Center (CMTC) in Hohenfels, Germany, has the mission of training European forces. The NTC has the mission of training heavy battalions and brigades. The Battle Command Training Center (BCTC) at Fort Leavenworth, Kansas has the mission of training division and corps commanders and staffs.

<sup>5</sup>This is a broader definition of doctrine than many would use. The Army's keystone warfighting field manual, FM 100-5, defines doctrine as "The statement of how America's Army intends to conduct war and operations other than war." We have included publications that describe training doctrine as well as tactical doctrine. We have also included tactics, techniques, procedures, and methods because the doctrinal publications describe these as well, and at company team level these are hard to separate from fundamentals.

**Collective training at home station.** Collective training involves training individuals with a focus on collective unit performance. There are two basic types of collective training: gunnery and maneuver. During gunnery training, crews, platoons, and sometimes company teams engage targets with live fire on ranges with limited maneuver opportunity. Tank and Bradley crews and platoons have to execute standardized qualification exercises or tables on a semi-annual basis.<sup>6</sup> During maneuver training, units practice combat operations in the field. Maneuver training often includes an opposing force (OPFOR) and use of Multiple Integrated Laser Engagement Simulations (MILES), a system of laser devices that allows the casualty effects of weapons to be played during training exercises.<sup>7</sup>

**CTC training.** Training at the NTC, one of the CTCs, is also a collective training event. Each heavy battalion goes to the NTC approximately every 24 months.<sup>8</sup> The Army has devoted great resources to the NTC to provide training that replicates combat as closely as possible and much more so than is possible during home station training.

### Potential Training Improvements

Table 4.1 summarizes the responses from the three groups in each of the four areas of the training model. Because the responses of the three groups were so similar, we group them into “Interviewees’ Views” in the table.

**Doctrine.** When we asked about possible improvements in doctrine, responses were mixed. Some pointed out that it was not possible to describe specific tactics and techniques to cover all situations in

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<sup>6</sup>See FM 17-12-1 and FM 23-1 for details of gunnery training for tanks and BFVs.

<sup>7</sup>Instructions for conducting maneuver training exercises and the standards for collective events are contained in ARTEP manuals. There are two types of ARTEP publications: (1) Mission Training Plans (MTP) cover the overall training methods of the organization, a list of critical tasks for the organization, and the performance standards for these tasks. (2) Drills include the execution of more specialized tasks that should be performed automatically given an event or command, and performed the same way regardless of circumstances.

<sup>8</sup>Because the typical tour as infantry or tank company commander in U.S. battalions is approximately 14–18 months, most but not all company commanders go to the NTC once during their tour.

Table 4.1

## Summary of Interviewees Views About Areas Needing Improvement

Area of Training Model	Interviewees' Views
Doctrine	Needs selected improvement
Leader training	
Institutional	Needs some improvement
Home station	Needs much improvement
Home station collective training	Needs much improvement
CTC training	No improvement needed

doctrinal publications. However, most of those interviewed said that doctrinal improvements were needed, especially in the areas of company- and battalion-level fire control planning and intelligence preparation of the battlefield (IPB) at company level. The Infantry School's Student Handout, Fire Planning Handbook (SH 7-45), was cited by several O/Cs and schoolhouse instructors as the type of doctrinal enhancement effort needed in the area of direct fire control. Some of those interviewed stated that some of the doctrine company commanders need is dispersed across too many publications to be truly "ready references" for company commanders. A small number believed that current doctrinal publications contain all the information required by company commanders.

**Leader training.** Most of the comments we received about leader training were oriented on (1) the institutional schoolhouse training for captains that precedes company command and (2) the frequency and quality of training at home station.

In terms of schoolhouse training, most company commanders we interviewed reported that their advanced courses had effectively covered important concepts and principles, and that their instructors had been capable and helpful. Also, O/Cs generally reported that individual training in the advanced courses was reasonably effective, given the constrained time allocated to those courses. However, we found that in our observations of interactions and AARs between O/Cs and their counterparts, a large proportion of instruction time was devoted to teaching the same concepts and principles that commanders reported were effectively covered in their advanced courses. When we asked about the reason for this apparent discrep-

ancy, both O/Cs and company commanders indicated that the NTC provided the opportunity for commanders to apply the concepts taught and subsequently learn from their mistakes. Apparently, the advanced courses' environment may not necessarily provide commanders with a robust opportunity to apply what they learn, and consequently they may never fully learn the subject matter. In particular, there may not be enough available instruction time in the schoolhouses to provide for multiple iterations to allow student mastery of course content.

Most of the interviewees from the three groups stated that leader training at home station was a significant problem. The rationale given to support this statement was multifaceted, but it hinged on a few key points. First, home station leader training was infrequently conducted, thus limiting such opportunities for leader growth. Second, when leader training was conducted, it was often ineffective. For example, company commanders indicated that the majority of simulations training occurred at the battalion echelon with little focus on company-level training. Therefore, company commanders did not receive focused instruction in planning, preparing, and executing. Last, the effectiveness of this training was diluted by distractions that were not associated with training.

**Home station collective training.** Respondents were virtually unanimous in agreeing that home station collective training needed substantial improvement. Responses of O/Cs at the NTC and former O/Cs at the service schools indicated that home station exercises were often not effectively organized, that often too few trainers were allocated and received little training to perform their duties, and that the situations (in particular the OPFOR) were not demanding enough to prepare fully for the NTC. The responses of the company commanders we interviewed followed the same general pattern. They frequently commented about the distractions that prevented a full focus on training and about personnel turbulence that limited the effectiveness of field training because so many new members were introduced to the company team after major portions of the train-up had been completed.

Several interviewees suggested one possible way to rectify the above home station leader and collective training problem. They believed that training at the schools (including branch advanced courses,

Combined Arms and Services Staff School (CAS3), Command and General Staff College (CGSC), and Pre-Command Courses (PCC) for battalion and brigade commanders should increase course coverage of how to plan and conduct effective leader and collective training. We believe that a modification of course content such as this could lead to improved home station training of company commanders.

**CTC training.** Neither the company commanders nor the current and former O/Cs saw any compelling need for improvement in the CTCs.

## **IMPLICATIONS**

Based on the work of this study, we believe there are opportunities for the Army to improve the current levels of company performance. This section addresses issues and implications related to leader training.

### **Leader Training**

Based on the findings of this study, we believe that leader training needs to be and can be improved. By leader training, we specifically refer to developing a company commander's cognitive ability to visualize his battle and control the company's direct fires. Several findings lead us to the conclusion that there is opportunity to improve company commanders' cognitive planning skills.

First, recall from Chapter Three that fewer than half of the commanders observed were consistently adequate or better at any of the complex planning activities (refer to Figure 3.2) and even fewer adequately planned specific direct fire control measures (refer to Figure 3.3). Second, indicative of the need for commanders to have the cognitive skill to plan for battles was the fact that there was a strong positive correlation between commanders' planning skill and execution success. That is, companies with commanders who exhibited high levels of cognitive aptitude for complex planning (including an ability to integrate and synthesize enemy, terrain, and friendly force actions) were the companies that executed well. Third, individuals we interviewed stated frequently that leader training could be improved. Lastly, it appeared that at least a part of the reason company

performance improves during a rotation results from the interaction between O/Cs and the company commanders. We observed that the company O/Cs spent considerable time “coaching” their counterparts on cognitive skills of “battlefield visualization” and fire control planning. Much of this coaching appears possible to do in a classroom or during home station training exercises rather than waiting for an NTC rotation. If done prior to the rotation, companies could start off with a higher level of performance, which could well lead to substantially higher performance by the end of the rotation.

To formulate directions for improving leader training, we rely on two models for structure. The first is the notional model presented in Figure 4.1, which provides a framework for where commanders receive training: from doctrine, institutions, home station, and/or CTCs. The second model is in Figure 4.2. It is presented to suggest directions on how to educate cognitive battle planning skills to company commanders. It is not a “magic bullet” to fix problems, nor should it be seen as the only method to approach leader training issues.

### **Instruction Model**

Figure 4.2 both shows the stepwise nature of instruction and presents an example of how one aspect of understanding terrain analysis, using intervisibility lines (IV), could be taught. Complex cognitive skills are often taught in a stepwise fashion. That is, educators strive to teach the fundamentals or basics before going to the advanced topics.<sup>9</sup> Teaching company commanders complex skills such as threat analysis could be a stepwise learning process. For example, we would want to make sure that commanders understand how their own weapon systems and enemy weapon systems operate as a prerequisite to teaching threat analysis.

Figure 4.2 shows four progressive levels of understanding, starting from comprehension and leading up to synthesis. Working through

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<sup>9</sup>An obvious example of this stepwise nature of instruction can be seen in mathematics curricula. If we want to teach students how to calculate the length of a triangle’s hypotenuse (a complex skill), we would first make sure the students know more basic skills such as addition, then multiplication, division, and so on.

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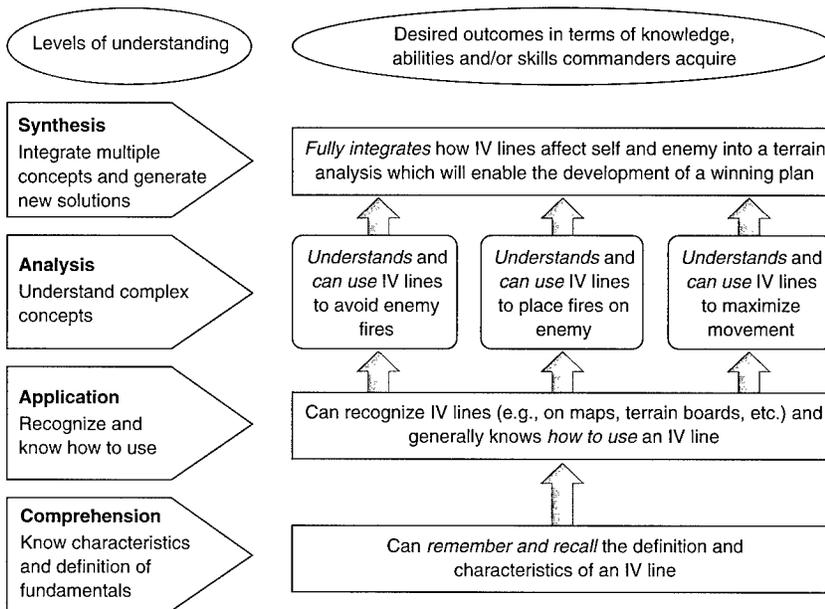


Figure 4.2—Instruction Model Showing an Example of Teaching the Use of Intervisibility (IV) Lines

this example, we see that commanders need first to know the characteristics and definition of IV lines, then how to apply this knowledge (e.g., recognizing IV lines on a map) and develop their ability to analyze the impact of such terrain features on friendly and enemy maneuver. Finally, commanders need the opportunity to participate in exercises that enable them to develop their ability to synthesize multiple events of terrain, enemy, and friendly into a cohesive and winning visualization of the battlefield.

Even though the example in Figure 4.2 will seem straightforward to many readers, we use this model and the model in Figure 4.1 to structure our discussion of improvement implications for leader education below.

## Training Improvements

**Doctrine.** To discover where changes could be made to improve leader education, we first considered current doctrine. Looking at Figure 4.1, one can see that Army doctrine is the foundation that guides and directs how leaders are trained. We investigated the main doctrine that defines and provides the principles for the skills pertinent to direct fire control and battlefield visualization for armor and mechanized companies.<sup>10</sup> We found that the doctrine coverage in these areas was inadequate.<sup>11</sup> This does not mean that the current doctrine does not include important skills or concepts, but that the coverage does not include specific information necessary for a company commander to master skills, nor does it explain how the subject matter is to be used in a battle.

As an example, consider the coverage of terrain analysis in FM 71-1. Terrain, enemy, and friendly effects are important components of a commander's effective battlefield visualization. The coverage of terrain analysis in FM 71-1 includes the basic definitions (a Comprehension level of knowledge) associated with terrain analysis and discusses many important factors, but it leaves many out, including IV lines. For example, Application levels of knowledge are included; FM 71-1 shows how to identify mobility corridors and determine the size of the formation that can move through an approach. Yet, an Analysis or Synthesis level of understanding is not discussed, for instance how to analyze the terrain to maneuver to defeat an enemy (e.g., move, shoot, and avoid exposure from the perspective of defender and attacker). So, as can be seen, current doctrine does include important skills that are required for commanders, yet it does not include all levels of understanding that commanders would need to be proficient warfighters.

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<sup>10</sup>These were FMs 71-1, 71-2, and 71-123. The Armor and Infantry Schools are currently revising these FMs, so this may be an appropriate time to make changes.

<sup>11</sup>Since the completion date of this study, the Army has published an initial draft of an updated version of FM 71-1. This new version includes much more specific and detailed coverage of skills related to direct fire control and battlefield visualization. We believe this new version is a substantial improvement in these areas; however, our data were gathered in the context of the currently approved FM. Since the data and findings of this study would have been influenced by the currently approved FM, our discussion of doctrinal sufficiency applies to the current FM.

**Institutional leader training.** Because this study did not specifically gather objective data on schoolhouse training, we must be cautious about making inferences in this area. Most of those interviewed stated that the advanced courses were reasonably effective. However, as we pointed out earlier in this chapter, commanders may not have enough opportunity to be involved in multiple opportunities to participate in “learn–practice–receive feedback–learn” processes in their advanced courses. Such limited opportunity may keep commanders from developing the higher levels of understanding, Analysis and Synthesis, necessary to be proficient warfighters. More specifically, many months after their advanced courses commanders may recall (Comprehension) and know how to use (Application) basic, important concepts of warfighting, but they may not be able to understand (Analysis) and integrate (Synthesis) complex, critical warfighting skills.

How can commanders reach these advanced levels of understanding, i.e., Analysis and Synthesis, in their advanced courses? In fact, they may already be reaching them. As we stated in the paragraph above, we did not gather data specifically for looking at institutional training; consequently, commanders may reach these advanced levels of understanding in their advanced courses, but we were not able to see it at NTC. However, whether commanders do or do not obtain the ability to analyze and synthesize critical planning skills in their courses may not be as important as the fact that many commanders were not proficient in these skills at the NTC. Thus, the more important question to answer is, How can the advanced courses enable more company commanders to reach and exhibit an ability to analyze and synthesize critical warfighting skills? The answer may lie in what both company commanders and company O/Cs said about NTC training: At the NTC, company commanders get the opportunity to learn, perform, receive performance feedback, and perform again. If such a method were systematically included into advanced courses—a method that involves instruction, execution in simulations, feedback, and follow-up in simulations—we might see improvement in the number of commanders who proficiently visualize the battlefield.

**Home station training.** Both NTC performance data and discussions with interviewees suggest significant impediments to home station training. We found little to no documentation defining the current

nature of the home station training environment and the methods actually used to conduct it. Except for weapons qualification, the methods by which training is conducted, while outlined in general concept in FMs 25-100 and 25-101, do not appear in detail in any reference we examined. Nor is there a requirement to report or maintain data in this area. The lack of data makes determination and analysis of reasonable alternatives for improvement difficult.<sup>12</sup>

However, we do see three possibilities for improving the development of leaders' warfighting cognitive skills at home station. First, units should strive to ensure that home station collective training events provide a realistically complex battlefield situation with effective feedback systems. For instance, a realistic exercise should include a balance of all required warfighting skills (e.g., maneuver should include *both* firing and movement). Tactical training events should include a competent, aggressive, and determined enemy. Effective feedback, e.g., an O/C team that is sufficiently large, knowledgeable, and prepared, is an important component to tactical training events. Reaching the same level as NTC is not possible at home stations, but improvement is warranted and possible. Second, both brigade and battalion commanders are responsible for developing their company leaders and conducting company training exercises. It is possible that by ensuring that battalion and brigade commanders and staffs receive instruction in how to conduct effective training, including an awareness of a general learning model such as presented in Figure 4.2, company commanders will have a better opportunity to improve their cognitive warfighting skills.

Third, we believe an increased use of simulations, *integrated* with other aspects of leader and unit training (in particular, field training exercises), at home station may more effectively enable company commanders to develop the ability to reach an Analysis and Synthesis level of knowledge. The Army appears to have a reasonably full set of fielded training simulations and is looking at heavy investment

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<sup>12</sup>RAND's Arroyo Center is presently conducting a study investigating leveraging simulations training at home station. The study will specifically investigate present unit training practices to determine the nature and extent of training distractors and possible mechanisms for improving training at home station. In addition, it will investigate different means of employing simulation training so as to determine ideal methods to improve commander proficiencies.

in this technology in the future. An example is the JANUS simulation, which is currently available to train company leaders but does not seem to be routinely used for this purpose. Moreover, this simulation when used with proficient trainers, despite possible limitations, would seem to be well suited for training leaders in the battle visualization and fire control skills we saw as a weakness in our study. Simulations could also provide additional training opportunities within current budget allocations. Our study suggests that improved leader training prior to field training could enhance performance. Structured research to determine how JANUS and other simulations are being used would provide a baseline for investigating the future potential of simulations.<sup>13</sup>

## RECOMMENDATIONS

We believe improved leader training is key to gaining affordable improvements in company tactical performance. We suggest the following recommendations to improve leader training:

- Improve doctrinal coverage of company-level direct fire control and specific skills required for effective battlefield visualization.
- Devote course coverage to teach future battalion and brigade commanders *how to* plan and conduct effective home station leader and collective training.
- Improve the use of simulations, both in institutions and at home stations, so that more company commanders can develop the advanced tactical skills necessary for good warfighters.
- Further examine the impact of current home station training methods on tactical proficiency of companies and their commanders.

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<sup>13</sup>Ibid.

Appendix A

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**OFFENSE AND DEFENSE SURVEYS**

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**O/C COMPANY DIRECT FIRE SURVEY CARD—OFFENSE**

Rotation \_\_\_\_\_ Training Day \_\_\_\_\_ O/C \_\_\_\_\_ Company's Mission \_\_\_\_\_

BATTLE TYPE (circle one): BDE — DATK MTC HATK      BTN — DATK MTC HATK

PLANNING AND PREPARATION	NON N E	I N A D E Q U A T E	M O D E R A T E L Y	A D E Q U A T E	S U P E R I O R	
1. TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission?	1	2	3	4	5	N/A
2. TF order was received in sufficient time for the Co Cdr to plan, prepare, and execute?	1	2	3	4	5	N/A
3. Company OPORD was given in sufficient time for platoons to plan, prepare, and execute?	1	2	3	4	5	N/A
4. Co Cdr conducted a terrain analysis to determine possible obstacles, fire sacks, EAs, and enemy positions?	1	2	3	4	5	N/A
During or at the end of plan/prep how well were the following accomplished...?						
5. The Co Cdr conveyed METT-T to subordinates	1	2	3	4	5	N/A
6. METT-T/IPB is integrated with the direct fire plan	1	2	3	4	5	N/A
7. Actions/locations of other elements of the task force	1	2	3	4	5	N/A
8. Actions on contact based on terrain, enemy, and mission	1	2	3	4	5	N/A
9. Procedures for reorganization/consolidation and shifting fires	1	2	3	4	5	N/A
10. Reactions to likely contingencies are discussed	1	2	3	4	5	N/A
11. Review of reporting requirements/procedures	1	2	3	4	5	N/A
12. Possible enemy positions and actions based on IPB	1	2	3	4	5	N/A
13. The company's planning and rehearsal includes the following fire control measures...						
TRPs	1	2	3	4	5	N/A
EAs	1	2	3	4	5	N/A
Fire patterns	1	2	3	4	5	N/A
Engagement priorities	1	2	3	4	5	N/A
Sectors of fire	1	2	3	4	5	N/A
Engagement criteria	1	2	3	4	5	N/A
Others (list) _____	1	2	3	4	5	N/A
14. Subordinates understood the Co Cdr's plan (purpose, task, IPB)	1	2	3	4	5	N/A
15. The company maximized the time available to prepare the offense	1	2	3	4	5	N/A
16. The scheme of maneuver makes effective use of TERRAIN...						
to protect the company (cover and concealment)	1	2	3	4	5	N/A
to facilitate direct fire and movement (observation and fields of fire)	1	2	3	4	5	N/A
17. The company rehearsed	1	2	3	4	5	N/A
18. Company boresighted relative to expected EAs	1	2	3	4	5	N/A

Combat Strength at LD: Tanks \_\_\_\_\_ BFVs \_\_\_\_\_ ITVs \_\_\_\_\_ **OFFENSE**

At Change of Mission: Tanks \_\_\_\_\_ BFVs \_\_\_\_\_ ITVs \_\_\_\_\_

**EXECUTION**

	NONE	INADEQUATE	MODERATELY	ADDEQUATE	SUPERIOR	
1. Cdr directed the movement of the platoons?	1	2	3	4	5	N/A
2. Effectiveness of the company's tactical operating procedures (e.g., use of terrain, proper formations)?	1	2	3	4	5	N/A
3. Cdr directed fires because of changes in METT-T?	1	2	3	4	5	N/A
4. Cdr directed fires because of inadequate planning?	1	2	3	4	5	N/A
5. Platoons were updated with important information?	1	2	3	4	5	N/A
6. Do the platoons work well together (e.g., good crosstalk, good synchronization)?	1	2	3	4	5	N/A
7. Subordinate units reported adequate and accurate information?	1	2	3	4	5	N/A
8. Cdr positioned himself to see the battlefield and survive?	1	2	3	4	5	N/A
9. Cdr made effective use of TERRAIN ...						
to protect the company (cover and concealment)?	1	2	3	4	5	N/A
to facilitate direct fire and movement (observation and fields of fire)?	1	2	3	4	5	N/A
10. The following fire control measures were executed...						
TRPs	1	2	3	4	5	N/A
EAs	1	2	3	4	5	N/A
Fire patterns	1	2	3	4	5	N/A
Engagement priorities	1	2	3	4	5	N/A
Sectors of fire	1	2	3	4	5	N/A
Fire commands	1	2	3	4	5	N/A
Engagement criteria	1	2	3	4	5	N/A
Others (list) _____	1	2	3	4	5	N/A
11. Company reaction to enemy fires and movement?	1	2	3	4	5	N/A
12. Overall how well were direct fires executed?	1	2	3	4	5	N/A
13. Did the company <u>avoid</u> engaging friendly units?	1	2	3	4	5	N/A
14. Overall, how effective was the company's plan, irrelevant of how well it is executed?	1	2	3	4	5	N/A
15. How well was the company plan executed?	1	2	3	4	5	N/A
16. The company accomplished its mission?	1	2	3	4	5	N/A
17. Co Cdr adjusted the company when changes in METT-T required	1	2	3	4	5	N/A
18. List any important aspects which led to the outcome of the battle not included above						

NOTE: Item 4 was not included in any analyses because it was statistically unreliable and not valid.

**O/C COMPANY DIRECT FIRE SURVEY CARD—DEFENSE**

Rotation \_\_\_\_\_ Training Day \_\_\_\_\_ O/C \_\_\_\_\_ Company's Mission \_\_\_\_\_

	N O N E	I N A D E Q U A T E	M O D E R A T E L Y	A D E Q U A T E	S U P E R I O R	
<b>PLANNING AND PREPARATION</b>						
1. TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission?	1	2	3	4	5	N/A
2. TF order was received in sufficient time for the Co Cdr to plan, prepare and execute?	1	2	3	4	5	N/A
3. Company OPORD was given in sufficient time for platoons to plan, prepare and execute	1	2	3	4	5	N/A
4. Company commander conducted a terrain analysis/IPB	1	2	3	4	5	N/A
5. Company commander conveyed the METT-T to his subordinates?	1	2	3	4	5	N/A
6. METT-T/IPB is integrated with the direct fire plan	1	2	3	4	5	N/A
7. Actions/locations of other elements of the task force	1	2	3	4	5	N/A
8. Reactions to likely contingencies are discussed	1	2	3	4	5	N/A
9. Company's planning and rehearsal includes the following fire control measures...						
TRPs	1	2	3	4	5	N/A
EAs	1	2	3	4	5	N/A
Fire patterns	1	2	3	4	5	N/A
Engagement priorities	1	2	3	4	5	N/A
Sectors of fire	1	2	3	4	5	N/A
Engagement lines	1	2	3	4	5	N/A
Trigger lines	1	2	3	4	5	N/A
Engagement criteria	1	2	3	4	5	N/A
Others (list) _____	1	2	3	4	5	N/A
10. Possible enemy actions/avenues of approach based on IPB	1	2	3	4	5	N/A
11. Actions on contact based on terrain, enemy, and mission	1	2	3	4	5	N/A
12. Procedures for reorganization/consolidation and shifting fires	1	2	3	4	5	N/A
13. Review of reporting requirements/procedures	1	2	3	4	5	N/A
14. Line of sight between weapon or battle positions and EAs checked?	1	2	3	4	5	N/A
15. The weapon positions (terrain placement and physical specifications)?	1	2	3	4	5	N/A
16. Is boresighting relative to weapon positions and EAs conducted?	1	2	3	4	5	N/A

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17. Obstacles integrated with the direct fire control plan?	1	2	3	4	5	N/A
18. Possible events (e.g., counterattacks, coordinating fires) synchronized with control measures?	1	2	3	4	5	N/A
During or at the end of planning/prep how well were the following accomplished..						
19. Subordinates understood the Co Cdr's plan?	1	2	3	4	5	N/A
20. The company rehearsed?	1	2	3	4	5	N/A
21. Company maximized the time available to prepare the defense	1	2	3	4	5	N/A
22. The scheme of maneuver makes effective use of TERRAIN...						
to protect the company (cover and concealment)?	1	2	3	4	5	N/A
to facilitate direct fire and movement (observation and fields of fire)?	1	2	3	4	5	N/A

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Combat Strength at LD: Tanks \_\_\_\_\_ BFVs \_\_\_\_\_ ITVs \_\_\_\_\_ **DEFENSE**  
 At Change of Mission: Tanks \_\_\_\_\_ BFVs \_\_\_\_\_ ITVs \_\_\_\_\_

EXECUTION	NON E	I N A D E Q U A T E	M O D E R A T E L Y	A D E Q U A T E	S U P E R I O R	
1. Co Cdr directed the movement of platoons?	1	2	3	4	5	N/A
2. Cdr directed fires because of changes in METT-T?	1	2	3	4	5	N/A
3. Cdr directed fires because of inadequate planning?	1	2	3	4	5	N/A
4. Cdr positioned himself to see the battlefield and survive?	1	2	3	4	5	N/A
5. Platoons were updated with important information?	1	2	3	4	5	N/A
6. Do the platoons work well together (e.g., good crosstalk, good synchronization)?	1	2	3	4	5	N/A
7. Subordinate units reported adequate and accurate information?	1	2	3	4	5	N/A
8. The following fire control measures were executed...						
TRPs	1	2	3	4	5	N/A
EAs	1	2	3	4	5	N/A
Fire patterns	1	2	3	4	5	N/A
Engagement priorities	1	2	3	4	5	N/A
Sectors of fire	1	2	3	4	5	N/A
Engagement lines	1	2	3	4	5	N/A
Trigger lines	1	2	3	4	5	N/A
Fire commands	1	2	3	4	5	N/A
Engagement criteria	1	2	3	4	5	N/A
Others (list)	1	2	3	4	5	N/A
9. Cdr made effective use of TERRAIN...						
to protect the company (cover and concealment)?	1	2	3	4	5	N/A
to facilitate direct fire and movement (observation and fields of fire)?	1	2	3	4	5	N/A
10. Company's reaction to enemy fires and movement?	1	2	3	4	5	N/A
11. Overall how well were direct fires executed?	1	2	3	4	5	N/A
12. Did the company avoid engaging friendly units?	1	2	3	4	5	N/A
13. Overall, how effective was the company's plan, irrelevant of how well it is executed?	1	2	3	4	5	N/A
14. How well was the company plan executed?	1	2	3	4	5	N/A
15. The company accomplished its mission?	1	2	3	4	5	N/A
16. Co Cdr adjusted the company when METT-T required?	1	2	3	4	5	N/A
17. List any important aspects which led to the outcome of the battle not included above						

NOTE: Item 3 was not included in any analyses because it was statistically unreliable and not valid.

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**PERFORMANCE BY BATTLE**

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For each battle observed, the percentage of times that a company was rated at each level of performance for the survey's planning and preparation items is recorded in Table B.1, and Table B.2 contains the results for the execution items.

In each of these tables the results are separated by whether the battle was a defensive or offensive mission. In addition, for discussion purposes of this analysis, we assume that scores of "moderately adequate," "adequate," or "superior" mean the item was done at a sufficiently appropriate level to ensure that the task could be accomplished.

In terms of planning and preparation there are three general patterns. First, for the majority of missions observed, task force and company orders were generally issued in a timely manner that can give subordinate elements time to plan and prepare. With regard to the task force OPORD, it appears that approximately half of the orders (with nearly 50 percent of the observed task force OPORDs rated moderately adequate or better) company commanders received were sufficient to allow them to perform well. In addition, for the majority of missions (approximately 60 percent), the task force issued the OPORD in a timely fashion, thus allowing companies to prepare and execute well. In turn, for nearly half of all missions, the company orders were provided to platoons in a timely manner.

The second and third patterns involve the percentage of times items related to the quality of planning and preparation were performed adequately. Even though leaders gave their subordinates timely orders, one could argue that the quality of the orders is more important

than how rapidly they are provided. The remainder of items in Appendix B investigate the quality of the companies' planning and preparation process. The second general pattern is that for many of the battles, observed performance on the items is inadequate. For the offensive battles, 11 out of 24 items (46 percent of those on the survey) and for the defense, 9 out of 30 items (30 percent of those on the survey) were either not performed or inadequately performed for more than 60 percent of the observed training events. In addition, items were conducted at a superior level for only a very small percentage of the battles. The third pattern is that the defenses appear to be planned and prepared slightly better than the offensive missions.

Similarly, a large number of the execution skills were not performed well when we look at them by battle (see Table B.2). Specifically, for the offensive training events, 12 out of 22 items (54 percent of those observed) were performed inadequately or not at all. The pattern is analogous for the defensive training events: 11 out of 24 items (46 percent of those observed) were performed poorly.

Table B.1  
Quality of Performance of Planning and Preparation Items by Battle

		Observation Reported				Number of Cases	
		None	Inadequate	Moderately Adequate	Adequate Superior		
<b>I. Task Force</b>							
TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission.	Off.	0.0	49.1	35.8	14.7	0.4	232
	Def.	1.0	51.5	39.2	8.2	0.0	97
TF order was received in sufficient time for the Co Cdr to plan, prepare, and execute.	Off.	0.4	35.1	37.2	26.8	0.4	231
	Def.	1.0	38.1	44.3	16.5	0.0	97
<b>II. Basic Planning</b>							
Company OPORD was given in sufficient time for platoons to plan, prepare, and execute.	Off.	1.7	38.1	38.5	20.3	1.3	231
	Def.	3.1	51.0	31.6	13.3	1.0	98
The Co Cdr conveyed METT-T to subordinates.	Off.	3.5	45.0	34.6	15.2	1.7	231
	Def.	4.1	44.9	35.7	14.3	1.0	98
Actions/locations of other elements of the task force.	Off.	3.0	38.5	43.3	13.4	1.7	231
	Def.	0.0	29.6	52.0	14.3	4.1	98
Subordinates understood the Co Cdr's plan (purpose, task, IPB).	Off.	0.4	40.1	45.7	11.6	2.2	232
	Def.	1.0	37.8	48.0	12.2	1.0	98
<b>III. Complex Planning</b>							
Co Cdr conducted a terrain analysis to determine possible obstacles, fire sacks, EAs, and enemy positions (Company commander conducted a terrain analysis/IPB).	Off.	4.8	48.9	31.2	13.0	2.2	231
	Def.	4.1	49.0	34.7	9.2	3.1	98
Possible Enemy Positions and Actions based on IPB (Possible Enemy Actions/Avenues of approach based on IPB).	Off.	4.8	53.2	32.5	7.8	1.7	231
	Def.	4.1	43.3	34.0	16.5	2.1	97

Table B.1 (continued)

	Observation Reported							Number of Cases
	None	Inadequate	Moderately		Superior			
			Adequate	Adequate				
Actions on Contact based on Terrain, Enemy, and Mission.	Off. 8.2	56.3	26.0	9.5	0.0		231	
Procedures for reorganization/ consolidation and shifting fires.	Def. 9.6	40.4	43.6	4.3	2.1		94	
Reactions to likely contingencies are discussed.	Off. 12.5	61.6	20.3	5.6	0.0		232	
Review of reporting requirements/procedures.	Def. 17.3	54.1	24.5	3.1	1.0		98	
Possible events (e.g., counterattacks, coordinating fires) synchronized with control measures.	Off. 10.0	52.8	29.0	6.9	1.3		231	
	Def. 11.5	49.0	32.3	6.3	1.0		96	
	Off. 13.5	47.5	29.1	8.5	1.3		223	
	Def. 20.2	42.6	27.7	9.6	0.0		94	
	Off. N/A	N/A	N/A	N/A	N/A		N/A	
	Def. 16.1	60.2	19.4	4.3	0.0		93	
<b>IV. Movement and Position</b>								
The scheme of maneuver makes effective use of TERRAIN...								
to protect the company (cover and concealment).	Off. 0.4	49.6	39.1	10.0	0.9		230	
to facilitate direct fire and movement (observation and fields of fire).	Def. 2.0	44.9	42.9	10.2	0.0		98	
	Off. 0.5	52.8	36.1	10.2	0.5		216	
	Def. 1.1	50.5	31.6	15.8	1.1		95	
<b>V. Direct Fire Control</b>								
The company's planning and rehearsal includes the following fire control measures...								
TRPs	Off. 24.3	35.7	29.6	10.0	0.4		230	
EAs	Def. 7.1	33.7	35.7	19.4	4.1		98	
	Off. 42.1	34.4	16.9	6.2	0.5		195	
	Def. 5.1	29.6	42.9	19.4	3.1		98	

Table B.1 (continued)

	Observation Reported					Number of Cases
	None	Inadequate	Moderately Adequate	Adequate	Superior	
Fire patterns	Off. 34.5	40.2	19.7	4.8	0.9	229
	Def. 18.6	40.2	34.0	5.2	2.1	97
Engagement priorities	Off. 23.4	35.9	30.3	9.1	1.3	231
	Def. 13.3	35.7	38.8	10.2	2.0	98
Sectors of fire	Off. 24.1	35.5	29.8	10.1	0.4	228
	Def. 6.2	33.0	45.4	14.4	1.0	97
Engagement criteria	Off. 30.0	33.5	27.0	8.3	1.3	230
	Def. 28.1	33.3	26.0	10.4	2.1	96
Engagement lines	Off. N/A	N/A	N/A	N/A	N/A	N/A
	Def. 24.2	43.2	20.0	8.4	4.2	95
Trigger lines	Off. N/A	N/A	N/A	N/A	N/A	N/A
	Def. 26.0	38.5	22.9	6.3	6.3	96
METT-7/IPB is integrated with the direct fire plan.	Off. 6.5	59.9	22.0	11.6	0.0	232
	Def. 7.1	49.0	26.5	14.3	3.1	98
Obstacles integrated with direct fire plan.	Off. N/A	N/A	N/A	N/A	N/A	N/A
	Def. 22.5	57.3	16.9	2.2	1.1	89
<b>VI. Preparation</b>						
The company maximized the time available to prepare the offense (defense).	Off. 0.9	55.7	31.3	11.3	0.9	230
	Def. 4.1	69.1	20.6	5.2	1.0	97
The company rehearsed.	Off. 28.8	41.6	19.7	7.3	2.6	233
	Def. 44.3	35.1	12.4	7.2	1.0	97
Company boresighted relative to expected EAs.	Off. 8.4	29.6	31.4	27.4	3.1	226
	Def. 10.3	40.2	22.7	21.6	5.2	97
Line of sight between weapon or battle positions and EAs checked.	Off. N/A	N/A	N/A	N/A	N/A	N/A
	Def. 11.6	46.3	24.2	16.8	1.1	95
The weapon positions (terrain placement and physical specifications).	Off. N/A	N/A	N/A	N/A	N/A	N/A
	Def. 6.3	49.0	31.3	12.5	1.0	96

Table B.2  
Quality of Performance of Execution Items by Battle

		Observation Reported					Number of Cases
		None	Inadequate	Moderately Adequate		Superior	
				Adequate	Adequate		
<b>I. Command and Control</b>							
Platoons were updated with important information.	Off.	3.5	33.3	47.4	14.5	1.3	228
	Def.	1.0	27.1	51.0	18.8	2.1	96
Do the platoons work well together (e.g., good crosstalk, good synchronization)?	Off.	1.3	45.1	40.8	11.2	1.7	233
	Def.	1.0	44.3	40.2	11.3	3.1	97
Subordinate units reported adequate and accurate information.	Off.	1.3	45.1	44.6	8.6	0.4	233
	Def.	0.0	46.9	45.8	6.3	1.0	96
<b>II. Movement and Position</b>							
Cdr directed the movement of the platoons.	Off.	0.4	33.9	49.6	15.2	0.9	230
	Def.	7.9	39.3	39.3	12.4	1.1	89
Cdr positioned himself to see the battlefield and survive.	Off.	3.5	38.5	37.7	19.0	1.3	231
	Def.	2.1	35.4	45.8	15.6	1.0	96
Cdr made effective use of TERRAIN ... to protect the company (cover and concealment).	Off.	1.3	52.6	33.8	11.8	0.4	228
	Def.	2.0	49.0	37.8	11.2	0.0	98
Cdr facilitated direct fire and movement (observation and fields of fire).	Off.	1.7	55.7	33.0	9.6	0.0	230
	Def.	2.1	57.7	27.8	11.3	1.0	97

Table B.2 (continued)

		Observation Reported					Number of Cases
		None	Inadequate	Moderately Adequate		Superior	
				Adequate	Adequate		
<b>III. React and Adjust</b>							
Company reaction to enemy fires and movement.	Off.	3.5	67.7	23.6	4.8	0.4	229
	Def.	3.1	57.7	32.0	5.2	2.1	97
Cdr directed fires because of changes in METT-T.	Off.	6.3	52.9	33.0	7.7	0.0	221
	Def.	7.4	57.9	24.2	9.5	1.1	95
Co Cdr adjusted the company when changes in METT-T required.	Off.	4.4	59.1	26.7	8.0	1.8	225
	Def.	7.2	54.6	29.9	5.2	3.1	97
<b>IV. Direct Fire Control</b>							
The following fire control measures were executed...							
TRPs	Off.	43.6	34.7	15.6	6.2	0.0	225
	Def.	17.9	36.8	31.6	11.6	2.1	95
EAs	Off.	56.7	27.3	12.9	3.1	0.0	194
	Def.	16.1	41.9	26.9	12.9	2.2	93
Fire patterns	Off.	49.8	32.3	14.3	3.1	0.4	223
	Def.	23.2	49.5	23.2	2.1	2.1	95
Engagement priorities	Off.	42.9	32.1	19.2	5.8	0.0	224
	Def.	24.0	44.8	17.7	11.5	2.1	96
Sectors of fire	Off.	42.3	31.7	19.4	6.6	0.0	227
	Def.	17.0	42.6	29.8	9.6	1.1	94

Table B.2 (continued)

		Observation Reported					Number of Cases
		None	Inadequate	Moderately Adequate	Adequate	Superior	
Engagement lines	Off.	N/A	N/A	N/A	N/A	N/A	N/A
	Def.	31.9	47.9	12.8	6.4	1.1	94
Trigger lines	Off.	N/A	N/A	N/A	N/A	N/A	N/A
	Def.	32.6	49.5	11.6	6.3	0.0	95
Fire commands	Off.	42.5	35.0	19.5	3.1	0.0	226
	Def.	19.8	50.0	25.0	4.2	1.0	96
Engagement criteria	Off.	41.4	33.5	19.4	5.7	0.0	227
	Def.	27.4	43.2	16.8	10.5	2.1	95
Overall how well were direct fires executed.	Off.	4.8	70.3	18.3	5.7	0.9	229
	Def.	2.1	69.8	16.7	6.3	5.2	96
Did the company avoid engaging friendly units?	Off.	2.3	19.2	11.0	45.7	21.9	219
	Def.	3.1	18.6	12.4	39.2	26.8	97
<b>V. Overall Effectiveness</b>							
Overall, how effective was the company's plan, irrelevant of how well it is executed?	Off.	0.4	53.9	34.5	9.9	1.3	232
	Def.	0.0	57.1	34.7	6.1	2.0	98
How well was the company plan executed?	Off.	0.4	65.0	27.0	6.2	1.3	226
	Def.	1.0	62.5	27.1	6.3	3.1	96
The company accomplished its mission.	Off.	14.3	57.0	21.7	5.2	1.7	230
	Def.	14.4	55.7	16.5	7.2	6.2	97

Appendix C

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**QUALITY OF PLANNING, PREPARATION, AND  
EXECUTION PERFORMANCE BY COMPANY**

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This appendix contains the results of the by-company analysis for both planning and preparation (Table C.1) and execution (Table C.2) items. The “performed well” category is a subset of the “performed adequately” category. Consequently the rows do not add to 100 percent.

**Table C.1**  
**Quality of Planning and Preparation Performance By Company**

	Performed Inadequately	Performed Adequately	Performed Well
<b>I. Task Force</b>			
TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission.	40	60	25
TF order was received in sufficient time for the Co Cdr to plan, prepare, and execute.	19	81	48
<b>II. Basic Planning</b>			
Company OPORD was given in sufficient time for platoons to plan, prepare, and execute.	27	73	29
The Co Cdr conveyed METT-T to subordinates.	35	65	29
Actions/locations of other elements of the task force.	25	75	36
Subordinates understood the Co Cdr's plan (purpose, task, IPB).	23	77	35
<b>III. Complex Planning</b>			
Co Cdr conducted a terrain analysis to determine possible obstacles, fire sacks, EAs, and enemy positions {Co Cdr conducted a terrain analysis/IPB }.	54	46	25
Possible Enemy Positions and Actions based on IPB { Possible Enemy Actions/Avenues of approach based on IPB }.	52	48	15
Actions on Contact based on Terrain, Enemy, and Mission.	65	35	10
Procedures for reorganization/consolidation and shifting fires.	77	23	11
Reactions to likely contingencies are discussed.	65	35	4
Review of reporting requirements/procedures.	63	37	19
Possible events (e.g., counterattacks, coordinating fires) synchronized with control measures.	69	31	12

Table C.1 (continued)

	Performed Inadequately	Performed Adequately	Performed Well
<b>IV. Movement and Position</b>			
The scheme of maneuver makes effective use of TERRAIN... to protect the company (cover and concealment)	39	61	23
to facilitate direct fire and movement (observation and fields of fire).	39	61	19
<b>V. Direct Fire Control</b>			
The company's planning and rehearsal includes the following fire control measures...			
TRPs	56	44	11
EAs	73	27	15
Fire patterns	81	19	8
Engagement priorities	60	40	17
Sectors of fire	52	48	19
Engagement criteria	66	34	12
Engagement lines	63	37	27
Trigger lines	58	42	27
METT-7/IPB is integrated with the direct fire plan.	61	39	15
Obstacles integrated with DF control plan.	73	27	6
<b>VI. Preparation</b>			
The company maximized the time available to prepare the offense (defense).	60	40	21
The company rehearsed..	79	21	2
Company boresighted relative to expected EAs.	31	69	46
Line of sight between weapon/battle positions and EAs checked.	54	46	31
The weapon positions (terrain placement and physical specs)	52	48	36

NOTE: Based on observations of 52 company commanders.

**Table C.2**  
**Quality of Execution Performance By Company**

	Performed Inadequately	Performed Adequately	Performed Well
<b>I. Command and Control</b>			
Platoons were updated with important information.	23	77	44
Do the platoons work well together (e.g., good crosstalk, good synchronization)?	40	60	25
Subordinate units reported adequate and accurate information.	37	63	23
<b>II. Movement and Position</b>			
Cdr directed the movement of the platoons.	31	69	40
Cdr positioned himself to see the battlefield and survive.	35	65	40
Cdr made effective use of TERRAIN ... to protect the company (cover and concealment). to facilitate direct fire and movement (observation and fields of fire).	56	44	23
	56	44	17
<b>III. React and Adjust</b>			
Company reaction to enemy fires and movement.	73	27	4
Cdr directed fires because of changes in METT-T.	54	37	13
Co Cdr adjusted the company when changes in METT-T required.	52	48	10

Table C.2 (continued)

	Performed Inadequately	Performed Adequately	Performed Well
<b>IV. Direct Fire Control</b>			
The following fire control measures were executed...			
TRPs	81	19	2
EAs	86	14	6
Fire patterns	88	12	6
Engagement priorities	77	23	10
Sectors of fire	77	23	8
Engagement lines	76	24	20
Trigger lines	76	24	16
Fire commands	86	14	4
Engagement criteria	79	21	8
Overall how well were direct fires executed?	75	25	2
Did the company avoid engaging friendly units?	8	92	85
<b>V. Overall Effectiveness</b>			
Overall, how effective was the company's plan, irrelevant of how well it is executed?	50	50	17
How well was the company plan executed?	63	37	8
The company accomplished its mission.	69	31	4

NOTE: Based on observations of 52 company commanders.



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**IMPROVEMENT TRENDS IN PLANNING AND  
EXECUTION**

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Tables D.1 and D.2 report the percentage of companies that obtained a value of moderately adequate or better sometime during their NTC rotation for the planning and preparation items (Table D.1) and the execution items (Table D.2) for offenses, defenses, and battle types combined.<sup>1</sup> For the analysis in these two tables, only companies and their commanders with data from two or more battles are included. Both live fire and force-on-force exercises were included in this analysis.

**The design of the analysis.** To obtain a stable estimate of an improvement effect found in Tables D.3 and D.4, we used the following regression equation:

$$\text{Item}_y = \text{Co} + \text{Battle}_{2-7} + \text{Battle Type} ,$$

where  $\text{Item}_y$  represents a question from the survey,  $\text{Co}$  represents a separate code for each company in the analysis,  $\text{Battle}_{2-7}$  estimates the change from the first battle relative to each of the six subsequent battles, and  $\text{Battle Type}$  accounts for variation due to offensive or defensive missions.<sup>2</sup> More specifically, we included a dummy code of 1 or 0 for each company so as to account for any company variation. Second, we used the chronological battle sequence (e.g., the

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<sup>1</sup>See footnote 3, page 16, for a discussion of the problems with inferences pertaining to differences between offensive and defensive battles.

<sup>2</sup>We investigated several different models of improvement, including a split model and a linear trend model; however, we decided to use this day model, because it best represents the data.

first battle a company fought was battle 1, the second battle fought was battle 2, and the third battle in sequence was battle 3, even if it occurred on training day 5). Each battle 2–7 is then dummy coded with 1 or 0 to represent the effect for that battle. Finally, we included the Battle Type variable (offensive missions coded 1 and defensive missions coded 0) to control for differences between offensive and defensive missions.

To evaluate whether companies and their commanders improved during their rotation training event, we compared the mean values of battle 1 to the other battles. Tables D.3 and D.4 show the scores of battles across rotations in planning and preparation and execution. The first column of both tables contains the mean value obtained on the first battle. Columns labeled “Amount of Change Due to Improvements” record the actual scale increase or decrease (that is, the regression coefficient for battles 2–7) of these particular battles relative to the mean from battle 1. For example, the mean of the first item in Table D.3 was 2.46; the only statistically significant increase seen was from battle 5 (0.51). Thus, the average value for battle 5 was 2.97, and this was statistically greater than the average value of battle 1.

The column “Battle Type” reports the differences between offensive and defensive values observed in this analysis. If the value is positive and statistically significant, it means that values for offensive battles were greater than defensive battles for an item (negative and statistically significant values indicate defensive scores were greater). Using the same example as above, the first item in Table D.3, we see that values obtained for offensive battles were 0.38 of a scale value greater than for defensive battles. The last column in both tables reports the number of company-level battles included in the analysis.

To ensure that this analysis best represents improvement, we placed three restrictions on the inclusion of data. First, we used only data from companies for which we had two or more observations. We did this so we could control for the fact that some companies consistently perform better than others. By controlling for variation in company performance, we obtain a better estimate of “true” improvement during the rotation. Second, for the analysis of each item, we did not include companies that never obtained a score higher than inadequate. We did this to ensure that any improvements

found are meaningful improvements; in other words, we did not consider companies that went from not doing the activity to inadequately doing it as “improvement.” Third, we included only force-on-force battles.

We excluded live fire data from this analysis so we could be sure that improvement results reported here are due to improvement over rotation and not other variables. First, because live fire battles occurred only during the early part of the rotation, improvement results for them could be incomplete. Specifically, if improvement at some skills, for example complex planning skills, take multiple battles (i.e., multiple experiences), it could appear that units improved in the force-on-force exercises (seven battles across all 14 days of a rotation) but not for live fire exercises (four battles across only the first 7–9 days of a rotation). Thus, we avoid reporting erroneous differences between training events. Second, when considering the effect that individual company variation could have on the data, the live fire effects would also be confounded with other possible effects. For example, in our data a company could maximally provide two observations from live fire exercises (five from force-on-force), and one observation is always an offense and the other a defense. It is extremely difficult to determine whether apparent improvement effects for live fire were attributable to battle type, battle sequence, live fire, company, or interactions among any of these possible effects. We do not have enough data points to estimate all of these possible effects.

**Table D.1**  
**Percentage of Companies That Perform Planning and Preparation Tasks Moderately Adequate or Better During Their NTC Rotation by Defense, Offense, and Combined Battle Types**

	Percent of Companies by Battle Type		
	Defense	Offense	Combined
<b>I. Task Force</b>			
TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission.	58	86	90
TF order was received in sufficient time for the Co Cdr to plan, prepare, and execute.	64	94	96
<b>II. Basic Planning</b>			
Company OPORD was given in sufficient time for platoons to plan, prepare, and execute.	60	92	96
The Co Cdr conveyed METT-T to subordinates.	64	86	92
Actions/locations of other elements of the task force.	84	88	96
Subordinates understood the Co Cdr's plan (purpose, task, IPB).	74	88	94
<b>III. Complex Planning</b>			
Co Cdr conducted a terrain analysis to determine possible obstacles, fire sacks, EAs, and enemy positions { Company commander conducted a terrain analysis/IPB }.	58	76	86
Possible Enemy Positions and Actions based on IPB { Possible Enemy Actions/Avenues of approach based on IPB }.	63	78	88
Actions on Contact based on Terrain, Enemy, and Mission.	61	74	84
Procedures for reorganization/consolidation and shifting fires.	40	52	64
Reactions to likely contingencies are discussed.	52	74	86
Review of reporting requirements/procedures.	47	76	80
Possible events (e.g., counterattacks, coordinating fires) synchronized with control measures.	39	N/A	N/A
<b>IV. Movement and Position</b>			
The scheme of maneuver makes effective use of TERRAIN... to protect the company (cover and concealment).	70	84	90
to facilitate direct fire and movement (observation and fields of fire).	64	80	86

Table D.1 (continued)

	Percent of Companies by Battle Type		
	Defense	Offense	Combined
<b>V. Direct Fire Control</b>			
The company's planning and rehearsal includes the following fire control measures...			
TRPs	72	82	90
EAs	76	49	84
Fire patterns	56	58	74
Engagement priorities	66	72	86
Sectors of fire	78	76	88
Engagement criteria	53	74	82
Engagement lines	46	N/A	N/A
Trigger lines	52	N/A	N/A
METT-T/IPB is integrated with the direct fire plan.	56	72	82
Obstacles integrated with DF control plan.	30	N/A	N/A
<b>VI. Preparation</b>			
The company maximized the time available to prepare the offense (defense).	36	74	80
The company rehearsed.	26	64	64
Company boresighted relative to expected EAs.	64	92	92
Line of sight between weapon/battle positions and EAs checked.	54	N/A	N/A
The weapon positions (terrain placement and physical specs)	56	N/A	N/A

NOTE: Based on observations of 50 companies.

**Table D.2**  
**Percentage of Companies That Perform Execution Tasks Moderately Adequate or Better During Their NTC Rotation by Defense, Offense, and Combined Battle Types**

	Percent of Companies by Battle Type		
	Defense	Offense	Combined
<b>I. Command and Control</b>			
Platoons were updated with important information.	88	92	94
Do the platoons work well together (e.g., good crosstalk, good synchronization)?	70	84	94
Subordinate units reported adequate & accurate information.	64	80	86
<b>II. Movement and Position</b>			
Cdr directed the movement of the platoons.	69	90	92
Cdr positioned himself to see the battlefield and survive.	72	92	94
Cdr made effective use of TERRAIN ... to protect the company (cover and concealment). to facilitate direct fire and movement (observation and fields of fire).	56	86	90
	48	82	84
<b>III. React and Adjust</b>			
Company reaction to enemy fires and movement.	50	74	82
Cdr directed fires because of changes in METT-T.	50	76	82
Co Cdr adjusted the company when changes in METT-T required.	52	80	84

Table D.2 (continued)

	Percent of Companies by Battle Type		
	Defense	Offense	Combined
<b>IV. Direct Fire Control</b>			
The following fire control measures were executed...			
TRPs	59	52	66
EAs	53	34	66
Fire patterns	35	38	52
Engagement priorities	47	52	62
Sectors of fire	53	56	72
Engagement lines	29	N/A	N/A
Trigger lines	29	N/A	N/A
Fire commands	42	46	64
Engagement criteria	43	48	60
Overall how well were direct fires executed?	38	60	68
Did the company avoid engaging friendly units?	80	96	98
<b>V. Overall Effectiveness</b>			
Overall, how effective was the company's plan, irrelevant of how well it is executed?	56	72	82
How well was the company plan executed?	46	72	76
The company accomplished its mission.	38	62	70

NOTE: Based on observations of 50 companies.

**Table D.3**  
**Improvement Trend Analysis of Company's Planning and Preparation**

	Mean for Battle 1	Amount of Change Due to Improvements						Battle Type	Number of Battles Observed
		Battle 2	Battle 3	Battle 4	Battle 5	Battle 6	Battle 7		
<b>I. Task Force</b>									
TF OPORD enabled the Co Cdr to plan, prepare, and execute his mission.	2.46	0.28	0.15	0.22	0.51**	0.10	-0.24	0.38**	220
TF order was received in sufficient time for the Co Cdr to plan, prepare and execute.	3.40	-0.50**	-0.67**	-0.65**	-0.45**	-0.51**	-1.83**	0.30**	233
<b>II. Basic Planning</b>									
Company OPORD was given in sufficient time for platoons to plan, prepare and execute.	2.87	-0.10	-0.23	-0.04	-0.14	0.14	-0.41**	0.27	234
The Co Cdr conveyed METT-T to subordinates.	2.59	0.10	0.07	0.13	0.27	0.23	0.17	0.26*	228
Actions/locations of other elements of the task force.	2.48	0.08	0.12	0.11	0.32	0.14	-0.08	-0.02	235
Subordinates understood the Co Cdr's plan (purpose, task, IPB).	2.67	-0.16	0.03	0.04	0.18	-0.03	0.00	0.08	229

Table D.3 (continued)

	Amount of Change Due to Improvements							Number of Battles Observed	
	Mean for Battle 1	Battle 2	Battle 3	Battle 4	Battle 5	Battle 6	Battle 7		Battle Type
<b>III. Complex Planning</b>									
Co Cdr conducted a terrain analysis to determine possible obstacles, fire sacks, EAs, and enemy positions (Company commander conducted a terrain analysis/IPB).	2.54	0.10	0.06	0.38	0.27	0.20	0.16	0.24	215
Possible Enemy Positions and Actions based on IPB (Possible Enemy Actions/Avenues of approach based on IPB).	2.18	0.11	0.34*	0.48*	0.56**	0.45**	0.40*	-0.06	215
Actions on Contact based on Terrain, Enemy, and Mission.	2.00	0.26	0.54**	0.58**	0.69**	0.53**	0.56**	0.04	209
Procedures for reorganization/consolidation and shifting fires.	2.06	0.00	0.22	0.29	0.61**	0.45*	0.26	0.11	155
Reactions to likely contingencies are discussed.	2.15	0.32	0.33	0.19	0.44*	0.39*	0.46**	0.15	210
Review of reporting requirements/procedures.	2.46	-0.12	0.16	0.06	0.23	0.20	0.18	0.10	197

Table D.3 (continued)

	Mean for Battle 1	Amount of Change Due to Improvements							Number of Battles Observed
		Battle 2	Battle 3	Battle 4	Battle 5	Battle 6	Battle 7	Battle Type	
<b>IV. Movement and Position</b>									
The scheme of maneuver makes effective use of TERRAIN...	2.48	0.08	0.15	0.18	0.05	0.38*	0.25	-0.23	216
to protect the company (cover and concealment).									
to facilitate direct fire and movement (observation and fields of fire).	2.42	0.08	0.26	0.11	0.16	0.24	0.25	-0.09	214
<b>V. Direct Fire Control</b>									
The company's planning and rehearsals includes the following fire control measures...									
TRPs	1.79	0.66**	0.40	0.73**	0.91**	0.51*	0.47**	-0.18	222
EAs	1.70	0.40	0.17	0.43	0.65**	0.41*	0.15	-0.70**	205
Fire patterns	1.73	0.56*	0.48*	0.60*	0.67*	0.19	0.42	-0.06	187
Engagement priorities	2.22	0.25	0.05	0.24	0.35	0.30	0.13	0.08	210

Table D.3 (continued)

	Amount of Change Due to Improvements							Number of Battles Observed	
	Mean for Battle 1	Battle 2	Battle 3	Battle 4	Battle 5	Battle 6	Battle 7		Battle Type
Sectors of fire	2.00	0.59**	0.32	0.55*	0.51*	0.42*	0.41*	-0.01	220
Engagement criteria	2.12	0.43	0.30	0.35	0.68*	0.31	0.21	0.25	197
METT-IPB is integrated with the direct fire plan.	2.17	0.20	0.32	0.47*	0.54**	0.51**	0.43**	-0.03	197
<b>VI. Preparation</b>									
The company maximized the time available to prepare the offense (defense).	2.36	0.21	0.23	0.26	0.30	0.56**	0.34*	0.53	201
The company rehearsed.	2.39	-0.43	-0.07	-0.38	0.04	0.00	-0.10	0.40	157
Company boresighted relative to expected EAs.	2.75	0.22	0.12	0.16	0.52*	0.52*	-0.03	0.46**	229

NOTE: \*p < .05, \*\*p < .01.

**Table D.4**  
**Improvement Trend Analysis of Company's Execution**

	Amount of Change Due to Improvements							Number of Battles Observed	
	Mean for Battle 1	Battle 2	Battle 3	Battle 4	Battle 5	Battle 6	Battle 7		Battle Type
<b>I. Command and Control</b>									
Platoons were updated with important information.	2.43	0.42*	0.23	0.50*	0.55**	0.37*	0.44**	-0.08	230
Do the platoons work well together (e.g., good crosstalk, good synchronization)?	2.32	0.19	0.41**	0.44*	0.67**	0.34*	0.61**	-0.05	236
Subordinate units reported adequate and accurate information.	2.46	0.16	0.13	0.28	0.34	0.34*	0.45**	0.04	220
<b>II. Movement and Position</b>									
Cdr directed the movement of the platoons.	2.79	-0.03	0.10	0.17	0.22	0.05	0.12	0.09	224
Cdr positioned himself to see the battlefield and survive.	2.72	-0.01	0.03	0.46*	0.22	0.00	0.24	-0.05	229
Cdr made effective use of TERRAIN ... to protect the company (cover and concealment).	2.46	0.07	0.16	0.43*	0.26	0.14	0.28	-0.01	223
to facilitate direct fire and movement (observation and fields of fire).	2.41	0.21	0.17	0.45*	0.43*	0.20	0.39*	0.13	215
<b>III. React and Adjust</b>									
Company reaction to enemy fires and movement.	2.15	0.19	0.19	0.54*	0.44*	0.04	0.50**	0.00	199
Cdr directed fires because of changes in METT-T.	2.20	0.28	0.28	0.69**	0.43*	0.38*	0.44**	0.11	200

Table D.4 (continued)

	Amount of Change Due to Improvements							Number of Battles Observed	
	Mean for Battle 1	Battle 2	Battle 3	Battle 4	Battle 5	Battle 6	Battle 7		Battle Type
Co Cdr adjusted the company when changes in METT-T required.	2.35	0.00	0.07	0.13	0.35	0.14	0.37**	-0.03	204
<b>IV. Direct Fire Control</b>									
The following fire control measures were executed...									
TRPs	1.93	-0.01	0.01	0.13	0.24	0.05	0.01	-0.34	163
EAs	1.47	0.38	0.44*	0.65*	0.45	0.36	0.24	-0.34*	160
Fire Patterns	2.00	-0.04	0.03	0.17	0.38	0.07	0.19	-0.04	130
Engagement Priorities	2.25	-0.16	0.02	0.21	0.41	0.14	0.11	-0.15	153
Sectors of Fire	2.11	0.02	0.16	0.54*	0.26	0.01	0.04	0.01	178
Engagement Criteria	2.39	-0.19	-0.13	0.11	0.23	-0.04	0.10	-0.16	151
Fire Commands	1.78	0.06	0.29	0.53	0.31	0.23	0.44*	-0.11	160
Overall how well were direct fires executed?	2.10	0.05	0.37	0.59*	0.47	0.15	0.38	-0.08	170
Did the company avoid engaging friendly units?	3.29	0.02	0.26	0.11	0.55*	0.03	0.22	0.25	239
<b>V. Overall Effectiveness</b>									
Overall, how effective was the company's plan, irrelevant of how well it is executed?									
How well was the company plan executed?	2.33	0.13	0.29	0.15	0.47*	0.27	0.34*	0.30*	199
The company accomplished its mission.	2.35	-0.01	0.21	0.40	0.28	0.04	0.35*	-0.47	185
	2.19	-0.02	0.42	0.62*	0.75*	0.15	0.49*	0.02	176

NOTE: \*p < .05, \*\*p < .01.

Appendix E

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**PLANNING AND PREPARATION FACTORS'  
RELATIONSHIPS TO EXECUTION ITEMS**

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**Table E.1**  
**Planning and Preparation Factors Relationships to Execution Items**

	Offense				Defense				
	P&E	DFC	TIME	TF	P&E	DFC	WPP	TIME	TF
<b>I. Command and Control</b>									
Platoons were updated with important information.	+						+		
Do the platoons work well together (e.g., good crosstalk, good synchronization)?	+	-			+				
Subordinate units reported adequate and accurate information.	+				+				
<b>II. Movement and Position</b>									
Cdr directed the movement of the platoons.					+				
Cdr positioned himself to see the battlefield and survive.	+				+				
Cdr made effective use of TERRAIN ...									
to protect the company (cover and concealment).	+						+		
to facilitate direct fire and movement (observation and fields of fire).	+				+		+		
<b>III. React and Adjust</b>									
Company reaction to enemy fires and movement.	+						+		
Cdr directed fires because of changes in METT-T.	+	+			+	+	+		
Co Cdr adjusted the company when changes in METT-T required.	+	+		-			+		

Table E.1 (continued)

	Offense				Defense			
	P&E	DFC	TIME	TF	P&E	DFC	WPP	TF
<b>IV. Direct Fire Control</b>								
The following fire control measures were executed...								
TRPs	+	+					+	
EAs	+	+			+			
Fire patterns		+			+			
Engagement priorities		+			+			
Sectors of fire	+	+			+		+	
Engagement criteria	N/A	N/A	N/A	N/A				
Engagement lines	N/A	N/A	N/A	N/A				
Trigger lines	N/A	N/A	N/A	N/A				
Fire commands	N/A	N/A	N/A	N/A				
Overall how well were direct fires executed?	+						+	
Did the company avoid engaging friendly units?	+			+		+		+
<b>V. Overall Effectiveness</b>								
Overall, how effective was the company's plan, irrelevant of how well it is executed?	+			+			+	
How well was the company plan executed?	+						+	
The company accomplished its mission.	+			+		+		+

NOTE: All reported coefficients are statistically significant at  $p < .05$ .

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