Technical Report 943

Combat Vehicle Command and Control Systems: Training Implications Based on Company-Level Simulations

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To improve the command and control of armor units, the Army is evaluating the usefulness of including an automated command and control system on future tanks. This research evaluates the training implications for two concept configurations of the Combat Vehicle Command and Control (CVCC) system. This research, part of a larger company-level evaluation, was conducted using the Close Combat Test Bed (CCTB) at Fort Knox. Two hundred ninety-four armor soldiers (56 commissioned officers, 85 noncommissioned officers, and 153 enlisted men) participated in the research over a 14-week period. During each 5-day data collection period, seven manned simulators (with three-man crews plus autoloader) and six semiautomated vehicles formed a tank "company."

Each company was randomly assigned to one of three conditions: (a) a fully capable configuration with automatic transmission capability referred to as the CVCC system, (b) a less capable configuration without the radio interface unit required for automatic data transmission referred to as the Intra Vehicular Command and Control (IVCC) system,
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(c) an M1 baseline for comparison purposes. Each company completed a 2 1/2-day training program and a 2 1/2-day testing and data collection program. Tank commanders completed five questionnaires related to the training program and three diagnostic tests of performance. Gunners and drivers also completed items related to the training program as part of a larger questionnaire. Results indicated that tank commanders (TCs) were generally favorable about the training provided. They tended to evaluate the hands-on simulator training more positively than the classroom training, although their ratings of the instructor presentation during classroom instruction were almost as favorable as those for simulator training. They also reported positive views about the tactical training exercises, particularly the company training exercise. Training was generally perceived as clear by the TCs, and they reported the opportunity for hands-on practice as adequate. TC performance on diagnostic tests showed that performance was generally adequate (at or above 75% mastery level). However, there were a few poorer performers, particularly on the CITV diagnostic, who would have profited from more systematic remedial instruction. A number of concrete recommendations were offered for improving the various segments of the training program. These suggestions focused on methods for improvement in the training program. These suggestions focused on methods for improvement in five areas: classroom instruction, hands-on simulator training, diagnostic tests, tactical exercises, and field training with real tanks. The results of this research and development effort suggest investigating additional CVCC concept configurations and extensions of the CVCC concept to the battalion level. Findings also provide information on the training requirements associated with new equipment should the CVCC system be fielded.

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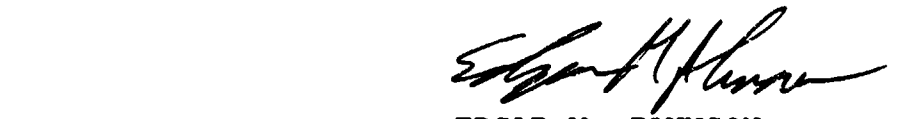
Training Simulation

FOREWORD

This report presents findings and recommendations for training derived from a company-level simulation of an automated command control system. It is one of a series of four reports that are the result of this major undertaking. The system, referred to as the Combat Vehicle Command and Control (CVCC) system, is intended to support the requirements of AirLand battle by increasing the ability of lower-echelon commanders to synchronize, plan, and control combined arms operations throughout their respective areas of influence. CVCC capabilities are expected to provide vehicle commanders with a real-time tactical display consistent with their areas of operation and timely transmission and reception of reports, messages, battlefield intelligence, and orders.

This report supports the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) effort to provide research-based findings on human performance that can be used early in the design process to improve equipment prototypes. The effort reported here is part of a larger research program being carried out by the Future Battlefield Conditions Team at ARI's Fort Knox Field Unit, Training Requirements for the Future Integrated Battlefield. This research supports the Memorandum of Agreement (MOA) between ARI and the Tank Automotive Command (TACOM) on the CVCC dated 22 March 1989 and the MOA between ARI and the U.S. Army Armor Center and School on Research in Future Battlefield Conditions dated 12 April 1989.

Results of this effort were briefed to the Director, Vetronics Division, TACOM Research Development and Evaluation Center and to the Director of Combat Developments at Fort Knox. It is expected that these results will be used for automated command and control devices generally and the CVCC in particular.



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The company-level CVCC evaluation was a major undertaking requiring a concerned and coordinated effort by a large number of individuals. Technical guidance and oversight was provided by Dr. Barbara Black, team leader of the Future Battlefield Conditions Team at ARI's Fort Knox Field Unit. The other members of Dr. Black's team, Dr. Kathleen Quinkert and Dr. Carl Lickteig, also provided extensive substantive input, particularly in the training and soldier-machine interface (SMI) areas, respectively. Major Milton Koger, ARI's R&D Coordinator at Fort Knox, provided substantial administrative support, especially in coordinating requirements for soldier participants.

The BDM International, Inc., on-site contract support team implemented all phases of the evaluation. The team was headed by Dr. Bruce Leibrecht, senior research scientist. Other members of the on-site team included Mr. James Kerins, Command and Control subject matter expert (C2 SME); Ms. Frances Ainslie, research scientist; Ms. Mary Campbell, junior research scientist; Ms. Karen Lameier, junior research scientist; and Ms. Alicia Sawyer, junior research scientist. Off-site personnel supporting this effort included Dr. William Doherty, program manager; Dr. Nancy Atwood, project director; Dr. Jerry Childs, project director; and Ms. Tiffany Mayden, production manager. Research assistants were responsible for hands-on simulator training, observations within the simulators, and SAFOR operations over the 14-week evaluation. They included Ms. Valerie Barham; Ms. Maureen Barthen; Mr. David Behringer; Ms. Michelle Cole; Ms. Sandra Hall; Ms. Terri Hall; Ms. Jane Hurtgen; Mr. Charles Meier II; Mr. Owen Pitney; Ms. Rosemary Terry; Mr. Michael Vanderkarr; and Mr. Timothy Voss. Technical support of simulators and control equipment was provided by personnel of the on-site facilities support contractor, Bolt, Beranek, and Newman, Inc.--in particular, Mr. Rex Downey and Ms. Diane York. Supporting data collection and analysis activities were Mr. Paul Monday and Mr. George Bradford.

The evaluation resulted in a large, multifaceted set of data. To facilitate presentation of findings, four reports have been developed, each report focusing on a different aspect of the data. Since the data all derived from a single evaluation effort, they share the same background and methodology. Consequently, the authors of all four reports have relied on common narrative where appropriate. This approach ensures clarity and consistency across the separate reports. The occasional use of uniform text is limited to the background, design, and method sections of the reports. The commonalities reflect the full knowledge and agreement of all authors.

COMBAT VEHICLE COMMAND AND CONTROL SYSTEMS: TRAINING IMPLICATIONS BASED ON COMPANY-LEVEL SIMULATIONS

EXECUTIVE SUMMARY

Requirement:

To improve the command and control of armor units, the Army is evaluating the utility of including an automated command and control system on future tanks. This research evaluates the training implications for two concept configurations of the Combat Vehicle Command and Control (CVCC) system and is intended to provide input to training developers for the development of training requirements. This research is part of a larger company-level evaluation focused on operational effectiveness and soldier-machine interface issues in addition to training requirements.

Procedures:

Two hundred and ninety-four armor soldiers (56 commissioned officers, 85 noncommissioned officers, and 153 enlisted men) participated in the research, which was conducted over a 14-week period in the Close Combat Test Bed (CCTB) at Fort Knox. During each 5-day data collection period, seven manned simulators (with three-man crews plus autoloader) and six semiautomated vehicles formed a tank "company." Manned simulator positions included the company commander, three platoon leaders, and the platoon sergeant and the two wingmen of the second platoon. The platoon sergeants and wingmen from the other two platoons were represented by semiautomated vehicles.

Each company was randomly assigned to one of three conditions that differed in the capabilities of the automated command and control device housed in the simulator. The first condition, referred to as the Intra Vehicular Command and Control (IVCC) system included a Command and Control Display (CCD) for displaying own vehicle location and for preparing reports and a Commander's Independent Thermal Viewer (CITV), which allowed the tank commander to designate targets for the gunner. The second condition, referred to as the CVCC condition, included all capabilities of the IVCC condition as well as enhanced CCD and CITV capabilities. For the CCD, these included a mutual position navigation (POSNAV) capability displaying the location of all friendly vehicles and a radio interface unit that allowed reports to be sent and received digitally. For the CITV, enhancements included a target stacking capability and an independent laser

locator. The third condition, referred to as the M1 baseline, did not provide either the CITV or the CCD and was included for comparison purposes.

Each company completed a 2 1/2-day training program (the primary focus here) and a 2 1/2-day testing and data collection program. Thank commanders completed five questionnaires related to the training program and three diagnostic tests of performance. Gunners and drivers also completed items related to the training program as part of a larger questionnaire.

Findings:

Results indicated that tank commanders (TCs) were generally favorable about the training provided in both the CVCC and IVCC configurations. They evaluated their hands-on simulator training more positively than their classroom training, although their ratings of the instructor's presentation during classroom instruction were almost as favorable as those for simulator training. They also reported positive views about the tactical training exercises, particularly the company training exercise. Training was generally perceived as clear by the TCs, and they reported the opportunity for hands-on practice as adequate. TC performance on diagnostic tests showed that performance was generally adequate (at or above a 75% mastery level). However, there were a few poor performers, particularly on the CITV diagnostic, who would have profited from more systematic remedial instruction than was offered in the company evaluation due to time constraints.

In general, TCs viewed classroom training time on CITV and CCD functions as sufficient and slightly longer than necessary. In contrast, they indicated that somewhat more time for individual hands-on training in the simulators would be productive. In addition, they generally reported that more training time, both classroom and individual, would be useful for the more complex tasks relating to tactical usage of the CITV and the CCD integrated usage of both components in a tactical situation.

TCs generally viewed the individual CITV and CCD functions as relatively easy to learn. They regarded target stacking using the CITV as the least easy to learn of the individual CITV and CCD functions. They perceived tactical usage of the equipment and tasks requiring integration of the CITV and the CCD as less easy to learn than the individual functions. Using the thumb control as an input device for the CCD was reported as the most difficult function to learn. There was also some evidence that TCs with greater amounts of experience in armor found learning to use the CITV and the CCD more difficult than their less experienced counterparts.

TC estimates of required new equipment training time if the system were fielded depended on the nature of the task to be trained. Training time for individual CITV functions and the CCD map and navigation functions was estimated at less than 1 1/2 hours each. CCD report and communications functions were viewed as requiring more time but not more than 2 hours for any given function. The greatest amount of training time was seen as necessary for tactical employment of the CVCC equipment with estimates at 2 1/2 hours for CITV tactical usage and closer to 3 hours for CCD tactical usage.

A number of concrete recommendations were offered for improving the various segments of the training program. These suggestions largely focused on specific methods for improvement in five areas: classroom instruction, hands-on simulator training, diagnostic tests, tactical exercises, and field training with real tanks.

Utilization of Findings:

The results of this research provide input to training developers responsible for designing training programs for future research and development efforts investigating additional CVCC concept configurations and extensions of the CVCC concept to the battalion level. Findings also provide information on the training requirements for new equipment training should the CVCC system be fielded.

This research also raises three important issues that warrant consideration by training developers. The first issue concerns the tactical uses of new equipment under development or fielding. While new systems grow from a concept about how they will contribute to a soldier's or unit's combat capability, the full range of tactical uses is not explicit or necessarily known. Tests such as the CVCC company evaluation provide a forum for observing how soldiers make use of the equipment in tactical situations and for discovering novel applications of the systems. However, there is a natural tension between how much explicit instruction on tactical usage should be provided and how much should be left unspecified for the participants to make explicit as the "tactical experts" participating in the equipment evaluation. The training development community needs to consider this issue in planning training in conjunction with testing or fielding new equipment.

A second issue related to technology-based equipment considers differences in background that may influence the ease with which soldiers are able to learn to operate new equipment and to use it effectively. For example, with complex electronic equipment, prior computer experience may facilitate a soldier's ability to learn the system competently and quickly. In some

cases, greater military experience may actually interfere with this ability, since the more experienced soldier has a well established repertoire of skills and ways of operating in tactical situations. Training developers need to consider how individual differences among trainees may influence learning and design training programs accordingly.

A third issue considers the naturally occurring tradeoff decisions that must be made in designing a training program. Time and resources are always constrained and becoming more so, while training requirements are becoming more complex and technology-based. Satisfactory resolution of these tradeoffs must draw on cost-effective training strategies and clear specification of acceptable levels of training outcomes. Effectiveness of training programs must be operationalized by acceptable standards of performance so that the impact of resourcing decisions can be assessed. Design of cost-effective training strategies, along with explicit and accepted standards for mastery, are critical challenges facing training developers today.

COMBAT VEHICLE COMMAND AND CONTROL SYSTEMS: TRAINING IMPLICATIONS BASED ON COMPANY-LEVEL SIMULATIONS

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COMBAT VEHICLE COMMAND AND CONTROL SYSTEMS: TRAINING IMPLICATIONS BASED ON COMPANY-LEVEL SIMULATIONS

Introduction

Rapid technological advances are allowing the armor community to develop increasingly sophisticated weapon systems and battlefield equipment. However, as technologies evolve to support systems with greater and greater capabilities, equipment generally becomes more complex for commanders and crews to use and to maintain and more expensive to build. For example, recent studies suggest that currently fielded weapon systems possess greater capabilities than are being used by Army crews (Beecher, 1989). This trend has focused attention within the armor research and development community on three related needs. The first is to investigate and to identify strategies for facilitating the ability of commanders and crews to use emerging systems effectively. The second is to evaluate concept configurations of systems early in the acquisition cycle so that soldier-machine interface issues are satisfactorily resolved and development costs controlled. The third is to determine new training requirements imposed by these concept configurations.

The research reported here is aimed at investigating performance of armor companies using concept configurations of an automated command and control (C2) system. The system, referred to as the Combat Vehicle Command and Control system (CVCC), is the focus of a research and development program intended to provide information to the materiel community. This evaluation is part of an ongoing research program being conducted by the Future Battlefield Conditions Team of the U.S. Army Research Institute (ARI) Field Unit at Fort Knox. The research is using networked simulation technology to provide a low-cost environment for examining soldier performance using concept configurations of an automated command and control system with varying capabilities in armor units at various echelons (from tank crews eventually through battalions).

A series of four reports documents the results of the CVCC company evaluation. This report focuses on the implications for training that emerged from the research. It is intended primarily for training developers. Companion reports address soldier, crew and unit performance issues derived from objective data gathered during the evaluation (Leibrecht, Kerins, Ainslie, Sawyer, Childs, and Doherty, in preparation), tactical aspects of performance (Kerins and Leibrecht, in preparation) and soldier-machine interface issues (Ainslie, Leibrecht, and Atwood, in preparation). The report by Leibrecht et al. is the capstone report of the series and fully describes procedures and methods as well as findings related to operational effectiveness. The other three reports provide an overview of the evaluation methodology with major emphasis on results bearing on the report's focal area.

This report is organized into four major sections. The remainder of this section provides a brief description of the background for the study and key literature. The second section describes the research problem and provides an overview of key elements of the research design and methods. The third section presents the major results bearing on training and is organized around the five training-related issues addressed. Finally, the fourth section discusses the implications of these findings, draws conclusions about training on automated C2 systems, such as CVCC, and makes recommendations for future training design for such systems.

Background and Review of Key Literature

The Army's long-term strategy for C2 is to provide technological support through the use of an overall battlefield information system. As described in the Army's Technology Base Master Plan (Department of the Army, 1989), the desired capabilities of the system include distributed C2 capabilities, battlefield synchronization, increased decision aiding, force level interoperability, self configuring/maintaining C2 systems and improved analysis tools.

The CVCC is one concept for a battlefield information system that is envisioned to be housed on future ground combat vehicles. Thus, the CVCC must support the requirements of AirLand battle by increasing the commander's ability to synchronize, plan and control combined arms operations throughout his area of influence. CVCC capabilities are expected to provide vehicle commanders with a real-time tactical display consistent with their area of operations and timely transmission and reception of reports, battlefield intelligence, and orders across both echelons and functional areas and between adjacent units. Ultimately, the CVCC system is expected to be integrated with higher echelon C2 systems.

As with most complex systems, the CVCC system consists of several components including navigation, information display and communication functions. Furthermore, communications must occur within a tank (i.e., among tank crew members) as well as up, down and across multiple echelon levels including platoons, companies and battalions. A systematic research and development program has been put in place to ensure that soldier capabilities and limitations are considered in the design process and that concept configurations are tested to examine personnel capabilities to use the system and its components effectively. This program, described in the following section, is being carried out under the auspices of the ARI Field Unit at Fort Knox.

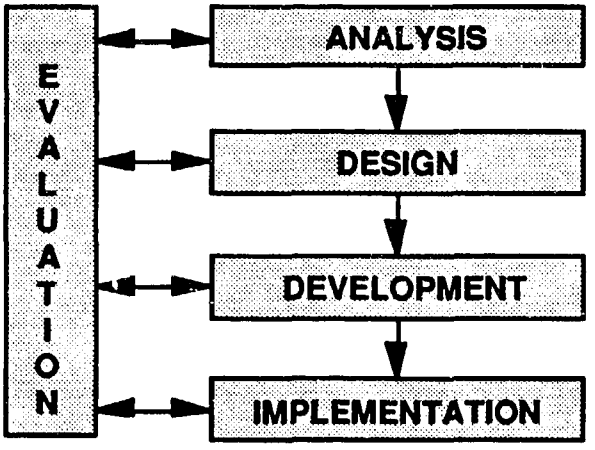
ARI-Fort Knox Future Battlefield Conditions Research Program

The Future Battlefield Conditions Research Program has focused on three major sets of research issues for advanced combat vehicle systems. They include: 1) training-related issues such

as training requirements for concept configurations of future systems and strategies for training soldiers to properly operate and use these systems; 2) operational effectiveness issues related to soldier capabilities to use the system effectively and to enhance unit performance on the battlefield; and 3) soldier-machine interface issues related to the design of user interfaces and controls. The research reported here falls within the first set of research issues and is a direct extension of earlier research described below.

Army doctrine for training development is provided in TRADOC Regulation 350-7, Systems Approach to Training (SAT). As shown in Figure 1, this approach requires a systematic methodology for training development involving a front end analysis of tasks to be trained, design of explicit training objectives and a training program format, development of training programs and materials aimed at accomplishing the training objectives, followed by implementation of the training program. A key aspect of SAT is continuous evaluation throughout the development cycle. This approach allows for iterative improvements over the course of the development process along with systematic evaluation of the effectiveness of the training program as implemented. Thus, SAT provides a conceptual framework for the training requirements research conducted as part of the Future Battlefield Conditions Research Program.

Figure 1. TRADOC SAT Model from TRADOC Reg 350-7



For example, Lickteig (1987) developed preliminary training requirements for planned generations of automated C2 systems referred to as the Battlefield Management System (BMS) based on their unique functional capabilities. This analysis identified anticipated changes in task performance by the platoon leader and additional training considerations such as training device configuration, training media and training site, as well as personnel issues related to selection and training assignment. A similar analysis was conducted by Quinkert (1988) for the Commander's

Independent Thermal Viewer (CITV), a surveillance and target acquisition system for the tank commander. These studies served as evaluations of the front end analysis phase of training development and provided guidance for subsequent training design and development.

Evaluations of training programs during the design and development phase have also been routinely conducted as part of the research program. For example, formative evaluations of training programs for CVCC components such as the CITV (Quinkert, 1990), Position Navigation System (Du Bois and Smith, 1989) and the Intervehicular Information System (IVIS) (Du Bois and Smith, in preparation) have yielded data used to improve and strengthen training prior to formal implementation and evaluation.

In addition, evaluations of the implementation of training programs conducted as part of this research program have yielded important insights for training developers who will ultimately have responsibility for developing training programs as systems are fielded. For example, the CITV is based on a "hunter-killer concept" for the tank commander and the gunner. The tank commander can use the CITV to independently search a sector, identify and hand off targets to the gunner, and continue the search. One outcome of the training evaluation for the CITV was the identification of specific training requirements to facilitate coordination between the tank commander and the gunner. TCs and gunners needed to learn strategies and procedures for coordinating CITV use in order to use the system effectively for target detection, acquisition, and engagement.

The most recent research conducted as part of ARI's Future Battlefield Conditions research program has been conducted using simulated networking technology. The facility housing this technology for research purposes is currently referred to as the Close Combat Test Bed (CCTB). This simulation facility[1] has supported the research team's capability to conduct a series of focused examinations of various CVCC component capabilities by virtue of its low cost and capability for rapid reconfigurability of vehicle simulators. The CCTB, described below, offers unique capabilities and advantages while levying some constraints.

The Close Combat Test Bed

The CCTB employs selective fidelity networked simulation at Fort Knox, Kentucky. As human performance research initiatives have evolved in conjunction with evaluations of new technology, the CCTB has been used increasingly as a soldier-in-the-loop research facility. The CCTB represents a pioneering armor C2 simulation research and development program. It is designed to

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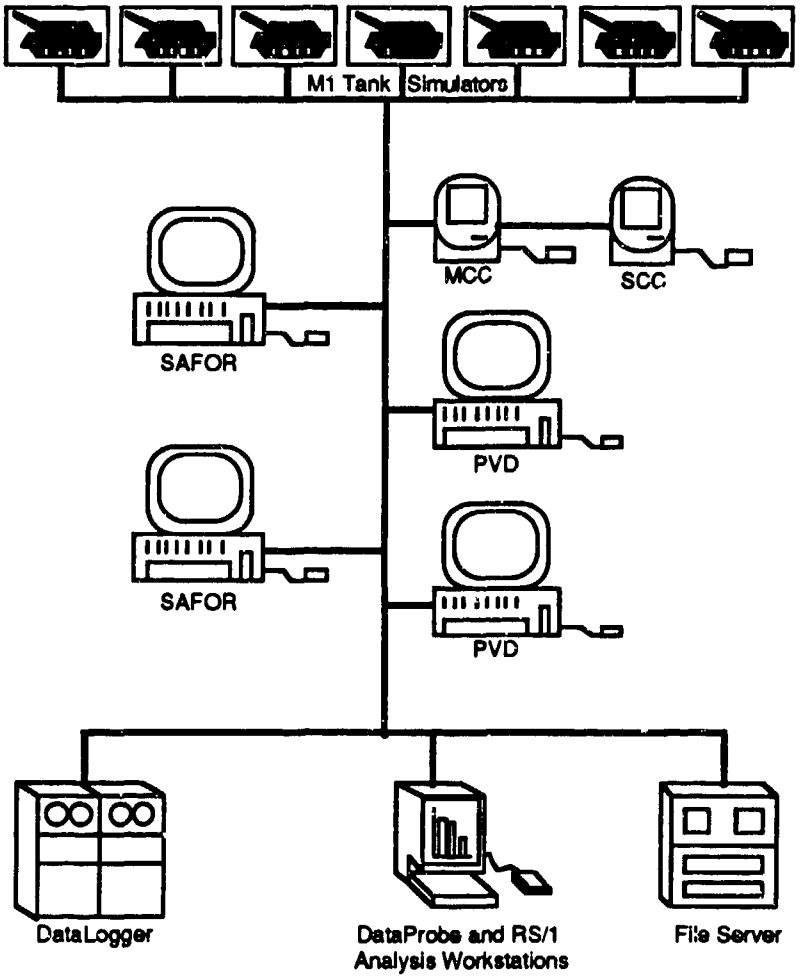
[1]The CCTB was formerly named Simulation Networking-Developmental (SIMNET-D). For the sake of clarity, the facility is referred to here as CCTB, regardless of its name at the time of reference.

realize low-cost, unit-level, full mission simulation using extended local and long-haul networking and families of simulators supported by site-specific microprocessors (Miller and Chung, 1987; Du Bois and Smith, 1989).

Figure 2 represents the distributed networking architecture which can be modified to accommodate a broad range of research and development activities in soldier performance. One of the features of this architecture is the employment of selective physical and functional fidelity to achieve desired levels of C2 system realism. Selective fidelity enables system performance to be sufficiently emulated to elicit the required levels of perceptual realism among users (Chung, Dickens, O'Toole, and Chiang, 1988). This "psychological fidelity" enables the battlefield oriented perceptual cues within the test bed to be exploited without having to employ expensive operational technology. The CCTB allows the Army to simulate and assess combat capability using conceptual C2 configurations prior to system design and development.

Figure 2. Simulation Networking (SIMNET) Architecture



CCTB capabilities. Du Bois and Smith (1989) have thoroughly described the research capabilities of the CCTB. Central to the test bed are manned vehicle simulators, which model actual vehicles to the minimum degree necessary for soldiers to accept them as realistic and useful (Chung, et. al, 1988). Sound and visual simulation components reproduce key aspects of the battlefield operating environment. A variety of computer-based systems provides tactical communications, scenario control and monitoring capabilities, and robust data collection and analysis support. Table 1 summarizes these capabilities.

TABLE 1. BASIC CAPABILITIES OF THE CCTB

CAPABILITY	SYSTEM IMPLEMENTATION
Reconfigurable manned simulators	Selective fidelity crewstations, with supporting hardware and software, designed for easy reconfiguration.
Tactical communications	Simulated SINCGARS for linking manned simulators and control stations; capable of both voice and digital burst transmissions.
Surrogate vehicles	Semi-Automated Forces (SAFOR) program for creating and controlling unmanned vehicles and aircraft, both friendly (BLUFOR) and enemy (OPFOR); provides automated message traffic.
Scenario control	Management, Command and Control (MCC) system for controlling and monitoring manned simulators and implementing fire support. SEND station for transmitting automated messages.
Scenario monitoring	Plan View Display (PVD) monitors providing a "bird's eye view" of a simulation exercise; supports map manipulation and event flagging. Stand-alone Command Control and Display (SACCD) to monitor automated messages.
Data recording and analysis	Data Collection and Analysis (DCA) system for on-line recording of automated data and off-line reduction and analysis; supports playback. LISTEN station to record automated messages.

CCTB advantages. Armor crew and unit performance-oriented research carried out within the test bed in recent years has produced data of substantial operational significance. This is directly related to the advantages inherent in the CCTB, including its:

(1) Cost effectiveness in evaluating concept configurations of C2 systems;

(2) Value in identifying C2 training requirements;

(3) Capability to present tank crews and units with operationally realistic tasks and mission loading levels;

(4) Flexibility in allowing crews to perform a broad range of missions;

(5) Versatility in providing realistic engagement interaction in a variety of simulation battlefield settings;

(6) Tactical communications fidelity;

(7) Automated capability to capture and analyze objective performance data;

(8) Unique analysis capabilities afforded by playback.

CCTB constraints. As with any large-scale simulation, the CCTB possesses several constraints with respect to its representation of operational armor settings. These limitations have been described in detail by Du Bois and Smith (1989). Briefly they are:

(1) Inability to conduct open hatch operations, which limits the tank commander's view of the battlefield;

(2) Limited visual fidelity of the computer-generated imagery, which limits depth perception, battlefield orientation, long-range target identification, and certain tactical maneuvers;

(3) Maximum simulated viewing distance of 3500 meters, resulting in a potentially distorted horizon;

(4) Lack of vehicle identification plates, resulting in problematic identification of friendly vehicles;

(5) Lack of a gunner's auxiliary sight.

Several special features help offset the above constraints. These include special topographics paper maps, a grid azimuth indicator, and a turret reference display to provide cues that are critical for positioning, maneuvering, and navigation.

In summary, the CVCC company evaluation is firmly grounded. Capabilities of the CVCC concept configurations used in the evaluation (described in the following section) are derived from the Army's combat developments programs. The company evaluation is one effort in a systematic program of research conducted using the CCTB. These evaluations have progressed in an orderly fashion from crew and platoon to company and from individual component evaluations to evaluation of integrated systems. Specific methods used to conduct the company evaluation are described in the following chapter.

Evaluation Design and Methods

Previous CVCC research has examined the performance of crews and platoons using concept configurations of system components such as POSNAV, CITV and IVIS. The company evaluation was intended to extend previous research by examining the performance of armor companies using concept configurations of an integrated CVCC system. Eventually, this research program will be extended to the battalion level with battalion Tactical Operations Center (TOC) elements interacting with manned and semiautomated company elements.

Research Issues

The CVCC company evaluation had three primary objectives: (1) evaluate the operational effectiveness of armor companies using a concept configuration tactical C2 system; (2) identify critical soldier-machine interface issues associated with the use of the system and make recommendations for system design; and (3) determine operational training requirements, issues, and concerns for the new systems.

The latter objective is the focus of this report. This research objective was operationalized into five research issues listed below:

(1) How adequate are the training materials and procedures used to prepare soldier participants to use the equipment?

(2) How sufficient is the amount of time devoted to training the specific functions of the equipment?

(3) How easy is it to learn to use the prototype equipment?

(4) What would be the training requirements (type and length of training) to prepare tankers to use this type of new equipment if it were fielded?

(5) What are the soldier-participant suggestions for improving the training program?

These five issues were used to guide planning for the training-related portion of the company evaluation. In particular, they influenced the types of instruments and the specific measures used to gather data related to training effectiveness.

The remainder of this section is organized into two major sections. The first provides an overview of the evaluation design. The second describes methods for the evaluation with particular attention to the capabilities of the concept configurations on which soldier-participants were trained, the nature of the training program and strategies for collecting data related to training issues. This discussion draws heavily from the capstone report for the CVCC company evaluation. A more detailed discussion of the research design and methods can be found in this report on operational effectiveness (Leibrecht et al., in preparation).

Overview of Evaluation Design

The original design of the evaluation called for a comparison of two concept configurations of the C2 equipment in order to support determination of soldier training and performance requirements and operation effectiveness estimates. The design also included an M1 baseline condition with no automated C2 capability as a baseline for comparison.

The two C2 configurations represented different levels of automated C2 functionality. The first and most capable configuration was referred to as CVCC. The second configuration, referred to as the Intravehicular Command and Control (IVCC) system, was somewhat less capable. Most importantly, the IVCC did not support automated transmission of information because it did not include a radio interface unit, which is required to digitally burst information from vehicle to vehicle. Near the midpoint of the data collection for this evaluation, the Army reached a decision that the radio interface unit was a supportable requirement. This decision greatly limited the applicability of the IVCC data for analyzing performance-related issues and, therefore, the condition was eliminated from the design. However, for the training analysis, the decision was made to retain the IVCC condition since it represented an intermediate level of training difficulty between the CVCC and M1 baseline conditions providing the potential for additional insight into training requirements and issues. Thus, this report examines training issues related to the CVCC, IVCC and M1 baseline configurations.

Three different local troop units furnished armor soldiers as dedicated participants over a one week period. These participants were formed into tank "companies" supported by semiautomated

vehicles to fill nearly half the tank positions. The simulators were equipped with an autoloader capability and thus required only three-man crews (tank commander, gunner, driver). New crews were formed by assigning men to their normal position but not allowing men who normally worked in the same crew to be together. This decision was made to control for the confounding effects of experience that would be likely to occur if intact crews were used.

The evaluation was conducted using the CCTB facility and simulation technology. The "company" was represented using seven manned simulators. The manned tank commander positions included the company commander and three platoon leaders. Other manned positions included the platoon sergeant and the two wingmen of the second platoon. The "company" was filled out using the semiautomated forces (SAFOR) capability of the technology. Positions within the company represented by SAFOR included the platoon sergeants and two wingmen of the first and third platoons. The enemy force in each combat scenario was also represented using SAFOR. Research staff performed control functions for both friendly and enemy SAFOR elements and role-played key friendly battalion staff positions and tank commanders for the SAFOR elements of the manned company.

Each evaluation session was conducted over a five day period. The first 2 1/2 days were devoted to training and included classroom and supervised hands-on instruction as well as crew and unit practice using doctrinally based combat scenarios. The remaining 2 1/2 days were used for offensive and defensive test scenarios, questionnaire administration and debriefings.

Data collection techniques relied heavily on the automated recording capabilities of the simulation network in addition to manually recorded data. The latter were collected using a broad range of instruments including questionnaires, diagnostic tests, observation logs, end-of-mission recall quizzes and post-exercise debriefings.

Methods

Subjects/Participants

A total of 294 U. S. Army personnel--56 commissioned officers, 85 noncommissioned officers, and 153 enlisted men--served as participants in the data collection phase, which lasted 14 weeks. These participants were scheduled in groups of 21 each week. An additional group numbering 84 participated in four weeks of pilot testing. All were males stationed at Fort Knox, KY. Members of the principal group ranged in age from 18 to 46. The primary source units of these participants included an armored brigade, a cavalry regiment, and an armor training brigade. Additionally, some of the officers had just graduated from the Armor Officers Advanced Course or the Armor Officers Basic Course.

In response to a Troop Support Request from ARI, the supporting units provided participants in groups comprised of seven tank commanders (4 officers, 3 NCOs) and fourteen soldiers (NCOs and enlisted personnel) to serve as gunners and drivers. Unit leaders determined who would participate in the evaluation. All participants were required to hold armor Specialty Skill Identifiers (SSIs) or to be currently qualified in armor Military Occupational Specialties (MOSs). The participants within a group did not necessarily come from the same company, although same-company composition was generally true of groups from the armor brigade.

All participants received a briefing explaining the purpose of the evaluation and the role they played in it. Each participant signed a Privacy Act Statement after listening to the provisions for ensuring his privacy and his right to withhold any information he might desire. The potential uses of the data to be collected were also explained.

Capabilities of Simulator Configurations

Seven M1 tank simulators in the Fort Knox CCTB facilities supported this evaluation. Table 2 lists the simulator capabilities which characterized the M1 Baseline, IVCC and CVCC configurations. The key features common across all three conditions included vision blocks in all three crew stations (TC, gunner, driver), grid azimuth indicator, odometer, laser range finder (LRF), gunner's primary sight (GPS), GPS extension in the commander's station (GPSE), turret reference display, and simulated SINCGARS radio without terrain modeling capability and an intercom system for communication within the crew. In addition, the three crew stations shared the identical physical layout across the three conditions, as well as access to paper maps with overlays.

The M1 Baseline condition utilized only equipment present in the fielded M1, except for the grid azimuth indicator, the turret reference display, and the SINCGARS radio. All other equipment was turned off at all times in the M1 Baseline condition.

In addition to the common features shared by all three conditions, the IVCC condition included a Command and Control Display (CCD) displaying own vehicle location and for preparing reports and a Commander's Independent Thermal Viewer (CITV) which allowed the tank commander to designate targets for the gunner.

The CVCC condition included all capabilities of the IVCC condition as well as enhanced CCD and CITV capabilities. For the CCD, these included a mutual position navigation (POSNAV) capability displaying the location of all friendly vehicles and a radio interface unit that allowed reports to be sent and received digitally. For the CITV, enhancements included a target stacking capability and an independent laser locator.

TABLE 2. BASIC CAPABILITIES OF SIMULATOR CONFIGURATIONS

Capabilities	— Condition — M1 Baseline	IVCC	CVCC
Navigation			
Vision blocks	X	X	X
Paper map w/overlays	X	X	X
Grid azimuth indicator	X	X	X
Odometer	X	X	X
Laser Range Finder (LRF)	X	X	X
CCD (own vehicle location)		X	X
Mutual POSNAV (all friendly)			X
Target acquisition/engagement			
Vision blocks	X	X	X
GPS/GPSE (w/thermal, 3X/10X, LRF)	X	X	X
Turret reference display	X	X	X
CITV			
Target Designate		X	X
Target Stack			X
Independent Laser Locator			X
Communications			
Intercom (w/in crew)	X	X	X
SINCGARS radio (voice)	X	X	X
CCD/Reports		X	X
CCD Radio Interface Unit			X

More specifically, the CCD used in the IVCC and CVCC conditions was configured as shown schematically in Figure 3, although the functions varied somewhat across conditions.

Du Bois and Smith (1990) have described an earlier version of the system, labelled the Intervehicular Information System (IVIS). Modifications incorporated in the current version are reflected in the descriptions below. The 10.25 inch diagonal CRT component displaying the CCD was mounted to the right of the TC. A 7 by 5.75 inch rectangular working area of the CRT face comprised the primary user interface. Five functional sections organized the interface: a) full-feature, five-color tactical map (4.5 by 5.12 inches) with directional own-vehicle icon; b) information center displaying date/time group, own grid location, and own vehicle heading, and own call sign; c) fixed array of soft-switch menu keys accessing specific functions; d) working menu area displaying queue/file listings, sub-menus, and selected functions step-by-step; and e) message receipt alert key.

Figure 3. Command and Control Display (CCD)

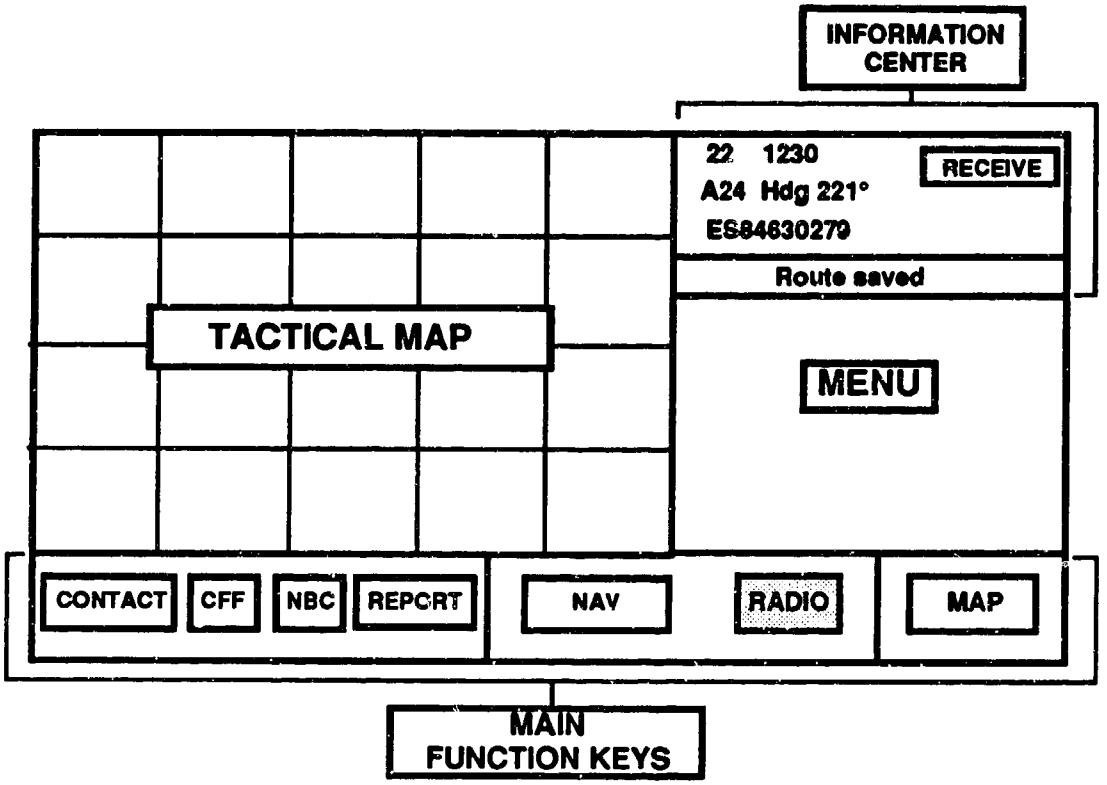


Table 3 lists the C2-related capabilities of the CCD configurations for the IVCC and CVCC conditions. Smith (in preparation) describes the functional features of the CCD. Below is a brief overview of the system.

Map functions. The basic tactical map for both the IVCC and CVCC conditions was a UTM grid representation of the terrain surrounding the tank's location, from an overhead perspective. Digital data in the SIMNET terrain database constituted the basis for all resident map graphics. Four map scales were available at all times--1:25,000, 1:50,000, 1:125,000, and 1:250,000--with at least a few seconds processing time required for rescaling. In addition, the CVCC configuration provided several additional features for optional selection by the tank commander (TC): contour lines, rivers, roads, and vegetation, all of which were color coded. Also, the CVCC system could display graphic tactical map overlays received electronically. UTM grid lines were optional.

TABLE 3. C2 CAPABILITIES OF THE TWO CCD CONFIGURATIONS

	IVCC	CVCC
Navigation		
Grid map	X	X
Terrain map		X
Graphic overlays		X
Own vehicle location (grid + icon)	X	X
Directional icon (own vehicle)	X	X
Friendly vehicle locations		X
Report-based icons		X
Route waypoints	X	X
Driver's steer-to display	X	X
Waypoint autoadvance		X
Transmission of routes		X
Communications		
Report preparation (text)	X	X
LRF input to reports	X	X
Laser locator input to reports		X
Send/receive/relay reports (text)		X
Receive/relay graphics		X
Report-based icons		X
General Characteristics		
Thumb control	X	X
Touchscreen control		X
Display	Monochrome	Color

Several map scroll functions enabled the TC to control positioning of the map in relation to his tank icon. The basic scroll function maintained the icon in the center of the map, scrolling the map as the tank moved. An option was to lock the map in position, maintaining the same terrain segment regardless of where the tank moved. The TC could reposition the map to show a new terrain segment, allowing him flexibility to inspect icons or terrain features of interest. Finally in the CVCC condition, he could position his tank icon in an off-center location while the map scrolled under it.

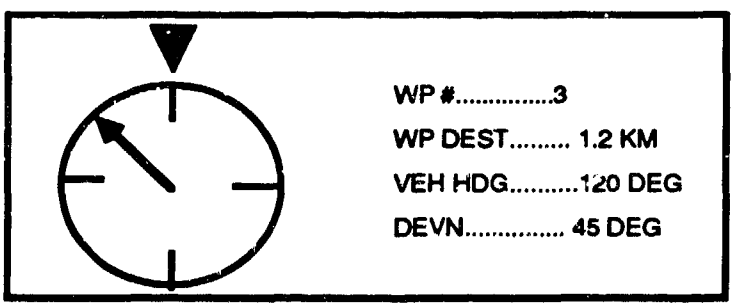
In the IVCC and the CVCC condition, the tactical map could display key symbols (icons) representing the battlefield. These included report-based and route-based icons. Reports being prepared electronically generated icons appearing on the map (e.g., NBC report symbols, enemy vehicle icons). Upon completing the report, the TC could post these icons to the map for an indefinite period.

Waypoints generated under navigation functions appeared on the map with connecting lines, forming graphic routes, in both conditions. Further, the location of one's own vehicle also appeared on the map ("POSNAV"). In addition, the CVCC tactical map displayed automatically icons representing all friendly vehicles located on the terrain segment currently displayed. This was labelled the "mutual POSNAV" feature. Finally, in the CVCC condition map icons (e.g., minefield symbols) signalled reports which were received electronically. These icons remained on the map until the TC took some kind of action on the report or until the report automatically transferred to the "old" file. Exceptions to the latter rule existed: when spot and intelligence reports transferred to the"old" file, their icons automatically posted on the map.

Navigation functions. The CCD enabled the TC to create and modify routes for navigation and to send route information to his driver. In addition, the CVCC configuration permitted any TC to transmit a route electronically to other vehicles in his unit. Routes were generated by designating up to six locations on the map (waypoints). An icon for each waypoint appeared on the map, while lines connected successive waypoints. The TC could send waypoints to his driver one at a time--manually or, in the CVCC condition automatically by means of an Autoadvance option.

In both configurations, the navigation subsystem included a "steer-to" display in the driver's compartment, mounted to the right of the T-bar control. Depicted in Figure 4, the "steer-to" display presented alphanumeric information about the tank's position. This information included the number of the waypoint (WP#), the distance from the waypoint (WP DIST), the vehicle heading (VEH HDG) and the deviation between current and required heading (DEVN). In addition, the display incorporated a graphic indicator with a pointer showing how the driver should steer to reach and maintain the proper heading, represented by the 12 o'clock position.

Figure 4. Driver's Steer-To Display



Also of value in navigating and positioning was the directional own tank icon displayed on the tactical map. This helped maintain proper orientation and direction of movement. Then too,

both UTM grid location and grid azimuth heading were available in the CCD information center.

Report functions. The CCD supported preparation of reports by means of menu-driven screen forms in both the CVCC and IVCC conditions. The TC was able to prepare any of the nine types of formal reports by filling in fields appearing in the working menu area. Table 4 lists these report types along with information about the number of fields in each. See Leibrecht et. al (in preparation) for a complete account of report formats. The TC could call up contact, call for fire, and NBC report forms directly from the fixed menu keys. The remaining report forms required him to call up a report menu first, then choose a report type from the options appearing in the working menu area.

TABLE 4. REPORT PREPARATION FORMS AVAILABLE ON THE CCD

Report Type	Number of option-input fields	Number of grid-input fields	Number of pages
CONTACT	4[a]	4[a]	1
CALL FOR FIRE	1	1	1
ADJUST FIRE	3	1	1
SPOT	9	2	3[b]
SHELL	2	1	1
SITUATION	8	2	3[b]
AMMUNITION	5	0	1
INTELLIGENCE	8	6	4[b]
NBC	7	2	3[b]

a - Up to four paired ID-location fields could be filled in.
b - Includes a final summary page.

Fill-in fields usually called for selecting inputs from option sets provided by the computer. Fields dealing with location or heading information called for grid inputs from the tactical map or from lasing to a vehicle or terrain point. Blank fields were permitted. Since typically only four or five fields could fit in the working menu area, four of the reports required more than one "page" for complete presentation, the final page being a summary of all fields.

At any time the TC could exit a report without completing it, leaving it open to work on later. He might, for example, exit to prepare another type of report. Multiple types could be open at the same time, but only one of a given type of report could be open at any time. No more than one report could be active on the working screen at a given moment. The TC had the option to delete a report if desired. Upon completing a report, the TC in the CVCC condition could transmit it electronically by a sequence of soft-switch presses. In the IVCC condition, reports had to be transmitted by voice over radio.

Automated report transmission. The CVCC configuration enabled the TC to transmit automatically reports prepared on the CCD. A routing menu offered the option of sending any report on any radio net available for the TC's use, including simultaneous transmission if two nets were available. (Only the platoon net was available to the platoon sergeant and the wingmen.) For example, a platoon leader could send a report to the TCs within his platoon (platoon net), to the company commander and the other platoon leaders (company net), or to all of them at the same time. Upon transmission, a report copy automatically transferred to the sender's "old" file, from which it could be retrieved later and sent again. The system provided no feedback to the sender as to whether the addressees actually received and read the report.

When a TC received a transmitted report, three cues appeared at once: the message receipt alert key lighted up, an audible cue sounded in the TC's headset (three tone beeps for a high priority report, one beep for others), and an icon appeared on the tactical map (blinking for the first five seconds). For up to five minutes or so, the report remained in the receive queue, with the icon remaining on the map. As high priority reports arrived, they went to the head of the queue. The TC could call up a directory listing the report type, originator, and time received for each report in his queue, enabling him to select a desired report for display in the working menu area. The directory display presented no more than five items at a time, with the TC having the capability to scroll forward and backward through the complete directory.

If the TC failed to retrieve a report from the queue within approximately five minutes, the report automatically transferred to the "old" file. In so doing, spot reports and intelligence reports automatically posted an icon to the map. For other reports, the icon disappeared from the map.

Once the TC selected a report to read, he could review it at his own pace. In the case of a multi-page report, only the summary page appeared. When ready to terminate his review, he could exit and file the report (with an option to post to the tactical map an icon representing it), he could relay it (see below), or he could delete it. Unless he deleted it, he could subsequently retrieve the same report as many times as he desired.

If the TC decided to pass a report along to other members of his unit, he could exercise the option to relay it. Under no circumstances could the report be modified. Relaying a report involved the same steps as transmitting one. The same options for routing were available. The system did not limit the number of times a given report could be relayed.

Control inputs. The TC controlled the operation for the CCD by means of a cursor appearing on the face of the display screen. He selected menus and functions by positioning the cursor on the desired key. The CVCC configuration afforded the TC the option of

manipulating the cursor position by touching with his finger the face of the touch-sensitive screen or by using a thumb control mounted in his control handle. In the IVCC condition, only the thumb control was available. Touching the screen automatically jumped the cursor to the new position designated by the finger's contact with the screen. When satisfied with the cursor position, the TC removed his finger from the screen. This action initiated the menu or function corresponding to the key on which the cursor rested.

When operating the thumb control in the CVCC and IVCC condition, the TC could move the cursor in virtually any direction at a variable speed. With the cursor resting on the desired key, release of the thumb control initiated the corresponding menu or function.

Housekeeping functions. The CCD provided a small set of housekeeping functions with which to manage a growing collection of prepared (CVCC and IVCC) and received (CVCC only) reports. The TC could delete reports which he created, both during preparation and after transmission/filing. He could also delete unwanted reports received. The latter action could be accomplished without reviewing the contents of the report or after it had been filed. Deletion resulted in no record of the contents. To declutter the tactical map, the TC could delete icons one at a time or he could select a menu option to delete all icons older than a specified time.

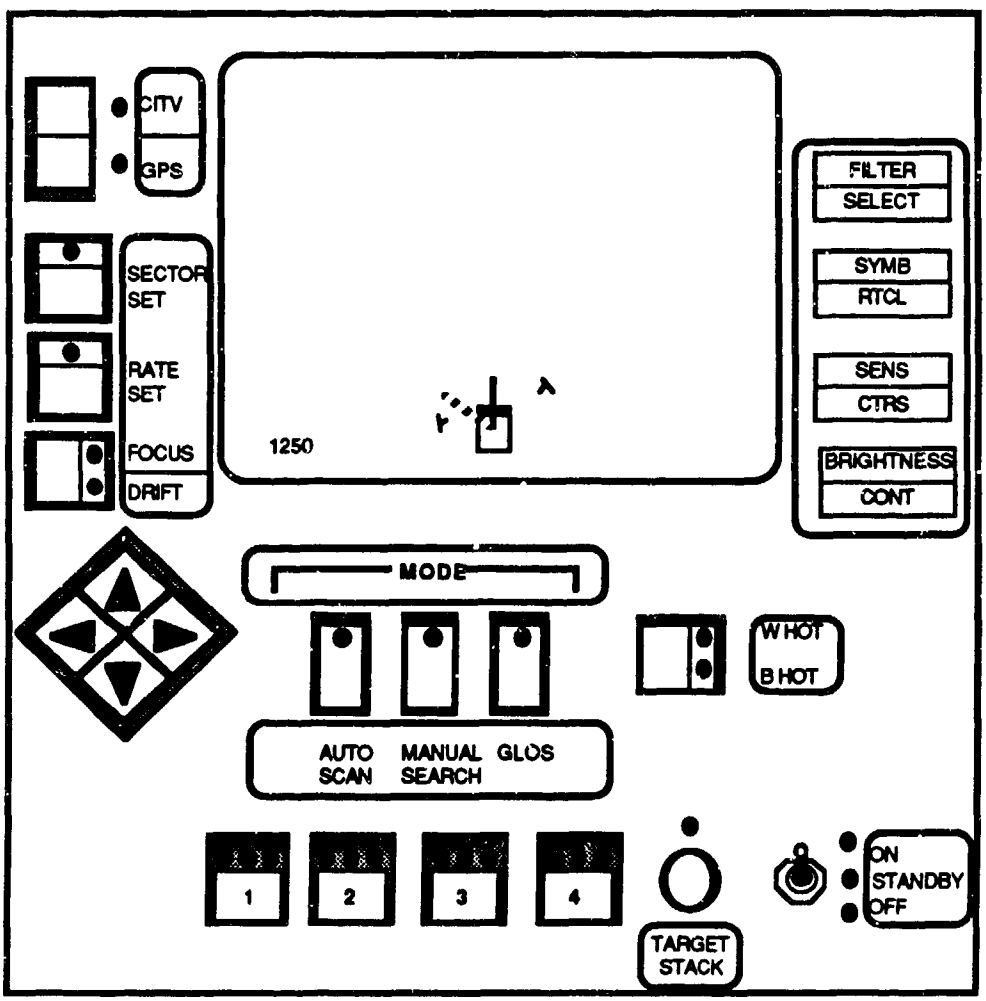
Commander's Independent Thermal Viewer configuration. The CVCC and IVCC conditions also included the CITV, which afforded the TC an independent battlefield viewing capability. In terms of tactical utility, the diverse functions of this system spanned navigation, battlefield surveillance, target acquisition (including identification), target management, and fire control. Table 5 lists the functional capabilities of the IVCC and CVCC configurations.

TABLE 5. CAPABILITIES OF THE CITV CONFIGURATION

	IVCC	CVCC
Independent thermal search	X	X
3X and 10X magnification	X	X
White-hot and black-hot polarity	X	X
Autoscan	X	X
Independent laser locator		X
ID friend or foe (IFF)		X
Target Designate	X	X
Target Stack		X
Own vehicle icon	Stationary hull	All parts moving

Mounted directly in front of the TC, the CITV interface arrayed control switches around three sides of a central display screen (Figure 5). None of the switches on the right margin of the interface were functional. The TC controlled operation of the CITV via inputs through the functional switches and through push buttons on his control handle. The interface components entailed: a) rectangular (6.5 by 5.88 inches) monochrome CRT display screen with own vehicle icon and sighting reticle; b) power switch with off, standby, and on positions (three-position toggle); c) push-button selector switches for basic mode (CITV, GPS); d) push-button selector switches for operational mode (autoscan, manual search, gun line of sight [GLOS]); e) two-position push-button switch for polarity (white-hot, black-hot); f) autoscan control switches for setting sector limits and adjusting scan rate; g) TC's Target Stack display with four push-button target selector switches and on-off push-button switch (CVCC only); h) gunner's Target Stack display similar to the TC's (CVCC only); and i) control handle push buttons for switching magnification (3X, 10X), operating the laser, and designating targets.

Figure 5. Commander's Independent Thermal Viewer (CITV)



Quinkert (1988) has described the functional features of the CITV. The SIMNET CITV User's Guide (DARPA, 1989, pages 7-15) explains the operating features. (NOTE: The physical layout of the user interface shown in the User's Guide is distinctively different from the configuration used in this evaluation. The operating procedures were the same.) Summarized below is an overview of the system functions.

Basic modes. In the GPS mode, the CITV was functionally inactivated, with the last active scene from the sensor remaining static on the screen. Requiring the TC to use his GPSE for viewing, this mode enabled him to override the gunner in moving the turret/gun tube and firing. The CITV mode permitted the TC to select three types of surveillance--Gunner's Line of Sight (GLOS), manual search and autoscan. The GLOS mode slaved the CITV line of sight to the main gun alignment, except when the TC depressed his palm switch to activate manual search. The slaved alignment provided a view overlapping the gunner's view while enabling the TC to operate his own laser and change magnification and polarity. The manual search and autoscan capabilities, both providing independent surveillance, are discussed below. In none of the CITV surveillance modes could the TC move the turret/gun tube or fire.

In all CITV modes, the display screen presented optional fields of view: wide field (3X magnification, 30 X 40 degrees) and narrow field (10X magnification, 10 X 13 degrees). In providing uninterrupted horizontal sweep capability, the system afforded a 360 degree field of regard. The vertical expanse of the field of regard ranged from +35 to -27 degrees. According to his preference, the TC could select white-hot or black-hot display options. In white-hot mode, warmer objects within the field of view appeared "white" against a darker background. In black-hot mode, warmer objects appeared "black" against a lighter background.

The own tank icon present on the display screen depicted the directional orientation of the turret/gun and CITV with respect to the tank hull. The CITV indicators included the CITV's line of sight as well as the autoscan sector limit markers. In the CVCC condition, the entire icon rotated to represent the proper grid azimuth heading of the tank hull.

Manual search. In selecting manual search, the TC could control the CITV's line of sight manually by manipulating his control handle. Both direction (horizontal, vertical, and oblique) and speed of movement could be controlled simultaneously. This mode allowed the TC to vary at will his pace and pattern as he searched for targets. It preserved access to other control options such as magnification, polarity, and target designation.

Autoscan. Autoscan permitted the TC to sweep automatically the CITV's line of sight back and forth across a specified sector

at a set rate of speed. The search pattern required no input from the TC once initial parameters were set. Setting or resetting left and right sector limit markers redefined the portion of the field of regard to be scanned. To adjust scan rate, the TC could increase or decrease the current rate, which began at a default value upon initialization. The entire 360 degree field of regard could be selected as the scanning sector, if desired. As with manual search, autoscan maintained availability of secondary control options such as polarity, magnification, and target designation. The latter function required the TC to activate a temporary manual search option by depressing his palm switch.

Independent laser locator. In the CVCC condition only, the CITV system included a laser capability independent of the standard LRF. The TC could exercise this capability in GLOS, manual search, and autoscan modes; lasing in the latter mode required interruption of scanning to stabilize the sight picture. Each lase event produced a range-to-target reading in meters, displayed in the lower left corner of the display screen; this reading could indicate flawed determinations and double returns. Lasing also supported the IFF function, generating symbology characterizing the target as friendly, enemy, or uncertain. This symbology appeared in the upper left portion of the display.

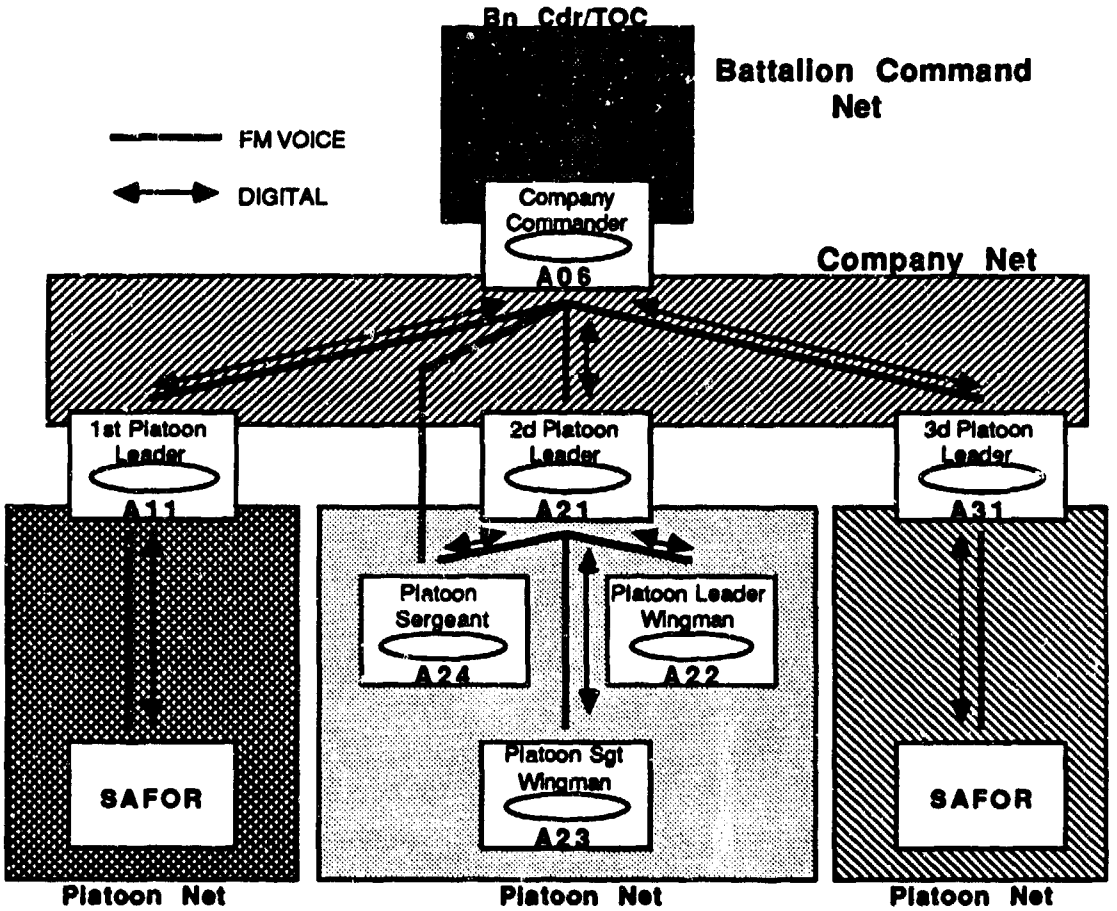
Target designation. In the manual search and autoscan modes, the TC could use a "Designate" procedure to quickly hand off a target to his gunner. Having identified an enemy target for immediate engagement, the TC pressed the Designate button on his control handle. This rapidly slewed the main gun to the CITV's line of sight, overriding the gunner's controls. The TC then could hand off the target, which now appeared in the middle of the gunner's primary sight.

Target stacking. In the CVCC condition, the CITV configuration incorporated a target management feature referred to as Target Stack. In both the manual search and autoscan modes, the TC could use this feature to cue the gunner about available targets. After identifying an enemy target, the TC pressed one of four buttons to mark the target's location. He could cumulate up to four targets in the stack, arranged in order of priority (number one being highest priority). As the TC stacked targets, cueing lights on the TC's display and gunner's display came on and, for each target, two LEDs indicated the relative position of the target with respect to the direction of the main gun (left, right, or centered). The gunner or TC could use these indicators to anticipate the direction in which the turret would slew after pushing a target button. After the gunner or TC engaged a target selected from the target stack, it automatically dropped from the stack unless overridden by the firer, and any lower priority targets moved up.

Radio nets. The simulated SINCGARS radio system serviced five radio nets--battalion, company, and three platoons. The

manned simulators connected to these nets in a doctrinally realistic arrangement (Figure 6). The company commander, platoon leaders, and platoon sergeant accessed two nets each, while the two wingmen accessed only one. In the CVCC condition, a Radio Interface Unit linked the CCD with the SINCGARS system to enable electronic transmission of messages via digital burst technique. The voice radio net scheme (Figure 6) defined the automated routing options for each TC except the platoon sergeant, who could transmit CCD messages on only the platoon net.

Figure 6. Communication Nets



The Training Program

The training development process began with an analysis of the tasks required to competently use the equipment in each of the three conditions (CVCC, IVCC and M1 Baseline). Since all participants were 19K qualified and the majority had experience with the SIMNET technology, attention was focused on tasks required by the equipment configurations in the evaluation rather than the broad spectrum of M1-related tasks. This analysis provided input into

the formulation of the training objectives for each condition as shown in Table 6.

TABLE 6. TRAINING OBJECTIVES

M1	IVCC	CVCC	
			<u>Objective 1</u>
X	X	X	In a simulator initialized to a specific terrain location, the TC will demonstrate the ability to operate the Grid Azimuth Indicator and the Turret Reference Display properly.
			<u>Objective 2</u>
X	X	X	In a simulator initialized to a specified terrain location, the gunner will demonstrate the ability to operate the Turret Reference Display properly.
			<u>Objective 3</u>
X	X	X	In a simulator initialized to a specified terrain, the driver will demonstrate the ability to operate the Steer-To-Display properly.
			<u>Objective 4</u>
			In a simulator initialized to a specified terrain location with three targets, the TC will demonstrate the capability to properly operate all functions of the CITV in both the CITV and GPS mode including:
	X	X	a) Manual Search
	X	X	b) BHOT/WHOT polarity
	X	X	c) 3X/10X magnification
	X	X	d) Autoscan (sector set and rate set)
	X	X	e) Target designation
	X	X	f) Use of commander's override and target engagement
		X	g) Target stacking
		X	h) Use of IFF
			<u>Objective 5</u>
	X	X	The TC will be able to explain the four key features of the CITV tank icon and identify that the GLOS and GPSE serve a common function.
			<u>Objective 6</u>
			Given preset waypoints and reports and a simulator initialized to a specified terrain location, the TC will demonstrate the capability to properly operate all functions of the CCD including:
	X	X	a) Adjust map scale
	X	X	b) Select map features
	X	X	c) Scroll map (enable scroll, center scroll, lock scroll)
	X	X	d) Designate navigational route up to six waypoints
		X	e) Send a waypoint or a navigational route
	X	X	f) Save a navigational route
	X	X	g) Activate a route file
	X	X	h) Remove a waypoint
	X	X	i) Delete a route from the route file
	X	X	j) Select a route from the route file
		X	k) Send the following types of reports: - Contact - Sitrep - Call For Fire - Intelligence - Adjust Fire - NBC - Spot - Ammo - Shell
		X	l) Receive reports
		X	m) Forward a received report

TABLE 6 (CONTINUED). TRAINING OBJECTIVES

M1	IVCC	CVCC	
	X	X	Objective 7 Given an operational CCD, the TC will explain the information contained in the CCD Information Center.
	X	X	Objective 8 Given a crew drill to perform in the simulator, the crew will use the CITV and the CCD functions in performing the drill.
	X	X	Objective 9 Given a platoon exercise to perform in the simulator, the platoon (either manned or unmanned with semi-automated BLUEFOR) will use the CITV and the CCD functions in accomplishing their mission.
	X	X	Objective 10 Given a company exercise to perform in the simulator, the company (with one manned and two unmanned platoons) will use CITV and CCD functions in accomplishing their mission.

The training objectives served as the starting point for designing the training program. A variety of training formats was required including classroom, hands-on, crew practice, and unit practice. Each training format levied requirements for specialized materials including presentation materials for group training, script-like outlines and simple diagnostic tests for one-on-one training, trainer checklists for unit exercises, simulation SOP and navigational aids for TC use, and operational specifications for controlling unit exercises.

Classroom briefings. For the classroom instruction sessions, view-graphs served to organize and standardize instructor presentations. The following view-graph packages were used:

(1) Introduction and overview, explaining the evaluation's purpose and objectives, the general methodology, the week's schedule of events, privacy considerations, and facility rules;

(2) SIMNET orientation, comparing the simulators to the actual M1 tank, emphasizing features unique to the simulators, and overviewing key equipment components;

(3) SIMNET navigation briefing (M1 Baseline only), explaining SIMNET map reading, protractor usage, dead reckoning, terrain association, resection, and polar plotting;

(4) CITV orientation (tailored to CVCC and IVCC), summarizing the hunter-killer concept, describing the CITV's functional capabilities, and suggesting some considerations for tactical employment; and

(5) CCD orientation (tailored to CVCC and IVCC), reviewing the system's evolution and benefits, overviewing the basic functions, and suggesting potential tactical applications.

Seat-specific guides. A training outline emphasizing the differences between the actual and simulated M1 tank was used for small-group orientations to specific crew stations (TC, gunner, driver). Tailored to the CVCC, IVCC or M1 Baseline, respectively, this outline standardized the seat-specific orientations given to all participants. It included practice for trainees on selected tasks, applicable during TC training only.

Hands-on guides. In conducting one-on-one familiarization training with IVCC and CVCC TCs in the simulators, the Research Assistants (RAs) used outlines listing the points to be made and the equipment functions to be demonstrated/explained. These outlines, one for the CITV and one for the CCD, ensured standardization of each hands-on session. A uniform sequence was followed for each function: explanation and demonstration, and ending with practice by the TC.

Diagnostics. At the end of the individual training phases were scheduled diagnostic tests. These tests helped determine if a TC was prepared to continue training and provided feedback about the effectiveness of the training program. Three separate diagnostics addressed the SIMNET M1, the CITV, and the CCD, respectively. The SIMNET M1 diagnostic dealt with use of the grid azimuth indicator and turret reference display, while the CITV and CCD diagnostics (tailored to the CVCC and IVCC conditions) covered the major functional features of the two systems. Each test consisted of a series of instructions and tests read by the trainer. The format required the trainer to make a pass-fail judgment by marking "Go" or "No-Go" for each task. To assist the trainer, the diagnostic summarized the set of steps defining correct performance of each task.

Company SOP. The company-level standard operating procedures (SOP) expressed the general guidelines to be followed in tactical exercises. Representing current doctrinal principles, the guidelines constituted the rules applying to maneuver, engagement, communication and reporting, combat support, combat service support, and command and control. The SOP for M1 Baseline companies defined the format for each structured report. The guidelines in the SOP applied to training as well as test exercises.

Crew Training. After individual training was complete, common training procedures applied to all conditions. Crew training provided the first opportunity for the members of each tank crew to work together as a team. This session utilized a "sandbox" terrain setting in which each crew was to navigate a six-waypoint route laid out within a 4-5 km by 4-5 km terrain

square. TCs in the IVCC and CVCC conditions were to use the CCD in creating routes and sending waypoints to the driver (either manually, or in the CVCC condition, using the Autoadvance option). M1 Baseline TCs used the same navigation techniques practiced the day before.

Stationary gunnery targets appeared on the terrain to trigger target engagement and generate contact and spot reports. The TCs were instructed to send limited types of reports based on events encountered during the exercise. For transmitting reports, TCs in the CVCC condition used their CCD, while IVCC and M1 Baseline TCs used their voice radio. TCs communicated directly with the exercise controller, bypassing normal unit communication channels. When a crew completed the first route, its simulator was reinitialized in a new sandbox so a second route could be negotiated. When time permitted, a crew was set up to run a third sandbox route.

The platoon training scenario included both offensive and defensive tactical components, with two changes in mission scripted. The scenario began with an offensive mission, followed by a defensive mission; an offensive mission ended this training session. The complete scenario required approximately two hours to execute, not counting pre-movement planning and preparation. This training scenario included both gunnery targets and SAFOR enemy vehicles/units (OPFOR) to set the stage for engagements and stimulate submission of reports. TCs were to transmit the full range of reports, in keeping with the tactical flow of the scenario.

Company Training. The situations and events comprising each company training exercise were specified in scenarios, developed by armor subject matter experts and validated by the Directorate of Combat Developments, U. S. Army Armor Center. Based on current warfighting doctrine, these scenarios combined typical elements of offensive and defensive combat operations to represent realistic battles staged on terrain surrounding Fort Knox, Kentucky. Each scenario contained segments organized around primary and follow-on missions. Each was designed to take approximately two hours to execute, not counting initial planning time. Serving as a simulation blueprint, each scenario provided the script used by the control room staff to implement unit training in a consistent manner. Table 7 illustrates the structure of a company training scenario.

Corresponding to each training scenario was a doctrinally correct operations order (OPORD) detailing the tactical situation, the unit's initial mission, and related information. The OPORD provided the basis for the unit to plan its tactical execution of the first mission, allowing the commander and his staff reasonable latitude in their operational planning. Fragmentary orders (FRAGOs) specified the follow-on missions for each scenario.

TABLE 7. TACTICAL STRUCTURE OF THE COMPANY TRAINING SCENARIO

Phase/Segment	Major activities
Initial planning	Mission briefing, preparation
I. Seize Objective Mink	
A. Movement	Move to objective
B. Enemy engagement	Fight Motorized Rifle Platoon (MRP)
C. Consolidation	Prepare hasty defense
II. Delay on Battle Position 10	
A. Pre-engagement	Prepare defensive positions
B. Enemy engagement	Fight Motorized Rifle Battalion [MRB(+)], Hinds (Soviet Helicopters)
C. Displacement	Displace to Battle Position 11
III. Defend Battle Position 11	
A. Pre-engagement	Prepare defensive positions
B. Enemy engagement	Fight MRB(+), Hinds

Unit training checklists. During crew, platoon, and company training, a checklist served to remind the trainer of the SIMNET M1, CITV, and CCD functions the TC was supposed to practice or exercise. For the M1 Baseline condition, the checklist keyed only on navigating and operating the SIMNET M1. In the CVCC and IVCC conditions, the checklist also included CCD and CITV functions tailored to conditions. Listing each function separately, the checklist called for the trainer to "check" each when he observed it being performed. This process provided a basis for the trainer to prompt the TC to use those functions which he appeared to be overlooking or ignoring.

Navigation aids. Each TC used a standard set of materials to help him navigate during training scenarios. These included: SIMNET terrain maps housed in clear plastic map cases, situation overlays drawn by hand on clear acetate, grease pencils for drawing overlays and map notations, duct tape for securing overlays to map cases, map protractors for platting azimuths, and rulers for measuring distance (M1 Baseline only).

Data Collection Systems

Both automated and manual systems were used to collect data related to training, although the majority of training-related data was gathered using paper-and-pencil instruments.

Automated Data Collection and Analysis Systems. The Data Collection and Analysis (DCA) system provided automated data recording, reduction, management, and analysis functions. Within this system, DataLogger handled automated data collection, recording data packets on-line. Data recording occurred in the real-

time, digital domain, storing information packets broadcast by each simulator over an Ethernet. Data samples were driven by events (e.g., a CCD soft-switch press) or by timed cycles (e.g., sampling every 30 seconds). In the control room, the two Plan View Display (PVD) stations provided the means for operators to embed "event flags" in the Data Logger recordings. Representing key events, such as start of an exercise, radio transmission of a report, or crossing of a phase line, these flags served as markers to be used during data reduction. To monitor CCD reports transmitted via digital burst, a Listen system displayed all reports on-line and recorded them in a computer file.

Two DCA subsystems handled off-line reduction and analysis of Data Logger recordings: RS/Probe, extracting and structuring data into intermediate files; and RS/1[2], analyzing data from the intermediate files by means of standard library routines as well as tailored programs.

Manual data collection materials. A variety of instruments served to collect data related to training. These instruments included soldier-completed questionnaires and researcher-collected diagnostic tests as shown in Table 8.

TABLE 8. MANUAL DATA COLLECTION INSTRUMENTS RELATED TO TRAINING

Instrument	Completed by:	Type of data
A. Biographical questionnaire	All participants	Factual/recall
B. SIMNET training questionnaires		
Training Evaluation	Tank Cdrs	Rating scale
Training items	Gunners, drivers	Rating scale
Ease of Learning	Tank Cdrs	Rating scale
Training Time Needed	Tank Cdrs	Rating scale
C. New Equipment Training questionnaires		
Time to Train	Tank Cdrs	Categorical
Type of Training Required	Tank Cdrs	Point estimate
D. Diagnostic Tests	Tank Cdrs	Recall

Biographical Questionnaire. The Biographical Questionnaire was designed to obtain limited information regarding demographic variables and military experience from each participant. This information provided a profile of participants and supported investigation of armor experience as a predictor or mediator of performance during training.

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[2]A registered trademark (TM) of Bolt, Beranek and Newman, Inc.

Training Questionnaires. Five paper-and-pencil questionnaires were developed to elicit participant responses and opinions regarding training aspects of the equipment used in the evaluation. The first three focused on the training received during the evaluation and the ease with which participants were able to learn to use the special equipment. The remaining two required participants to make decisions about a hypothetical program of instruction which would be developed when the CITV and CCD were fielded. Training questionnaires were designed for completion by all TCs including Company Commanders and Platoon Leaders; they also provided opportunities to respond with written comments. Participants in the M1 condition completed only a tailored version of the Training Evaluation Questionnaire, since the remaining questionnaires focused on aspects of the CVCC and IVCC equipment. (Copies of all training questionnaires are included in the Appendix.)

Training Evaluation. The Training Evaluation Questionnaire was designed to assess the effectiveness of the two and one-half day training program. There were three versions of the Training Evaluation: a CVCC, an IVCC, and an M1 version. The M1 version focused on the training program as it applied to M1 simulator training, as opposed to the CVCC or IVCC equipment training.

A five-point scale served to rate the quality of the classroom and "hands-on" training, as well as the crew, platoon and company training exercises. The five-point scale ranged from "Poor" to "Excellent." Participants also rated the clarity of: a) the presentation of training objectives, 2) the information provided on operation and tactical use of the CVCC and IVCC equipment (omitted in the M1 version), and 3) the clarity of the feedback received during training. In these three areas, clarity was rated on a 5-point scale ranging from "Very Unclear" to "Very Clear." The Training Evaluation Questionnaire also posed a number of open-ended questions which encouraged tank commanders to elaborate on the scale ratings.

Selected training evaluation items were administered to gunners and drivers as part of a Soldier-Machine Interface (SMI) questionnaire. These items solicited their reactions to training received using a five-point scale.

Training Time Needed for CCTB. The Training Time Needed for CCTB Questionnaire required CVCC and IVCC participants to rate the amount of time needed for training on various CCD and CITV functions, based on the amount of time provided during the training phase of the evaluation. CCD and CITV functions were rated using a six-point scale which ranged from "1/4 as much" time to "twice as much (time) again." The amount of training time needed for each function was rated independently for classroom and individual (hands-on) training.

Ease of Learning. The Ease of Learning Questionnaire asked participants to rate how easy it was to learn to use the various functions of the CVCC and IVCC equipment. Participants rated a list of CCD and CITV functions using a five-point rating scale that ranged from "Extremely Easy to Learn" to "Extremely Difficult to Learn." The lists of CCD and CITV functions were identical to those used in the Training Time Needed for SIMNET-D Questionnaire.

Time to Train on New Equipment. The Time to Train on New Equipment Questionnaire asked participants to imagine themselves as members of a New Equipment Training Team (NETT) providing input to programs of instruction for the newly fielded CVCC and IVCC equipment. They were asked to estimate (to the nearest quarter hour, up to a maximum of 8 hours) the amount of time necessary to train a variety of skills.

Type of Training for New Equipment. This questionnaire also required participants to imagine themselves members of a NETT and to judge the best method for training a variety of skills (identical to those skills presented in the Time to Train on New Equipment Questionnaire). Participants were instructed to choose among "Simulator" only, "Real Tank" only, or both Simulator and Real Tank as the best method for training each skill.

Diagnostics. Diagnostics were intended to assess the effectiveness of the training program in accomplishing training objectives. All diagnostics were administered in the simulators. Diagnostics consisted of a set of tasks read to the TC by the RA. TCs were scored "Go" or "No-Go" on each problem.

Three diagnostics were prepared. The first was a SIMNET diagnostic assessing the TC's capability to perform basic simulator functions. This test was given to TCs in all three conditions: M1 Baseline, IVCC and CVCC.

The other two diagnostics focused on the CITV and CCD respectively. These tests were tailored to the IVCC and CVCC conditions and yielded an assessment of the TCs capability to operate and use the specific functions of the equipment configurations.

Procedures

The basic schedule for training and testing each group of participants spanned Monday through Thursday, with Friday serving as back-up day. A depiction of the schedule for the CVCC and IVCC condition appears in Figure 7. The schedule for the M1 Baseline condition (Figure 8) was adjusted to reflect the elimination of CCD and CITV training requirements; at the same time, a block of SIMNET navigation training was added. The first two and one half days (two days with M1 Baseline) comprised the training phase, in which participants received individual, crew, and unit training in a progressive manner. Unit training included exercises at both the platoon and company levels. The remaining two and a half days were devoted to testing and a separate effort on workload. These latter activities are described in Leibrecht et. al., in preparation.

Figure 7. Training and testing schedule (CVCC and IVCC).

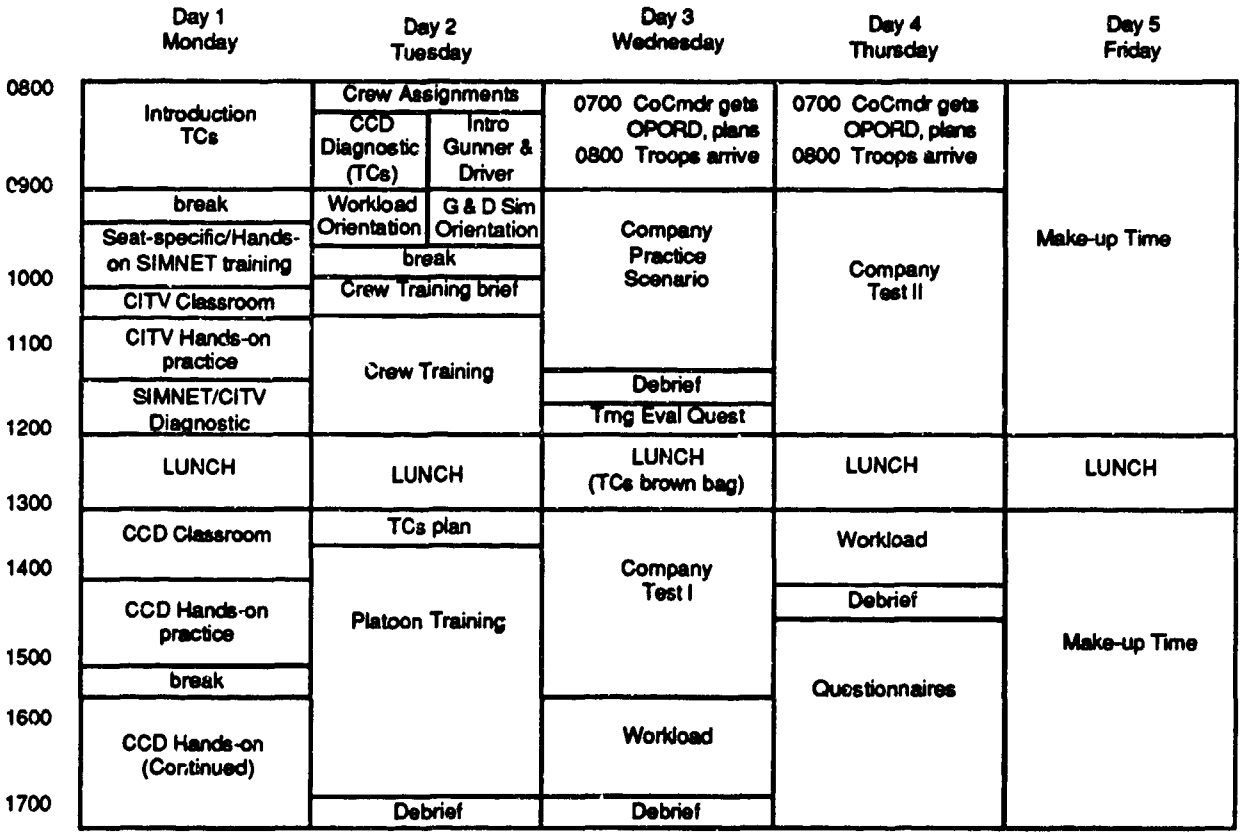
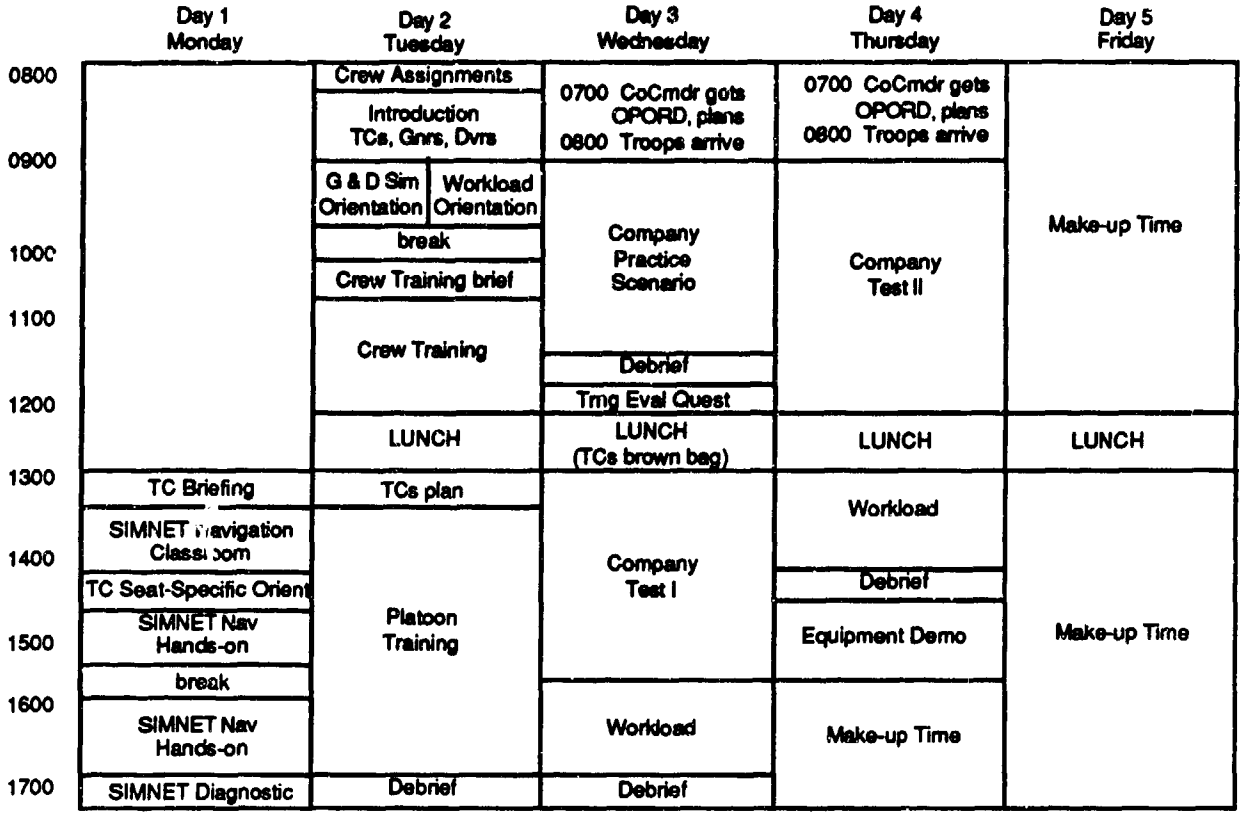


Figure 8. Training and testing schedule (M1 Baseline)



Throughout all phases of training and testing, a given crew was assigned to the same simulator. No exchange of positions within a crew was allowed. The RAs rotated across crews such that one RA trained a crew (though company training), another conducted diagnostic testing, and a third monitored the crew during testing.

Training Procedures

Procedures for training both research team members and participants were required. Training of researchers is described in detail by Leibrecht et al. (in preparation).

As noted earlier, a combination of individual, crew, and unit training methods was developed for the systematic, progressive train-up of soldier-participants. Somewhat different training programs were required for CVCC and IVCC compared to M1 Baseline participants, given the CITV and CCD training requirements for the former. In addition, training in all conditions was more extensive for tank commanders (including company commanders and platoon leaders) than for gunners and drivers. However, these differences applied only during individual training; once crew-level training began, training program differences disappeared.

Individual Training (CVCC and IVCC Condition). Individual training of tank commanders (TCs) in the CVCC and IVCC condition began with an overview briefing explaining the purpose and general methods of the evaluation. Issues affecting data collection were also discussed with emphasis on the importance of conscientious role-playing by each participant. A classroom presentation was then used to introduce the CCTB M1 simulator. Following this, RAs conducted one-on-one hands-on training in the simulators using seat-specific guides. This session focused on the TC's work-station, highlighting equipment differences between the simulator and a real M1 and introducing the CITV and CCD. Each TC performed selected tasks plus a few practice exercises at the end.

The TCs then returned to the classroom for a viewgraph-assisted lecture on the CITV. An explanation of the hunter-killer concept was followed by a description of each CITV feature and function. Suggestions for tactical applications, such as selecting autoscan sectors depending on one's position in the platoon and using Target Stack to pinpoint expected enemy avenues of advance, concluded the presentation. RAs then conducted hands-on CITV training in the simulators, during which explanations of features and functions alternated with practice by the TC. A scripted set of practice exercises ended the session, with the RA allowing the TC to do as much as possible on his own before prompting. By the end of this session, the TC had performed most functions three times.

At the end of the morning, RAs administered SIMNET and CITV diagnostic tests (see Appendix). Each RA tested a different TC than she/he trained. These tests were designed to: 1) determine if the TC possessed the skills and knowledge necessary to continue training and 2) indicate the effectiveness of the training program. The RA emphasized to the TC that the diagnostics were not given to judge or score his individual performance. For each diagnostic, the RA read a given task, then compared the TC's performance to the correct sequence of steps written on the RA's form, and finally marked a "Go" if the TC performed the task correctly within the allotted time (1.5 minutes per task). At the end of the test the RA informed the TC of the outcome for each task and conducted retraining on those tasks he had performed incorrectly.

Training of the TCs on the CCD began with a classroom lecture on the purpose, development, features, and potential tactical uses of the C^2 concept configuration. The RAs then conducted hands-on training in the simulators using the same approach as in the CITV hands-on session: alternating explanation with practice and ending with a fixed set of practice exercises. To ensure adequate training with the large number of tasks involved, the hands-on session lasted 3 hours. The next day, the CCD diagnostic test was administered in the same fashion used for the earlier diagnostics. Remedial training was provided, as necessary, given available time.

Training of the gunners and drivers began on Day 2 with the same project overview briefing and SIMNET orientation delivered earlier to the TCs. Following this classroom session, the RA's conducted seat-specific training: one RA trained a group of three of four gunners (or drivers) using the appropriate seat-specific guides. While each participant had a chance to practice selected tasks, there were no practice exercises at the end of the session.

Individual Training (M1 Baseline Condition) Individual training of TCs in the M1 Baseline condition began on the afternoon of Day 1 with a brief statement of the purpose of the evaluation. (The standard overview briefing was presented to the entire group of participants on Day 2.) Immediately following was the SIMNET orientation in the classroom, tailored appropriately to the simulator configuration lacking CITV and CCD functions.

The TCs then received special training in SIMNET navigation to compensate for the lack of automated navigation aids. This training started in the classroom with a viewgraph-assisted lecture on using the SIMNET map with protractor and land navigation methods of dead reckoning, terrain association, resection, and polar plotting. This instruction included practice exercises with the SIMNET map. Upon completion of the classroom session, the TCs were paired up for seat specific orientation and navigation training in the simulators. While one of the pair drove the tank, the other occupied the TC's crewstation and practiced navigating while using the SIMNET map, protractor, and distance scale. This exercise involved following a cross-country route from one checkpoint to the next. The task structure required the TC to determine his location at several points using resection or polar plotting, and to use his Grid Azimuth Indicator to determine what terrain feature or object lay along a given azimuth. At the end of an hour (sufficient for navigating three or four checkpoints), the participants changed positions so the second could complete his portion of the navigation exercise. During this session, an RA in the simulator delivered instructions for certain tasks, provided guidance to ensure proper use of techniques, and answered questions from the TC. At the end of the afternoon the RAs administered the same SIMNET diagnostic as was used with TCs in the other conditions, with the addition of an extra question addressing the odometer.

Training of the M1 Baseline gunners and drivers began on Day 2, when they received the project overview briefing together with the TCs. Following this, the gunners and drivers received their SIMNET orientation and hands-on seat-specific training sessions, which followed the corresponding sessions for the gunners and drivers in the other conditions except for minor tailoring to match the M1 Baseline configuration.

Crew Training. Once individual training was complete, common training procedures applied to the CVCC, IVCC and M1 Baseline conditions. Crew training allowed members of each tank crew to

work together as a team. As rated earlier, this session utilized a "sandbox" terrain setting requiring each crew to navigate a six-waypoint route laid out within a 4-5 km by 4-5 km terrain square. TCs in the CVCC and IVCC condition were to use the CCD in creating routes and sending waypoints to the driver, while M1 Baseline TCs had to use the same navigation techniques practiced the day before.

The TCs were instructed to send limited types of reports based on events encountered during the exercise. For transmitting reports, TCs in the CVCC condition used their CCD, while IVCC and M1 Baseline TCs used their voice radio. TCs communicated directly with the exercise controller, bypassing normal unit communication channels. When a crew completed the first route, its simulator was reinitialized in a new sandbox so a second route could be negotiated. When time permitted, a crew was set up to run a third sandbox route. This training session lasted approximately an hour and a half.

Inside each simulator, an RA observed crew performance and reminded crew members to utilize fully all available equipment. The RAs used checklists itemizing specific equipment functions to help keep track of TC performance and ensure prompting when the TC overlooked or ignored a function. They freely provided guidance to the TCs and answered their questions.

Platoon Training. The platoon training exercise was conducted on Day 2 in the afternoon. The Battlemaster (the head exercise controller) initiated the exercise by briefing the missions to the company commander, using the company Operations Order (OPORD) and graphic overlay materials (company operations overlay and fire support overlay). A copy of each was provided to the company commander. After the company commander backbriefed the Battalion S-3/Test Controller to ensure he understood the mission, he began the unit's planning and preparation process by briefing his platoon leaders. After demonstrating their understanding of the mission, they designated responsibilities for preparing working copies of the overlays. The 2nd Platoon Leader also briefed his three TCs on the mission.

After approximately forty-five minutes of planning and preparation, the unit moved to the simulators for final preparations lasting twenty minutes. This stage included checking the equipment, including radio nets; final navigation planning; intra-crew coordination; and pre-movement unit coordination. TCs in the CVCC and IVCC condition could create routes on their CCDs and send initial waypoints to their drivers. CVCC TCs also posted to their CCD tactical map the graphic operations overlay which had been transmitted earlier via digital burst, through standard channels originating in the ECR. When the company commander reported "REDCON-1" to the control room staff member acting as the Battalion Executive (XO), the Battlemaster issued the order to begin executing the mission.

The platoon training scenario included both gunnery targets and SAFOR enemy vehicles/units (OPFOR) to set the stage for engagements and stimulate submission of reports. TCs were to transmit the full range of reports, in keeping with the tactical flow of the scenario.

When the last scripted event of the scenario was complete, the staff member acting as the Battalion XO terminated the exercise. At this point the participants returned to the classroom for a debriefing, where they received feedback on their mission performance. Soldier comments and suggestions during this debriefing were collected.

Company Training. The final session of the training program was the company training exercise, scheduled on Day 3. The scenario for this exercise included an offensive mission to seize an objective, a delay mission with a displacement, and a mission to defend a battle position. The initial mission briefing, planning, and preparation activities were very similar to those during the platoon training exercise, except that the time allotted for these activities was one and a half hours. The twenty minute pre-movement preparation in the simulators remained basically the same, as did the sequence for initiating mission execution. Approximately two and a half hours were required to complete the entire scenario.

In addition to the company OPORD, a battalion/task force OPORD was used for mission briefing and planning. Instead of company overlays, battalion/task force level overlays were used. One fragmentary order (FRAGO) for each follow-on mission served to specify the mission parameters. In the M1 Baseline and IVCC conditions, the FRAGOs were delivered to the company commander completely via voice radio, including the locations for graphic control measures. In the CVCC condition, the basic FRAGO (including the new graphic overlay) was transmitted to the company commander via digital burst from the ECR at the start of the new mission. To compensate for the limited text capacity (51 characters) of the automated FRAGO, a voice radio supplement followed the automatic transmission. All TCs were expected to update their paper map overlays with the new FRAGO information. In-simulator planning followed receipt of the FRAGO, at the end of which the company commander reported "REDCON-1" and the Battlemaster ordered execution of the mission.

As in the platoon training exercise, both gunnery targets and SAFOR enemy units provided opportunities for engagement and submission of reports. Rules contained in the company SOP specified the parameters for transmitting reports.

The RAs performed the same roles in the simulators as during the platoon exercise, again using a training checklist. Additional responsibilities during the company training scenario included administering situational awareness assessments (practice

only) and copying map overlays. Both of these activities occurred at the end of FRAGO-based missions.

When the last scripted scenario event was complete, or at a tactically feasible break point falling between two and a half and two and three quarters of an hour of mission execution, an end to the exercise was declared. All participants then returned to the classroom for a debriefing, where they received feedback on the company's mission performance. Participants' comments and suggestions were collected.

Collection of Training-Related Data

Selected research team members administered the various training-related questionnaires to the participants (in a group setting) at designated points during training and following testing (see Table 9). All participants completed the Biographical Questionnaire; only TCs completed the remaining questionnaires, except for the Gunner's and Driver's Evaluations. For each training questionnaire, the administrator read a standard set of instructions tailored to the specific questionnaire. Participants were allowed as much time as needed to complete each questionnaire. SIMNET training questionnaires were scheduled for completion following the company training exercise for two reasons: to capitalize on recency of training experience and to reduce the volume of questionnaires following completion of the second test. When schedule delays prevented administering these questionnaires as planned, their administration followed the end of the second test scenario, coming before the development training questionnaires.

TABLE 9. QUESTIONNAIRE ADMINISTRATION SCHEDULE

	Questionnaire	When Administered
A.	Biographical Questionnaire	Overview briefing
B.	SIMNET training questionnaires	
	1. Training Evaluation	After CO trng
	2. Ease of Learning	After CO trng
	3. Training Time Needed	After CO trng
	4. Gunner/Driver Training Items	After Test 2
C.	New equipment training questionnaires	
	1. Type of Training Required	After Test 2
	2. Time to Train	After Test 2

Collection of data occurred at various points throughout the week. Collection of automated data took place during text exercises and was handled by employees of the site operations

contractor with input from exercise control room personnel. Standard DataLogger procedures were employed in collecting automated data. All test exercises were recorded on magnetic tape for subsequent reduction and analysis. A standard character string served to identify uniquely each scenario.

Data Reduction and Analysis. To protect the privacy of individual soldiers, a unique number was assigned to each participant at the start of the week. This number was used in place of the individual's name on all data collection instruments, except for the Biographical Questionnaire. This numbering system served to identify individual cases in all database activities.

Prior to analysis, database management (data entry and quality control), and data reduction activities were conducted.The descriptive and influential analyses were conducted as described in the following sections.

Descriptive analyses. Prior to analyzing manual and automated data, procedures were developed for handling missing and contaminated data. Missing data resulted from a unit's failure to complete the third mission, equipment failures, and participant absences. In addition, sometimes a participant skipped an occasional question on a questionnaire. Contaminated data resulted generally from equipment malfunctions and crew adjustments due to participant absences. The general rule for handling both missing and contaminated data was to omit the affected measures from analyses. Only those measures/values feasibly influenced by the unplanned event were omitted. This had the impact of reducing the sample size across cells and across measures.

The Statistical Package for the Social Sciences for the IBM Personal Computer (SPSS/PC+) was used for all data analyses. The REPORT procedure was used for computing means, medians, and standard deviations. The CROSSTABS procedure was used for generating frequency distributions, including percent response breakouts for questionnaire items.

Inferential and regression analyses. Factorial analyses of measures were performed using SPSS' MANOVA (Multivariate Analysis of Variance) procedure, which includes provisions for univariate ANOVA, testing of underlying assumptions, comparisons among individual means, and related capabilities. For correlation analyses, the REGRESSION procedure was utilized.

Results

The results of the analyses of data related to training gathered during the CVCC company evaluation are presented in this section. The discussion is organized into five major sections

corresponding to the five training-related issues formulated for the study.

Issue a: How Adequate are the Training Materials and Procedures used to Prepare Soldier-Participants to use the Equipment?

This issue was addressed by examining two major categories of data. The first included evaluations of the training provided on equipment operation gathered from soldier-participants using questionnaires. These data provided insights into the reactions of the participants on the adequacy of the training. The second included performance data derived from diagnostic tests and automated measures obtained during a tactical scenario. These data bear on the effectiveness of the training as indicated by participants' ability to use the equipment after participating in the training program. The results from these two sets of data are presented below.

Training Evaluations

Training evaluations were gathered from TCs, gunners and drivers after the completion of the training program. Since most of the tasks required to operate the CITV and the CCD must be completed by the TC, the most extensive data were gathered from the TCs with more limited evaluations gathered from gunners and drivers.

Table 10 summarizes the evaluations of TCs on the adequacy of the training program. The table presents their views on classroom training and hands-on simulator training. The first set of columns summarizes evaluations for CITV training in the CVCC and IVCC conditions. The second set summarizes evaluations for CCD training in the CVCC and IVCC conditions. The third set summarizes evaluations of TCs in the M1 Baseline condition.

Two noteworthy points emerge from an examination of the results shown in Table 10. First, average ratings in all conditions were above the midpoint of the rating scale (with two exceptions) indicating a generally positive view of the training provided for all three equipment configurations. Second, evaluations of hands-on simulator training tended to be somewhat more positive than those for classroom training, although ratings of the instructor's presentation during classroom training were also generally high and approached the more favorable views toward hands-on simulator training.

Table 11 presents the evaluations of TCs toward the tactical training exercises provided as part of the training program. Average ratings for each type of tactical exercise were also positive with the company exercise generally viewed most favorably overall.

TABLE 10. TC EVALUATIONS OF TRAINING ON EQUIPMENT OPERATIONS

How adequate were components of the training program in preparing you to operate the CITV and the CCD?

	CITV				CCD				M1 BASELINE	
	CVCC n=35		IVCC n=35		CVCC n=35		IVCC n=35		n=28	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Classroom Training:										
Classroom Sessions-Overall	3.69	0.76	3.69	0.72	3.69	0.76	3.71	0.96	3.71	0.90
Instructor's Presentation	4.00	0.77	3.89	0.80	4.06	0.77	3.74	1.01	3.79	0.88
Viewgraphs	3.49	0.78	3.34	0.94	3.51	0.78	3.29	1.10	3.54	0.64
Handouts	3.26	0.98	3.14	0.94	3.26	0.98	3.23	1.03		
Examples of Tactical Equipment Use	3.63	1.03	3.46	0.82	3.63	1.03	3.20	1.16		
Hands on Simulator Training:										
Hands-On Overall	4.43	0.70	4.03	0.98	4.43	0.70	4.11	0.96	4.04	0.69
RA Explanations	4.29	0.75	4.09	1.01	4.31	0.76	4.11	1.05	4.00	0.77
Hands-On Training	4.43	0.70	3.91	1.01	4.29	1.13	3.94	0.97	4.11	0.69
Diagnostic Test	3.24	1.30	2.60	1.91	3.26	1.33	2.63	1.97	3.75	1.04

NOTE: Ratings made on 5-point scale where 5 = excellent and 1=poor.

TABLE 11. TC EVALUATIONS OF TACTICAL TRAINING EXERCISES

How adequate were the tactical training exercises in preparing you to use the CITV and the CCD in a tactical situation?

	CITV				CCD				M1 BASELINE	
	CVCC n=35		IVCC n=35		CVCC n=35		IVCC n=35		n=28	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev
TC Nav Skill Drills									3.71	0.94
Crew "Sandbox" Drills	3.86	0.69	3.91	0.66	3.97	0.62	3.57	1.38	3.89	0.83
Platoon Trng Exercise	3.91	0.82	3.91	0.70	3.86	0.77	3.66	1.24	3.79	0.79
Company Exercise	4.06	0.87	4.03	0.62	4.03	0.86	3.66	1.19	3.82	0.72
How adequate was the opportunity for hands on practice using the equipment?	3.94	0.91	3.94	0.76	3.91	0.98	3.83	0.82	3.71	0 71

NOTE: Ratings made on a 5-point scale where 5=excellent and 1=poor.

TCs were also asked a summary question about the overall adequacy of opportunity for hands on practice in using the equipment. These ratings are included in Table 11. As shown there, opportunity for hands-on practice was generally viewed as good.

Finally, TCs were asked to reflect on the clarity of the training provided as a measure of the quality of training provided. These ratings are summarized in Table 12.

As shown in Table 12, the average ratings of TCs on training program clarity were consistently above the midpoint of the scale indicating that training was generally perceived as clear. Average ratings were consistently higher for training objectives and information on equipment operation compared to tactical usage and feedback on performance.

TABLE 12. TC EVALUATIONS ON CLARITY OF TRAINING.

Considering the training program as a whole, how clear were the following?

	CITV				CCD				M1 BASELINE	
	CVCC n=35		IVCC n=35		CVCC n=35		IVCC n=35		n=28	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Training Objectives (What you were expected to learn)	4.26	0.92	4.34	0.68	4.23	0.84	4.11	1.05	4.04	1.04
Information on how to operate the equipment	4.49	0.61	4.49	0.74	4.37	0.69	4.40	1.06	4.68	0.55
Information on how to use the equipment tactically	3.77	0.77	3.77	1.03	3.60	1.01	3.54	1.36		
Feedback on how well you were performing during training	3.57	1.12	3.66	1.14	3.54	1.09	3.46	1.29	3.54	1.10

NOTE: Ratings made on a 5-point scale where 5=very clear and 1=very unclear.

To more fully explore the training evaluations of TCs, relationships between selected background factors as collected by the Background Questionnaire and composite ratings derived from the Training Evaluation were examined. Three background factors were drawn from the Background Questionnaire for analysis: 1) Hands-on SIMNET; 2) Time in armor; and 3) M1 experience.

Composites were built based on data from the Training Evaluation by combining conceptually related sets of items to yield the following composite variables for CCD training: 1) Classroom Training; 2) Hands-on Simulator Training; 3) Tactical Training; 4) Clarity of Training; 5) Overall CCD training evaluation. Comparable composite variables were created from the Training Evaluation for CITV training.

Two types of exploratory analyses were conducted. First, simple correlations were computed between each background variable and each training composite to examine whether background was associated with composite ratings. Second, the two biographical variables with the greatest variability were categorized as follows: 1) Hours on SIMNET: a) 0-16 hours, b) 16-40 hours, c) 40+ hours; and 2) Time in Armor: a) 0-2 years, b) 2-8 years, c) 8+ years. Multivariate analyses of variance (MANOVAs) were conducted using these two categorical variables as independent variables and the composite ratings as dependent variables. Separate MANOVAs were run for CCD and CITV training. In each analysis, the overall training evaluation composite was omitted since it was non-independent (i.e., a sum of the other composite variables). These analyses were not statistically significant ($p>0.05$) suggesting that there was no evidence that background was related to reactions toward the training program. That is, these experience factors were unrelated to TC training evaluations.

Gunners and Drivers. Gunners and drivers were also queried on their views about the training program. Their ratings are summarized in Table 13. On the average, gunners and drivers tended to somewhat disagree that classroom instruction was useful and that the tactical training exercises were adequate. On the average, they also tended to express neutral views to some agreement that they needed more hands-on instruction in the simulator.

There are at least three explanations for their neutral to lukewarm reactions to the training program. First, since most gunners and drivers had some prior SIMNET experience, it may be that training tasks were perceived as straight forward with minimal training demand. An alternative explanation is that gunners and drivers desired greater participation in the training so they would understand the tasks required of TCs.

Training Outcomes. The performance outcomes of participation in the training program were examined using data gathered from diagnostic tests completed after each segment of the training program (SIMNET, CITV and CCD). The capability of participants to use the equipment in a tactical situation after completion of training was also examined using automated measures derived from a selected tactical scenario. Results based on these two sets of data are described below.

TABLE 13. GUNNER AND DRIVER EVALUATIONS OF TRAINING

	CVCC				IVCC			
	GUNNERS n=33		DRIVERS n=35		GUNNERS n=35		DRIVERS n=35	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Classroom instruction was useful	2.09	0.77	1.89	0.47	2.06	0.68	1.66	0.64
Needed more Hands-On instruction in simulator	3.06	1.34	3.97	1.22	3.74	1.12	3.89	1.04
Tactical training exercises were adequate	2.21	0.89	2.06	1.11	2.17	0.98	1.74	0.61

NOTE: Ratings made on a 5-point scale where 5=strongly agree and 1=strongly disagree.

Table 14 summarizes the performance of TCs on the three types of diagnostic tests (SIMNET, CITV, and CCD) administered after the completion of each segment of the training program. Data are reported based on mean percent correct. Since diagnostic test are criterion-referenced (i.e., performance compared to standard) rather than norm-referenced (i.e., performance is compared to other test takers), it was necessary to establish a standard of acceptable performance in order to interpret performance on the diagnostics. In this case, a 75% correct standard was adopted. While all such values are in some sense arbitrary, 75% correct was judged as acceptable for this research effort.

TABLE 14. PERFORMANCE OF TCS ON DIAGNOSTIC TESTS

	DIAGNOSTICS - MEAN PERCENT CORRECT							
	TOTAL		CVCC		IVCC		M1 BASELINE	
	N	mean	N	mean	N	mean	N	mean
SIMNET	98	93.37	35	89.29	35	95.00	28	96.43
CITV	70	82.30	35	77.58	35	87.01	-	—
CCD	70	88.66	35	85.72	35	91.61	-	—

As shown in the table, average performance was highest on the SIMNET diagnostic with average performance approaching 90% or

higher with all three equipment configurations. Average performance on the CITV and CCD diagnostics was above the 75% mastery level. Performance tended to be somewhat higher on the CCD diagnostic compared to the CITV diagnostic with both the CVCC and IVCC equipment configurations. Average performance on the CITV and CCD diagnostics tended to be slightly higher with the IVCC equipment configuration compared to the CVCC configuration.

To further investigate performance on the diagnostic tests, the distributions of scores were examined to determine the number of TCs who scored below 75% correct on any of the three diagnostics. The results of this analysis are shown in Table 15. Essentially, the table indicates that low performance occurred most frequently on the CITV diagnostic, with small numbers of low performers on the other tests in both the CVCC and IVCC equipment configurations. The largest number of low performers overall occurred with the CVCC equipment configuration.

TABLE 15. FREQUENCY OF LOW PERFORMANCE ON DIAGNOSTIC TESTS

	Number scoring less than 75 percent				
Condition	SIMNET Only	CITV Only	CCD Only	CITV + CCD	Total
CVCC	2	7	1	4	14
IVCC	1	5	2	1	9
M1 BASELINE	1	—	—	—	1

There are at least three possible explanations for the greater incidence of low performers on the CITV diagnostics compared to the CCD diagnostics. First, the questions in the CITV Diagnostic tended to be more difficult than in the CCD Diagnostic: they required more recall and judgment, frequently involved spatial relationships, and sometimes took a compound form. The TCs consistently had a hard time working with mils. Questions in the CCD Diagnostic usually called for straightforward responses and were quite repetitive in form (e.g., "prepare and send X report"). Second, as a crewstation system, the CCD prompts the TC a good deal, leading him through menus. In contrast, the CITV requires the TC to carry operating details in his head. Thus, taking a test on the CCD is probably a bit easier. Finally, cumulative test-taking experience in over the course of the week could

have favored the last (CCD) Diagnostic. Perhaps the TCs felt more comfortable being evaluated the third time around.

In an attempt to further understand factors influencing performance on the diagnostics, exploratory analyses were conducted examining the relationship between prior experience and diagnostic performance. These analyses paralleled those described earlier for the Training Evaluation. The same background variables drawn from the Biographical Questionnaire were used: 1) Hands-on SIMNET; 2) Time in Armor; 3) M1 experience. The dependent variables in these analyses were percent correct on the three diagnostic tests: SIMNET, CITV and CCD.

As described earlier, analyses included simple correlations between each of the experience factors and each of the diagnostic scores. In addition, MANOVAs were conducted treating the experience factors as categorical independent variables as described earlier for the Training Evaluation analyses.

The results of these relational analyses were not statistically significant ($p>0.05$). Thus, there was no evidence that experience influenced how well participants performed on the diagnostic tests.

To further explain performance on the diagnostics, correlations were computed between the composite ratings created for the Training Evaluation (described earlier) and the three diagnostic tests. These analyses were also not statistically significant ($p>0.05$). Thus, there was no evidence that reaction to the training program influenced performance on the diagnostics or vice versa.

The second set of performance measures focused on equipment usage in a tactical situation. These measures were collected automatically for both the defensive and offensive test scenarios. Because the test scenarios were conducted after the training program, they provide measures of post training outcomes. More specifically, automated measures were extracted from the first phase of the defensive test scenario for this analysis. This tactical segment was selected because it was more static and allowed greater opportunities for equipment usage than the offensive scenario which was faster paced and involved considerable vehicle movement.

Table 16 summarizes automated target acquisition and engagement measures in the first phase of the defensive scenario. Equipment configurations (CVCC, IVCC and M1 Baseline) are shown in the first column of the table. For each configuration, the positions of each manned simulator are identified since it was expected that leadership position would influence performance. The remaining columns of the table summarize average performance on four measures: 1) the number of times per hour the autoscan sector was set; 2) the number of times per hour the autoscan rate

was set; 3) the number of times per mission a target was designated; and 4) the number of times per hour a target was lased. The first three measures relate to CITV usage and are thus only appropriate for the CVCC and IVCC equipment configurations. Lasing can be accomplished with the CITV or the independent laser rangefinder (LRF) with the CVCC configuration but only with the LRF in the IVCC and M1 Baseline configurations.

Table 16 provides indications of CITV tactical usage with both the CVCC and the IVCC configurations. On the average, these functions were used two to three times per hour with somewhat more frequent use of the designate function than the autoscan reset functions. Furthermore, the average use of target lasing was about twice as frequent in the CVCC configuration than the IVCC or M1 Baseline configuration. This pattern suggests that the CITV target lasing function was being used in addition to the LRF.

In interpreting data on tactical usage of the CITV, it is important to consider opportunities for usage within the tactical scenario, particularly the availability of targets for designation and lasing. While the details of this phase of the defensive scenario can be found in Leibrecht et al. (in preparation), it should be noted here that the scenario provided a restricted target set. When compared to tactical events, CITV usage rates were compatible with opportunities for usage.

To further examine equipment usage in a tactical situation, measures of information acquisition and communication using the CCD were examined for the CVCC configuration. These results are summarized in Tables 17 and 18.

Table 17 is organized by position within the company and shows the average number of messages sent per hour using the CCD and the percent of reports retrieved using the CCD. Examination of the table shows that, on the average, over seven messages were sent over the CCD per hour. When compared to the number of significant tactical events in the scenario, these sending rates are at expected levels. Furthermore, over one quarter of messages sent were retrieved on the average with the company commander retrieving over half on the average.

These data illustrate two important points. First, when a significant tactical event occurred, most TCs sent a report to higher. This tendency resulted in "report proliferation" as multiple and redundant reports were forwarded up the chain of command. Second, because of the report proliferation, a large pool of reports was available to be retrieved. The latter point explains the less than comprehensive report retrieval (i.e., less than 100%) shown in Table 17.

TABLE 16. TARGET ACQUISITION AND ENGAGEMENT MEASURES

		(1) (CITV) Autoscan Sector Set		(2) (CITV) Autoscan Rate Set		(3) (CITV) Designate		(4) (CITV and/orLRF) Lase	
CVCC		mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
All	(n=35)	3.08	0.66	2.38	0.88	3.14	1.25	99.76	40.16
1PL	(n=5)	2.92	1.62	2.33	1.13	2.60	2.70	136.14	57.84
2PL	(n=5)	2.80	1.02	4.01	2.50	3.00	1.22	175.32	134.61
2PS	(n=5)	3.03	2.19	2.18	1.43	4.60	5.32	79.77	45.48
2PW	(n=5)	3.60	1.93	2.21	1.76	3.80	3.11	73.12	14.00
2SW	(n=5)	4.00	2.02	2.90	1.46	4.40	3.57	75.50	37.80
3PL	(n=5)	3.31	2.01	1.87	0.63	2.60	0.55	71.94	37.37
Co. Cdr.	(n=5)	1.91	1.08	1.19	0.15	1.00	2.24	86.56	43.63
IVCC									
All	(n=35)	2.57	0.75	2.38	0.72	3.81	2.05	47.31	16.28
1PL	(n=5)	2.12	1.30	1.15	0.19	2.40	2.70	69.28	48.07
2PL	(n=5)	3.40	1.26	2.97	1.36	3.60	4.93	43.25	26.69
2PS	(n=5)	2.51	1.62	2.47	1.15	2.50	2.38	29.05	12.94
2PW	(n=5)	3.68	2.40	2.84	1.28	7.00	7.68	36.81	27.64
2SW	(n=5)	2.67	1.95	3.17	1.60	3.00	1.22	33.63	22.67
3PL	(n=5)	1.57	0.51	1.77	0.81	6.40	4.62	68.53	37.01
Co. Cdr.	(n=5)	2.07	0.65	2.26	0.72	1.80	1.64	50.59	28.93
M1 BASELINE									
All	(n=28)							40.58	15.56
1PL	(n=4)							41.06	29.36
2PL	(n=4)							28.90	12.31
2PS	(n=4)							61.57	82.82
2PW	(n=4)							22.57	16.86
2SW	(n=4)							43.37	24.60
3PL	(n=4)							59.62	15.96
Co. Cdr.	(n=4)							27.05	22.64

TABLE 17. INFORMATION ACQUISITION AND COMMUNICATION USING CCD (CVCC CONDITION)

		Messages Sent per hour		% Reports Retrieved	
		mean	std. dev	mean	std. dev
All	(n=28)	7.46	5.32	27.77	16.04
1PL	(n=4)	12.24	10.64	23.91	13.33
2PL	(n=4)	9.07	4.26	30.74	13.37
2PS	(n=4)	9.98	4.06	29.67	16.92
2PW	(n=4)	5.10	3.48	24.30	11.01
2SW	(n=4)	4.03	3.20	17.70	6.79
3PL	(n=4)	5.62	2.69	17.72	14.47
Co. Cdr.	(n=4)	6.21	2.25	50.38	17.12

Table 18 shows the types of reports most actively relayed using the CCD. These reports included contact, shell, spot, intelligence (INTEL), and nuclear/biological/chemical (NBC) reports. The company commander was the most active relayer of reports as expected, given the chain of command.

TABLE 18. TYPES OF REPORTS MOST ACTIVELY RELAYED (CVCC CONDITION)

	CONTACT			SHELL			ADJUST FIRE		
	N	mean	std. dev.	N	mean	std. dev.	N	mean	std. dev.
All	16	33.49	24.47	16	24.16	18.26	9	4.40	8.77
1PL	4	19.43	17.66	4	22.25	18.41	2	0.00	0.00
2PL	4	31.67	16.44	4	28.01	23.10	3	6.06	10.50
3PL	4	19.44	21.52	4	11.49	10.82	2	0.00	0.00
Co. Cdr.	4	63.44	14.91	4	34.88	16.89	2	10.71	15.15

	INTEL			CALL FOR FIRE			NBC		
	N	mean	std. dev.	N	mean	std. dev.	N	mean	std. dev.
All	16	77.50	36.99	8	22.30	26.58	14	34.29	40.14
1PL	4	62.50	47.87	2	00.00	00.00	3	16.67	28.87
2PL	4	72.50	32.02	2	37.78	25.14	4	35.00	47.26
3PL	4	75.00	50.00	2	00.00	00.00	3	6.67	11.55
Co. Cdr.	4	100.00	0.00	2	51.43	12.12	4	67.50	39.48

	SPOT		
	N	mean	std. dev.
All	14	29.13	32.44
1PL	3	19.52	16.92
2PL	4	28.98	30.43
3PL	3	14.81	16.97
Co. Cdr.	4	47.27	50.15

NOTE: Values indicate percent of reports relayed.

In summary, indications were that training was generally adequate as judged by training outcomes. Performance on the diagnostic tests was above a 75% mastery level, although there were a small number of lower performers on each test. Furthermore, there was evidence of equipment usage in a tactical scenario consistent with significant tactical events suggesting that the training program provided soldiers with sufficient skills for operational usage.

Issue b: How Sufficient is the Amount of Time Devoted to Training the Specific Functions of the Equipment?

Data on this training issue were gathered using a questionnaire for TCs. The questionnaire identified specific functions for the CITV, CCD and tactical usage of the equipment and asked the TCs to indicate whether training time should be increased, kept the same or decreased. TCs were asked to make separate ratings for classroom and individual instruction. Since the questionnaire dealt exclusively with the CITV, CCD and their tactical usage, it was not administered to TCs in the M1 Baseline condition.

Table 19 summarizes ratings on training time needed for CITV functions. The first column of the table lists the specific CITV target acquisition and target engagement functions that TCs were asked to rate. The next set of columns summarizes the ratings of TCs in the CVCC configuration for classroom and individual instruction. The final set provides comparable information for TCs with the IVCC configuration.

The data in Table 19 reveal four major tendencies in TC reactions to the amount of training required for CITV functions. First, average ratings for classroom instruction in both the CVCC and IVCC conditions were below the neutral point of the scale with one exception (target stacking--a capability only found in the CVCC condition). This pattern suggests that TCs felt that some reduction in training time (i.e., less than 50% reduction) was desirable. However, the relatively large standard deviations indicate that there was considerable variability among TCs in their views. Thus, while it is probably useful to review classroom instruction for opportunities to reduce training time somewhat, these cuts should be made cautiously.

Second, the average rating for classroom instruction on target stacking was slightly above the neutral point of the scale suggesting that TCs perceived a need for somewhat more classroom instruction on this function. While the variability among TCs was also large for this rating, consideration to expanding classroom instruction is probably warranted given the difference in direction of the average rating for this function compared to all other ratings of classroom instruction (i.e., average above the neutral point of the scale rather than below).

TABLE 19. TRAINING TIME NEEDED FOR CITV FUNCTIONS

	CVCC (n=35)				IVCC (n=35)			
	Classroom		Individual		Classroom		Individual	
	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
Target Acquisition								
Manual Search	2.43	0.81	3.03	1.15	2.31	0.80	3.26	0.66
Gun Line of Sight (GLOS)	2.60	0.85	3.14	1.09	2.41	0.96	3.24	0.70
Operational Mode (CITV/GPS switch)	2.69	0.80	3.14	1.03	2.35	0.88	3.29	0.80
Magnification (3X and 10X)	2.23	0.91	2.69	1.05	2.24	1.10	3.06	0.85
Auto Scan	2.51	0.85	3.29	1.20	2.60	1.01	3.54	0.85
Sector Set	2.71	0.89	3.63	1.11	2.65	1.07	3.62	0.99
Scan Rate Set	2.31	0.80	3.06	1.11	2.50	0.86	3.12	0.77
Designate	2.49	1.04	3.11	1.21	2.21	0.84	3.06	0.78
Identification Friend or Foe (IFF)	2.43	1.01	3.00	1.14	-----	-----	-----	-----
Target Engagement								
Target Handoff	2.80	0.93	3.29	1.05	2.47	0.83	3.26	0.75
Kill Assessment	2.76	0.89	3.44	1.02	2.49	1.17	3.03	1.10
Target Stacking	3.14	1.40	3.94	1.37	-----	-----	-----	-----

NOTE: Ratings made on 6-point scale where 6=twice as much again, 5=one-half as much again, 4=one-quarter as much again, 3=no change, 2=one-half as much and 1=one-quarter as much.

Third, TCs also reported a need for more training time devoted to individual hands-on training in the simulators. The one exception to this pattern was magnification in the CVCC condition -- a very simple function to perform. As with classroom instruction, the standard deviations are quite large, indicating considerable variability of opinion among TCs.

Fourth, some of the CITV functions received mean ratings approaching a value of "4" on the rating scale (i.e., additional 25% training time desired). These functions are candidates for expanding hands-on individual training and include: 1) sector set (CVCC and IVCC), 2) target stacking (CVCC), 3) autoscan (IVCC).

Table 20 presents TC views on the training time needed for CCD functions. The table organizes CCD functions into four main categories, including: map, navigation, report and communication functions.

Table 20 reveals similar patterns in TC views of the amount of training time devoted to CCD functions as compared to CITV functions (Table 19). First, all average ratings for classroom instruction on CCD functions were below the neutral point of the scale (3). This pattern suggests that TCs perceived a need for somewhat less classroom training time on CCD functions. However, the standard deviations are quite large, suggesting considerable variability of opinion among TCs. Thus, while classroom

instruction should be reviewed with an eye toward compressing instruction, such reductions should be made cautiously and should probably not exceed 25%.

TABLE 20. TRAINING TIME NEEDED FOR CCD FUNCTIONS

	CVCC (n=35)				IVCC (n=35)			
	Classroom		Individual		Classroom		Individual	
	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
Map Functions								
MAP "SCALE"	2.60	0.91	3.46	1.15	2.59	0.93	3.26	0.86
MAP "POSTED ICONS"	2.89	0.99	3.66	1.06	2.68	0.94	3.32	0.84
MAP "OVERLAYS"	2.91	1.09	3.51	1.04	-----	-----	-----	-----
MAP "FEATURES"	2.50	0.86	2.94	0.89	-----	-----	-----	-----
(Grid Lines, Objects, Roads, Rivers, Vegetation)								
SCROLL "ENABLED"	2.71	0.93	3.63	1.21	2.64	0.99	3.55	0.71
SCROLL "LOCKED"	2.57	0.88	3.20	1.13	-----	-----	-----	-----
SCROLL "CENTERED"	2.57	0.92	3.23	1.17	2.55	0.87	3.18	0.58
SCROLL "OFF CENTERED"	2.63	1.03	3.51	1.25	-----	-----	-----	-----
SCROLL "MOVE"	2.77	0.91	3.57	1.04	-----	-----	-----	-----
Navigation Functions								
NAV "ROUTE DESIGNATION"	2.83	1.01	3.54	0.89	2.58	0.94	3.39	0.79
NAV "FILES"	2.83	1.01	3.60	1.01	2.58	0.97	3.39	0.90
NAV "SEND"	2.71	0.99	3.23	0.94	-----	-----	-----	-----
NAV "CLR FLD"	2.66	0.97	3.14	0.94	2.45	0.87	3.06	0.79
Report Functions								
CON (Contact)	2.68	0.91	3.59	1.07	2.40	0.81	3.23	0.84
CFF (Call For Fire)	2.68	0.94	3.76	1.21	2.50	0.93	3.44	0.86
REP (Reports) "CONTACT"	2.56	0.86	3.29	0.84	2.45	0.87	3.24	0.94
REP (Reports) "NBC"	2.68	0.88	3.41	0.89	2.58	0.94	3.30	0.81
REP (Reports) "CFF"	2.74	0.90	3.68	0.98	2.58	0.83	3.42	0.79
REP (Reports) "ADJUST"	2.65	1.01	3.47	0.86	2.54	0.83	3.27	0.80
REP (Reports) "SPOT"	2.59	0.82	3.38	0.99	2.61	0.86	3.30	0.92
REP (Reports) "SITREP"	2.71	0.91	3.35	0.73	2.52	0.87	3.39	0.90
REP (Reports) "SHELL"	2.74	0.96	3.41	0.78	2.52	0.87	3.21	0.99
REP (Reports) "INTEL"	2.79	1.04	3.62	0.82	2.52	0.87	3.42	0.83
Communication Functions								
RECEIVE "CANCEL"	2.54	0.98	3.03	0.95	-----	-----	-----	-----
RECEIVE "DELETE"	2.51	0.92	3.03	0.95	-----	-----	-----	-----
RECEIVE "SHOW"	2.51	0.95	2.97	0.95	-----	-----	-----	-----
SEND (Sending Reports)	2.57	1.01	3.11	1.08	-----	-----	-----	-----

NOTE: Ratings made on 6-point scale where 6=twice as much again, 5=one-half as much again, 4=one-quarter as much again, 3=no change, 2=one-half as much and 1=one-quarter as much.

Second, average ratings for individual hands-on simulator training on CCD functions were close to the neutral point of the scale (3) or above indicating that TCs viewed no change or slightly more training as desirable. Again, the standard deviations are quite large indicating variability in the ratings of TCs. Thus, increases in training time for individual training should be made cautiously and focus on CCD functions with ratings approaching "4" on the scale (i.e., 25% more training time). Most

of these ratings occurred in the CVCC condition. CCD functions included five map functions: MAP "POSTED ICONS" (CVCC), MAP "OVERLAYS" (CVCC), SCROLL "ENABLED" (CVCC and IVCC), SCROLL "OFF CENTERED"(CVCC), and SCROLL "MOVE" (CVCC); two navigation functions: NAV "ROUTE DESIGNATION" (CVCC) and NAV "FILES" (CVCC); and four report functions: CON (Contact) (CVCC). CFF (Call for Fire), REP (Reports) "CFF" (CVCC), and REP (Reports) "INTEL" (CVCC).

Table 21 reports TC ratings of the training time needed related to tactical usage of the CITV and CCD. Generally speaking, TCs indicated a desire for more training time, especially individual, on tactical usage of the equipment and on tasks that require integrated usage of both the CITV and the CCD. This view also extended to crew and unit training generally in the CCTB facility.

TABLE 21. TRAINING TIME NEEDED FOR TACTICAL USAGE

	CVCC (n=35)				IVCC (n=35)			
	Classroom		Individual		Classroom		Individual	
Tactical Functions	mean	std. dev.	mean	std. dev.	mean	std. dev.	mean	std. dev.
Tactical employment of CITV	3.14	1.40	4.11	1.23	3.06	1.21	3.80	1.18
Tactical employment of CCD	3.23	1.37	4.46	1.12	3.14	1.06	3.80	1.16
Using the thumb control	2.54	1.12	3.74	1.42	2.85	1.05	4.09	1.36
Using the touch panel	2.77	1.09	3.83	1.15	——	——	——	——
Using the map functions to bring overlays into useful position on the display	3.03	1.20	4.09	0.95	——	——	——	——
Finding a target with CITV and knowing where to place it on your CCD	3.17	1.22	4.06	1.11	2.94	1.15	4.03	1.11
Finding a TRP in the CITV that you have posted to the map on the CCD	3.11	1.23	3.94	1.24	2.91	1.14	3.82	1.09

	CVCC		IVCC	
	mean	std. dev.	mean	std. dev.
Estimate time needed for CCTB training overall				
Crew Training	4.60	1.09	3.69	0.90
Unit Training	4.60	1.17	3.69	0.96

NOTE: Ratings made on 6-point scale where 6=twice as much again, 5=one-half as much again, 4=one-quarter as much again, 3=no change, 2=one-half as much and 1=one-quarter as much.

In summary, TCs generally viewed classroom training time on CITV and CCD functions as sufficient and slightly longer than necessary although there was considerable variability of opinion among TCs. As far as individual hands-on training, TCs generally indicated somewhat more time would be productive. In addition, it was generally reported that more training time, especially individual, would be useful for the more complex tasks relating to

tactical usage of the CITV and the CCD and the integrated usage of both components in a tactical situation.

Issue c: How Easy is it to Learn to Use the Prototype Equipment?

This issue was addressed by asking TCs to rate how easy or difficult it was to learn the functions necessary to operate the CITV and the CCD, as well as to use them in a tactical situation. The same functions were included in this questionnaire as described for the previous issue on training time. Again, since this questionnaire focused exclusively on the CITV and the CCD, it was only administered to TCs in the CVCC and IVCC configurations.

Table 22 summarizes TC ratings of the ease of learning for CITV functions. Functions are organized into those concerned with target acquisition and those related to target engagement.

TABLE 22. EASE OF LEARNING FOR CITV FUNCTIONS

	CVCC (n=35)		IVCC (n=35)	
	mean	std. dev.	mean	std. dev.
Target Acquisition				
Manual Search	1.34	0.64	1.23	0.43
Gun Line of Sight (GLOS)	1.63	0.88	1.37	0.55
Operational Mode (CITV/GPS switch)	2.00	0.91	1.80	0.93
Magnification (3X and 10X)	1.40	0.69	1.37	0.69
Autoscan	1.91	0.74	2.17	0.89
Sector Set	2.40	0.91	2.11	0.90
Scan Rate Set	1.66	0.76	1.51	0.70
Designate	1.34	0.64	1.40	0.60
Identification Friend or Foe (IFF)	1.54	0.66	——	——
Target Engagement				
Target Handoff	1.88	0.84	1.77	0.91
Kill Assessment	1.85	0.91	1.86	0.97
Target Stacking	2.83	1.04	——	——

NOTE: Ratings made on 5-point scale where 1=extremely easy to learn and 5=extremely difficult to learn.

On the average, CITV functions were regarded as relatively easy to learn with the averages for all functions falling well below the midpoint of the scale (3). Target stacking was rated as the least easy to learn of the CITV functions, although the average for this item fell below the neutral point of the scale toward the "easy to learn" direction.

The ease of learning ratings for CITV functions are somewhat at odds with TC performance on the CITV diagnostic (presented under issue a). While TCs rated these functions relatively easy

on the average, mean performance was lowest on the CITV diagnostic (80% correct) as compared to the SIMNET diagnostic (93% correct) and the CCD diagnostic (89% correct).

Table 23 presents comparable data for CCD functions. These functions are organized by map, navigation, report and communication functions. As with the CITV functions, TCs reported the CCD functions as relatively easy to learn with the averages for all items in both the CVCC and IVCC configurations falling well below the neutral midpoint of the scale. The range of these average ratings of CCD functions was relatively comparable to the range of average ratings on CITV functions (except for target stacking in the CITV) suggesting that they were perceived as similar in ease of learning.

TABLE 23. EASE OF LEARNING FOR CCD FUNCTIONS

	CVCC (n=35)		IVCC (n=35)	
	mean	std. dev.	mean	std. dev.
Map Functions				
MAP "SCALE"	1.89	0.93	1.77	0.81
MAP "POSTED ICONS"	1.94	0.91	2.00	0.94
MAP "OVERLAYS"	2.03	0.89	-----	-----
MAP "FEATURES" (Grid Lines, Objects, Roads, Rivers, Vegetation)	1.74	0.92	-----	-----
SCROLL "ENABLED"	2.14	0.97	1.94	0.91
SCROLL "LOCKED"	2.00	1.03	1.60	0.69
SCROLL "CENTERED"	1.71	0.93	1.51	0.56
SCROLL "OFF CENTERED"	2.20	0.96	-----	-----
SCROLL "MOVE"	2.37	0.88	-----	-----
Navigation Functions				
NAV "ROUTE DESIGNATION"	1.97	0.82	1.71	0.62
NAV "FILES"	2.14	0.91	1.86	0.65
NAV "SEND"	1.57	0.74	-----	-----
NAV "CLR FLD"	1.71	0.75	1.69	0.76
Report Functions				
CON (Contact)	2.17	0.95	1.74	0.70
CFF (Call For Fire)	2.23	0.97	1.94	0.73
REP (Reports) "CONTACT"	1.80	0.80	1.69	0.72
REP (Reports) "NBC"	1.97	0.92	2.06	0.91
REP (Reports) "CFF"	2.00	0.84	2.14	0.85
REP (Reports) "ADJUST"	2.06	0.97	2.00	0.87
REP (Reports) "SPOT"	2.00	0.97	2.00	0.87
REP (Reports) "SITREP"	1.89	0.93	1.77	0.60
REP (Reports) "SHELL"	1.83	0.92	1.74	0.78
REP (Reports) "INTEL"	2.17	1.04	1.86	0.97
Communication Functions				
RECEIVE (Receiving reports)	1.89	0.93	----	----
RECEIVE "SHOW"	1.69	0.72	----	----
RECEIVE "ACT"	1.77	0.81	----	----
SEND (Sending Reports)	1.66	0.68	----	----

NOTE: Ratings made on 5-point scale where 1=extremely easy to learn and 5=extremely difficult to learn.

Table 24 shows TC ratings of the ease of learning how to use the CITV and CCD in a tactical situation. These items include operating the equipment in a tactical environment and performing tasks that require using both the CITV and the CCD in an integrated fashion. On the average, these ratings also fell on the "easy to learn" side of the rating scale; however, they were generally viewed as less easy to learn than the individual CITV and CCD functions. One function, using the thumb control for CCD functions, received average ratings just above the neutral point toward the "difficult to learn" side of the rating scale.

TABLE 24. EASE OF LEARNING FOR TACTICAL USAGE

	CVCC (n=35)		IVCC (n=35)	
	mean	std. dev.	mean	std. dev.
Tactical Functions				
Tactical employment of CITV	2.14	0.77	1.80	0.80
Tactical employment of CCD	2.37	1.03	2.40	1.17
Using the thumb control (CCD)	3.26	1.44	3.03	1.12
Using the touch panel (CCD)	2.17	1.10	-----	-----
Using the map functions to bring overlays into useful position on the display (CCD)	2.17	0.89	-----	-----
Finding a target with CITV and knowing where to place it on your CCD	2.11	0.90	2.57	0.88
Finding a TRP in the CITV that you have posted to the map on the CCD	2.59	0.96	2.57	0.95

NOTE: Ratings made on 5-point scale where 1=extremely easy to learn and 5=extremely difficult to learn.

Finally, to further explore factors influencing ease of learning, the relationship between prior experience and ratings of ease was investigated. More specifically, a multivariate analysis (MANOVA) of variance was conducted. In this analysis, Time in Armor constituted the independent variable with three levels: 0-2 years, 2-8 years, and 8 years or more. The ease of learning ratings were combined to form three dependent variables for the purposes of this analysis: CITV functions (see Table 22), map and navigation CCD functions and report and communications CCD functions (see Table 23). Parallel tests were conducted for the CVCC and IVCC conditions using appropriate CITV and CCD functions.

The logic of the multivariate test is to first test for an overall effect which yields evidence of a relationship between the independent variable (in this case, Time in Armor) and the dependent variables (in this case, CITV functions, map/navigation CCD functions and report/communications CCD functions). For the CVCC configuration, the multivariate test for the overall effect was statistically significant (Pillais test value = .37, F = 2.34

(6, 62), $p < .05$). This result suggests that, for TCs in the CVCC configuration, time spent in armor influenced the three composite ratings of ease of learning when considered together.

To further extend the logic underlying the MANOVA, when a multivariate test is significant, univariate analysis of variance (ANOVA) tests are conducted to isolate the effect. These tests examine whether the independent variable is significantly related to each of the dependent variables considered individually. In this case, these univariate F tests examined the individual relationships between time in armor and each of the three ease of learning measures for TCs in the CVCC configuration. These tests were also statistically significant, as shown in Table 25. Thus, these results suggest that time spent in armor influenced each of the composite ease of learning ratings (i.e., CITV, map/navigation for CCD and report/communications for CCD) individually.

TABLE 25. UNIVARIATE ANOVAS FOR TIME IN ARMOR AND EASE OF LEARNING RATINGS

Univariate F-tests with (2,32) D. F.						
Variable	Hypoth.SS	Error SS	Hypoth.MS	Error MS	F	Sig. of F
Report	4.97518	16.02368	2.48759	0.50074	4.96783	0.013
MAP/NAV	3.94698	11.16924	1.97349	0.34904	5.65407	0.008
CITV	1.97609	5.26806	0.98805	0.16463	6.00173	0.006

In order to interpret the univariate ANOVAs, it is necessary to examine the means for each level of the independent variable. In this use, it was necessary to examine mean ratings for the three sets of ease of learning ratings (CITV, map/navigation, report/communications) broken down by Time in Armor: 0-2 years, 2-8 years and 8+ years. Table 26 presents the average ratings for the composite ratings of ease of learning CITV functions, map and navigation CCD functions and report and communications CCD functions. These ratings are broken out by time in armor using the three categories identified above. The results in the table indicate that TCs with more time in armor (8 years or more) tended to view all functions as less easy to learn than those with less experience.

TABLE 26. RELATIONSHIP BETWEEN TIME IN ARMOR AND COMPOSITE RATINGS OF EASE OF LEARNING (CVCC CONFIGURATION ONLY)

		CITV		MAP/NAV		Report/Commo	
Time in Armor	N	mean	std. dev.	mean	std. dev.	mean	std. dev.
0-2 years	11	1.77	0.33	1.76	0.46	1.86	0.78
2-8 years	15	1.62	0.42	1.76	0.51	1.57	0.64
8 + years	9	2.20	0.47	2.53	0.82	2.51	0.73
Total	35	1.82	0.46	1.96	0.67	1.91	0.79

While these results may appear counterintuitive to some readers, there is ample evidence in the research literature on negative transfer of learning. This term refers to the interfering effects that prior knowledge may exert when a new but related learning task is approached. Quinkert (in preparation) found similar results in an earlier CITV study.

As noted earlier, similar analyses were conducted for TCs in the IVCC condition; however, no statistically significant results were obtained. Parallel analyses on a second background variable, hours in SIMNET, were also conducted for TCs in the CVCC and IVCC conditions. None of these analyses yielded statistically significant results.

In summary, individual CITV and CCD functions were generally viewed by TCs as relatively easy to learn. Target stacking using the CITV was rated as the least easy to learn of the individual CITV and CCD functions. Tactical usage and tasks requiring integration of the CITV and the CCD were generally perceived as less easy to learn than the individual functions, with using the thumb control for CCD functions rated as the most difficult function to learn. There was also some indication that TCs with greater amounts of experience in armor may have found learning to use the CITV and CCD less easy than their less experienced counterparts. As noted earlier, this finding reflects negative transfer of prior knowledge and has been observed in earlier studies.

Issue d: What would be the Training Requirements (Type and Length of Training) to Prepare Tankers to Use the New Equipment if it were Fielded?

This issue was examined using three sources of data. First, TCs were asked to imagine that they were members of a New Equipment Training Team (NETT) with the mission to develop the transition training, the program of instruction (POI), and to teach these new tasks to tankers who were already trained on the M1. TCs were asked to make projections about the amount of time required for training on CITV and CCD skills. In a second questionnaire, TCs were asked to make a similar assumption about their role as a NETT member and to indicate the best type of training for CITV and CCD skills. Since both of these questionnaires focused on the CITV and CCD, they were administered only to TCs participating in the CVCC and IVCC configurations. Finally, three of the soldier-participants had actually served as Armor NETT members. These individuals were administered a structured interview to ascertain their views on new equipment training for CVCC.

Table 27 summarizes TC views about the amount of training required to teach CITV functions in a new equipment training environment. The table organizes CITV functions into three categories: target acquisition, target engagement and tactical

engagement. Results are presented for TCs in both the CVCC and the IVCC conditions.

As shown in Table 27, TCs, on the average, felt that most CITV functions could each be trained in less than one and a half hours per function. Tactical employment of the CITV was judged to require more time: about 2 1/2 hours on the average for the CVCC configuration and about 2 hours on the average for the somewhat less complex IVCC configuration.

TABLE 27. TIME TO TRAIN ON NEW EQUIPMENT: CITV FUNCTIONS.

	Training Hours Required			
	CVCC (n=35)		IVCC (n=35)	
	mean	std. dev.	mean	std. dev.
Target Acquisition				
Acquire targets with the CITV	1.10	0.81	0.76	0.85
Determine most dangerous threat with the CITV	0.97	1.08	0.65	0.77
Designate main gun to position of the CITV	0.51	0.40	0.51	0.68
Establish sectors of search or scan using SECTOR SET	0.84	0.65	0.70	1.00
Regulate the rate of the CITV scan	0.44	0.32	0.33	0.23
Determine identification of a target using IFF	0.52	0.34	----	----
Target Engagement				
Hand off targets to gunner	0.50	0.30	0.54	0.97
Stack targets using TARGET STACK	1.10	0.96	----	----
Prepare Range Card using CITV	1.31	1.03	1.36	1.41
Tactical Engagement				
Maintain platoon sectors of responsibility with the CITV	0.99	0.89	0.89	1.12
Maintain company sectors of responsibility with the CITV	1.29	1.48	1.15	1.66
Determine orientation of the CITV, main gun & hull using the CITV orientation icon	0.63	0.46	0.58	0.67
Use the CITV to input range into reports generated on the CCD	0.84	0.60	----	----
Tactical employment of the CITV	2.55	2.51	1.94	2.58

NOTE: Responses made in time from 15 minutes to 8 hours, in 15 minute increments. Responses converted to hours for analytic purposes.

Table 28 presents parallel data for CCD functions. The table organizes CCD functions into three major categories: map/navigation skills, report/communications skills, and tactical engagement skills.

TABLE 28. TIME TO TRAIN ON NEW EQUIPMENT: CCD FUNCTIONS

	Training Hours Required			
	CVCC (n=35)		IVCC (n=35)	
	mean	std. dev.	mean	std. dev.
MAP/Navigation Skills				
Determine your tank grid location	0.44	0.32	0.37	0.25
Determine your tank orientation	0.44	0.32	0.36	0.25
Maintain your tank orientation	0.58	0.53	0.72	0.37
Determine the grid location of other objects	0.71	0.52	0.72	0.80
Perform Map-Terrain association	1.41	1.50	——	——
Navigate from one waypoint to another using the NAV function	1.11	0.80	0.83	0.85
Report/Communication Skills				
Prepare battlefield reports	1.78	1.39	1.86	2.07
Send battlefield reports	1.29	1.17	——	——
Relay battlefield reports	0.99	1.35	——	——
Receive battlefield reports	1.01	1.37	——	——
Receive a FRAGO	0.76	0.57	——	——
Issue (relay) a FRAGO	0.77	0.75	——	——
Establish graphic control points (CPs, LDs, etc.)	1.21	0.93	——	——
Tactical Engagement Skills				
Maintain platoon formation	1.58	1.53	——	——
Maintain company formation	1.94	1.93	——	——
Reorient platoon after reacting to enemy fire (e.g., air or artillery strikes)	1.59	1.61	——	——
Reorient a company after reacting to enemy fire (e.g., air or artillery strikes)	1.85	1.89	——	——
Occupy and monitor battle positions	1.06	0.67	——	——
Adjust platoon fires	1.46	1.30	0.86	0.91
Adjust company fires	1.70	1.59	1.06	1.58
Consolidate a platoon	1.33	1.13	0.89	1.01
Consolidate a company	1.52	1.45	1.09	1.57
Move under direct/indirect fires	1.81	2.08	——	——
Conduct displacement at platoon level	1.44	1.26	1.09	1.26
Conduct displacement at company level	2.16	2.10	1.36	1.75
Control platoon fires	1.39	1.36	——	——
Control company fires	1.66	1.81	——	——
Control tactical movement of the platoon	2.14	2.00	1.42	1.90
Control tactical movement of the company	2.54	2.35	1.75	2.45
Tactical employment of the CCD at the platoon level	2.90	2.57	2.21	2.58
Tactical employment of the CCD at the company level	3.36	2.72	2.58	2.87

NOTE: Responses made in time from 15 minutes to 8 hours, in 15 minute increments. Responses converted to hours for analytic purposes.

In general, TCs saw map and navigation skills as requiring less than 1 1/2 hours per function to train. They perceived report and communications skills as taking somewhat longer but less than 2 hours on the average for each function. Finally, they judged tactical engagement skills as taking somewhat longer to train with average time estimates at 2 1/2 hours or less for most tactical engagement skills. However, tactical employment of the CCD at both the platoon and company levels, particularly with the CVCC configuration, was seen as requiring more training time with averages closer to 3 hours.

In interpreting the new equipment training requirements offered by TCs, it is useful to make comparisons with the amount of training time provided as part of this research project. Summing the average values over functions provides an estimate of overall training time viewed as necessary for each new equipment component. These sums can then be compared to the time allotted to the component as part of the training program described here.

Overall, TCs in the more complex CVCC condition recommended over 7 hours of new equipment training on CITV functions, over 6 hours of training on tactical equipment of the CITV, 12.5 hours of training on CCD functions and over 33 hours for tactical employment of the CCD. When compared to the amount of training presented as part of the CVCC training program, these recommendations amount to six times more time for CITV functions, three times more time for CCD functions and about four times as much time for tactical employment of the CITV and CCD.

Thus, TCs recommended considerably more training time when the new equipment is fielded. Some of the recommended increase is undoubtedly due to the need for well-practiced and automatic usage of operational equipment. Some of the increase may also be attributable to the need for other, more realistic types of training experiences. Recommendations on type of new equipment are considered below.

Table 29 summarizes TC judgments about type of new equipment training necessary for CITV functions. The table organizes CITV functions as target acquisition, target engagement and tactical engagement skills. For each skill, the frequency and percent of TCs indicating that training would be needed on simulators, real tanks or both is shown.

In general, simulator training was the preferred mode for CITV functions. However, real tank training or a combination of both simulator and real tank training was viewed as needed by over one-third of the TCs for more complex skills such as maintaining platoon and company sectors of responsibility with the CITV, target identification using IFF, preparing a range card using the CITV, and tactical employment of the CITV.

TABLE 29. TYPE OF TRAINING FOR NEW EQUIPMENT: CITV FUNCTIONS

	CVC2 (n=35)						IVC2 (n=34)					
	simulator		tank		both		simulator		tank		both	
Target Acquisition	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Acquire targets with the CITV	17	48	10	29	8	23	19	56	4	12	11	32
Determine most dangerous threat with the CITV	18	51	7	20	10	29	17	50	13	38	4	12
Designate main gun to position of the CITV	24	69	6	17	5	14	23	68	10	29	1	3
Establish sectors of search or scan using SECTOR SET	18	51	7	20	10	29	28	82	4	12	2	6
Regulate the rate of the CITV scan	26	74	6	17	3	9	27	79	6	18	1	3
Determine identification of a target using IFF	12	34	13	37	10	29	—	—	—	—	—	—
Target Engagement												
Hand off to gunner	24	69	7	20	4	11	25	73	7	21	2	6
Stack targets using TARGET STACK	18	56	6	19	8	25	—	—	—	—	—	—
Prepare Range Card using CITV	8	23	18	51	9	26	13	41	12	37	7	22
Tactical Engagement												
Maintain platoon sectors of responsibility with the CITV	14	40	8	23	13	37	14	41	14	41	6	18
Maintain company sectors of responsibility with the CITV	14	40	9	26	12	34	15	44	13	38	6	18
Determine orientation of the CITV, main gun & hull using the CITV orientation icon	17	49	11	31	7	20	21	62	8	23	5	15
Use the CITV to input range into reports generated to the CCD	25	72	4	11	6	17	—	—	—	—	—	—
Tactical employment of the CITV	11	31	14	40	10	29	6	18	18	53	10	29

NOTE: Responses made by checking one of three choices for each item: simulator, real tank or both.

Table 30 provides parallel data for CCD functions. The table is organized using the three categories of skills identified earlier: map/navigation skills, report/communications skills, and tactical engagement skills.

For map and navigation functions, the simulator was generally preferred for specific functions related to using the CCD. However, for functions involving map-terrain association or navigation from one point to another, real tank training was the preferred method. For report and communications functions, the simulator was clearly the preferred mode of training. For tactical engagement skills, the results were mixed between the simulator and real tank as preferred modes of training.

TABLE 30. TYPE OF TRAINING FOR NEW EQUIPMENT: CCD FUNCTIONS

	CVC2 (n=35)						IVC2 (n=35)					
	simulator		tank		both		simulator		tank		both	
MAP/Navigation Skills	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Determine your tank grid location	18	52	4	11	13	37	16	47	10	29	8	24
Determine your tank orientation	20	57	4	11	11	32	19	56	9	26	6	18
Maintain your tank orientation	19	54	8	23	8	23	18	53	9	26	7	21
Determine the grid location of other objects	14	40	8	23	13	37	16	47	6	18	12	35
Perform Map-Terrain association	4	11	22	63	9	26	—	—	—	—	—	—
Navigate from one waypoint to another	5	14	18	52	12	34	8	24	14	41	12	35
Report/Communication Skills												
Prepare battlefield reports	28	80	4	11	3	9	25	76	6	18	2	6
Send battlefield reports	29	83	4	11	2	6	—	—	—	—	—	—
Relay battlefield reports	29	82	3	9	3	9	—	—	—	—	—	—
Receive battlefield reports	29	82	3	9	3	9	—	—	—	—	—	—
Receive a FRAGO	26	74	3	9	6	17	—	—	—	—	—	—
Issue (relay) a FRAGO	27	77	3	9	5	14	—	—	—	—	—	—
Establish graphic control points (CPs, LDs, etc.)	21	60	5	14	9	26	24	70	17	21	3	9
Tactical Engagement Skills												
Maintain platoon formation	7	20	12	34	16	46	5	15	18	55	10	30
Maintain company formation	8	23	12	34	15	43	6	18	20	61	7	21
Reorient a platoon after reacting to enemy fire (e.g., air or artillery strikes)	12	34	12	34	11	32	11	33	14	43	8	24
Reorient a company after reacting to enemy fire (e.g., air or artillery strikes)	12	34	14	40	9	26	14	43	12	36	7	21
Occupy and monitor battle positions	8	23	13	37	14	40	—	—	—	—	—	—
Adjust platoon fires	20	57	7	20	8	23	16	52	9	29	6	19
Adjust company fires	20	57	7	20	8	23	17	55	8	26	6	19
Consolidate a platoon	10	29	12	34	13	37	12	37	11	33	10	30
Consolidate a company	12	34	12	34	11	32	13	41	10	31	9	28
Move under direct/indirect fires	16	47	11	32	7	21	19	58	7	21	7	21
Conduct displacement at platoon level	9	26	14	40	12	34	10	30	13	40	10	30
Conduct displacement at company level	11	31	13	38	11	31	8	24	15	46	10	30
Control platoon fires	16	46	9	26	10	28	—	—	—	—	—	—
Control company fires	17	49	10	28	8	23	—	—	—	—	—	—
Control tactical movement of the platoon	7	20	13	37	15	43	8	25	16	50	8	25
Control tactical movement of the company	7	21	15	44	12	35	9	28	14	44	9	28
Tactical employment at platoon level	10	29	14	42	10	29	7	21	14	43	12	36
Tactical employment at company level	9	27	15	44	10	29	10	31	12	38	10	31

NOTE: Responses made by checking one of three choices for each item: simulator, real tank or both.

As noted earlier, the third source of data on new equipment training came from a structured interview with three soldier-participants who had actually served as NETT members. The interview was aimed at eliciting more detailed information on time and preferred mode of new equipment training than was possible to obtain through the questionnaires.

In response to questions on the time required to teach CITV and CCD functions during new equipment training, the NETT members essentially verified the response scale used on the training time questionnaire. They agreed that there were no CITV or CCD functions that could be trained in LESS than 15 minutes. They also agreed that none of the functions would take MORE than eight hours to train. Thus, the response scale provided to participants on the questionnaire appeared adequate for judging training time required for CITV and CCD functions.

NETT members were also asked for their views on how a program of instruction should be organized to make most productive use of available modes of instruction. Table 31 summarizes their recommendations for training activities best accomplished through classroom training, hands-on simulator training and real tank training.

TABLE 31. NETT MEMBER RECOMMENDATIONS ON TRAINING MODES FOR NEW EQUIPMENT TRAINING

CLASSROOM	HANDS-ON SIMULATOR	REAL TANK
• Conduct equipment demonstration using oversize mockups of CITV and CCD	• Become familiar with CCD and CITV equipment	• Teach navigation skills
• Demonstrate CCD map scrolling functions using map placed on overhead projector	• Learn shortcuts in using equipment	• Practice tasks requiring real world cues (identifying real vehicle thermal signatures using CITV Autoscan for target acquisition
• Provide instruction on CCD map icons since Universal military icons not used	• Practice reading CCD map	• Evaluate tactical usage of CCD and CITV
• Produce handbooks or textbooks to reinforce classroom instruction	• Learn CCD report function including order in which fields in each report are highlighted and cues on incoming reports (beep signals)	• Ultimately, perform all functions in real setting
	• Practice designating targets to gunner using CITV	
	• Practice TC/gunner target stack hand-off using CITV	
	• Practice tactical applications of CCD and CITV	
	• Learn novel applications of CCD and CITV (such as using target stack as an electronic range card)	

Members of the NETT saw a productive role for all three modes of instruction. They recommended classroom instruction for initial explanations and demonstrations of the equipment. Handbooks or textbooks were also viewed as useful reference tools for supplementing classroom instruction. Hands-on simulator training was generally regarded as a cost effective strategy for becoming familiar with equipment operation and for practicing a full range of functions from individual equipment operation skills to more complex functions requiring cocrdination among crew members and usage of the equipment in a tactical situation. Finally, the NETT members regarded real tank training as also playing an important role in the program of instruction. This mode was preferred for navigation skills and for skills that require real world cues and inputs such as using the CITV autoscan for acquiring real world targets. Interviewees felt that ultimately all training tasks should be performed in a real world setting, particularly tactical training, before new equipment training could be regarded as complete.

In summary, training time for new equipment was estimated at less than 1 1/2 hours for each CITV function and for each CCD map and navigation function. CCD report and communications functions were seen as each requiring somewhat more time but not more than 2 hours for any given function. Tactical employment of equipment was viewed as requiring the most training time with 2 1/2 hours estimated for CITV tactical usage and closer to 3 hours for CCD tactical usage. Data from soldier-participants and NETT members suggested a legitimate role for classroom training, hands-on simulator training and real tank training in a new equipment program of instruction. Classroom training was recommended for initial explanations and demonstrations with follow-up practice in the simulators. However, ultimately some real tank training was regarded as necessary in order to provide an opportunity for soldiers to perform training tasks in a field environment.

Issue e: What are the Soldier-Participant Suggestions for Improving the CCTB Training Program?

This final training issue was examined using open-ended comments made by soldier-participants over the course of the evaluation. These comments were recorded on the training questionnaires and entered into a database of comments. A listing of comments was reviewed to identify suggestions that were made by multiple participants over multiple data collection weeks.

Table 32 identifies suggestions for improving the training program that were offered consistently during the CVCC company evaluation. They are organized into five major categories: classroom, hands-on simulator, diagnostic tests, tactical exercises and real tanks.

TABLE 32. SOLDIER-PARTICIPANT SUGGESTIONS FOR IMPROVING TRAINING PROGRAM

CLASSROOM

- Include handouts & diagrams with functional descriptions
- Demonstrate equipment using oversize mock-ups
- Provide manuals or textbooks for self-study
- Give Gunners and Drivers more instruction on equipment so they understand what TC is doing
- Provide more explanation on target stacking (CITV)
- Build in discussion opportunities for TCs to consider strategies for tactical application as a group

HANDS-ON SIMULATOR

- Schedule more time in simulators
- Reduce redundancy with classroom instruction
- Provide more opportunities for practice
- Allow TC unstructured time for practice
- Build in time for TCs to teach and practice with his crew with RA as resource
- Stress operating equipment properly and quickly (Tactical use requires speed)

DIAGNOSTIC TESTS

- Include more realistic problems
- Provide more explicit feedback on quality of performance
- Allow more time and opportunity for training

TACTICAL EXERCISES

- Include more crew and unit exercises
- Consider more instruction on tactical applications of equipment (perhaps supervised by qualified Armor instructor) and how to use tools effectively as a leader

REAL TANKS

- Eventually, need real tank training for realism

In a nutshell, participants viewed classroom instruction as useful for initial "explaining and demonstrating". Suggestions for strengthening the classroom portion of the training program included providing handouts with equipment diagrams and descriptions of functions and a manual or handbook that could be used for self-study and reference. Equipment mock-ups (large size) were also recommended to facilitate classroom demonstrations. In addition, classroom sessions for gunners and drivers were also suggested to increase their understanding of tasks

required of the TC. Finally, TCs also suggested a classroom session after hands-on simulator training in which they could discuss the equipment and how they might use it on the battlefield.

As far as hands-on training, desires for more simulator training time were common. Suggestions were made to reduce the redundancy of explanation in the hands-on sessions (since similar explanations were provided earlier as part of the classroom instruction) and to focus primarily on opportunities for practice. It was felt that practice should not only be structured but should also provide some unstructured time for TCs to practice on their own or work with their crews. RAs were viewed as a useful resource for unstructured (as well as structured) practice. The importance of learning to use the equipment quickly as well as properly was consistently noted.

Suggestions were also offered for improving the diagnostic tests administered after the completion of hands-on simulator training. Some TCs suggested that more realistic problems needed to be formulated for inclusion on the diagnostics and that RAs needed to be more explicit in their feedback on quality of performance. Many indicated that they were not sure how well they were performing during training and would have appreciated more explicit feedback. They also noted the need for more time built into the schedule for retraining or remedial practice as needed by individual TCs.

Tactical exercises were regarded as paramount in importance. Recommendations were made for more crew and unit exercises so that equipment usage in a range of tactical situations could be practiced. In addition, some expressed a desire for more instruction on tactical applications of CCD and CITV equipment (perhaps supervised by a qualified Armor instructor) as well as leadership training on how to use the tools effectively as a leader.

Finally, soldier-participants shared similar views as NETT members on the importance of eventually training with real tanks. While they recognized the value and cost effectiveness of simulator training, they also felt strongly that tasks needed to be performed in a real tank at some point to ensure realism and transfer of skills acquired in a simulation environment to the real world.

In summary, soldier-participants underscored the importance of the instructional modes included in the training program. However, they made suggestions for fine-tuning training and strengthening the overall program of instruction.

Summary and Recommendations

This section summarizes the results of the CVCC company evaluation related to the five training issues formulated for study. Based on these findings, recommendations are also offered for strengthening the existing CVCC training program and for structuring new equipment training. The chapter concludes with a discussion of more general training issues that became salient during the study which need to be considered by the training development community.

Summary of Key Findings

Results of the CVCC company evaluation were organized around five training issues. Key findings for each issue are recapped below.

Adequacy of Training Program

This issue examined the adequacy of the training materials and procedures used to prepare soldier-participants in the company evaluation to use the CVCC equipment. Results indicated that TCs were generally favorable about the training provided. They tended to evaluate the hands-on simulator training somewhat more positively than the classroom training, although their ratings of the instructor's presentation during classroom instruction were almost as favorable as those for simulator training. They also reported positive views about the tactical training exercises, particularly the company training exercise. Training was generally perceived as clear by the TCs and they reported the opportunity for hands-on practice as adequate.

In contrast, gunners and drivers viewed the training program somewhat more negatively. While some of their views may be attributable to insufficient activity they tended to perceive the classroom instruction as less than helpful and the tactical training exercises as less than adequate. In addition, they reported the need for somewhat more hands-on training.

Adequacy of the training program was also explored by examining the performance of soldiers after participation in the training program. Results on diagnostic tests showed that performance was generally adequate (at or above a 75% mastery level). However, there were a few poorer performers, particularly on the CITV diagnostic, who would have profited from more systematic remedial instruction than was able to be offered in the company evaluation due to time constraints.

Performance in a tactical scenario was also investigated as a measure of training outcomes. These results provided evidence of relatively frequent CITV and CCD usage. This finding suggests

that the training program provided soldiers with sufficient skills to operate the equipment in a tactical application.

Sufficiency of Training Time

This issue examined how sufficient participants felt the amount of time devoted to training the specific functions of the CVCC equipment was, as allocated in the training program. In general, TCs viewed classroom training time on CITV and CCD functions as sufficient and slightly longer than necessary. In contrast, they indicated that somewhat more time for individual hands-on training in the simulators would be productive. In addition, they generally reported that more training time, both classroom and individual, would be useful for the more complex tasks relating to tactical usage of the CITV and the CCD and the integrated usage of both components in a tactical situation.

Ease of Learning

This issue focused on how easy or difficult it was to learn to use the prototype equipment in the CVCC company evaluation. Generally speaking, TCs viewed the individual CITV and CCD functions as relatively easy to learn. They regarded target stacking using the CITV as the least easy to learn of the individual CITV and CCD functions. They perceived tactical usage of the equipment and tasks requiring integration of the CITV and the CCD as less easy to learn than the individual functions. Using the thumb control for making CCD inputs was reported as the most difficult function to learn. There was also some evidence that TCs with greater amounts of experience in armor found learning to use the CITV and the CCD more difficult than their less experienced counterparts.

Training Requirements for New Equipment

This issue was centered on the length and type of training that would be required to prepare tankers to use the new equipment if it were fielded. Estimates of required training time depended on the nature of the task to be trained. Training time for individual CITV functions and CCD map and navigation functions was estimated at 1 1/2 hours or less each. CCD report and communications functions were viewed as requiring somewhat more time but not more than 2 hours for any given function. The greatest amount of training time was seen as necessary for tactical employment of the CVCC equipment with estimates at 2 1/2 hours for CITV tactical usage and closer to 3 hours for CCD tactical usage.

Reports from soldier-participants, including three participants who had actually served as NETT members, suggested a legitimate role for classroom training, hands-on simulator training and real tank training in a new equipment program of instruction. Classroom training was recommended for initial explanations and demonstrations with follow-up practice in the simulators.

However, ultimately some real tank training was regarded as necessary to provide an opportunity for soldiers to perform training tasks in a field environment.

Suggestions for Training Program Improvement

This issue was aimed at eliciting the suggestions of soldier-participants about strategies, approaches and methods for strengthening the training program used in the CVCC company evaluation. A number of concrete recommendations were offered for improving the various segments of the training program. These suggestions largely focused on specific methods for improvement in five areas: classroom instruction, hands-on simulator training, diagnostic tests, tactical exercises and field training with real tanks.

Recommendations for CVCC Training

The results related to the training issues formulated for the CVCC company evaluation provide a foundation for a number of recommendations on CVCC training. These recommendations apply to the existing training program developed for use in the company evaluation and for new equipment training when the CVCC equipment is fielded. These recommendations are provided below.

Existing CVCC Training Program

Table 33 offers eight recommendations for improving the current training program used as part of the CVCC company evaluation. These recommendations were derived from data collected during the evaluation. Essentially, they represent fine-tuning the existing program rather than a major redesign or overhaul.

Implementation of these strategies should provide a stronger, more effective CVCC training program for future uses. These uses may include future evaluations of new versions of CVCC concept configurations and anticipated battalion level tests. While the company training program would need to be modified and expanded to accommodate a battalion test, the revised company training program would provide a solid basis on which to build.

New Equipment Training

When and if the CVCC is fielded, a training program for the new equipment will potentially be required. Table 34 outlines the requirements for this potential training derived from the CVCC company evaluation.

TABLE 33. RECOMMENDATIONS FOR EXISTING CVCC TRAINING PROGRAM

1. Maintain basic programmatic structure including classroom instruction, hands-on simulator training and tactical exercises.
2. Review training materials to reduce redundancy in classroom instruction and and simulator training. Focus classroom training on explanation and demonstration and simulator training on practice.
3. Develop supporting materials for classroom instruction including handouts with diagrams and functional descriptions, oversize equipment mock-ups for demonstrations and a manual or handbook for self-study and reference.
4. Consider lengthening the training schedule to allow more training time in simulators including some instructional training time for TCs to practice alone and to work with their crews (with instructor available as resource).
5. Examine strategies for tactical usage of equipment and integrating usage of the CITV and the CCD. Incorporate more explicit discussion into classroom sessions and more opportunities for practice into hands-on training and tactical training exercises.
6. Implement more explicit feedback strategy to give soldiers more specific information on the quality of their performance. Build in more time in the training schedule for remedial training.
7. Develop strategy for assisting more experienced TCs to incorporate using CVCC equipment within their more well-established repertoire of tactical behaviors.

The schedule for the new equipment training program will necessarily be longer than the three-day schedule for the CVCC company evaluation. Estimates of time blocks required for training specific functions were collected in the evaluation and are summarized in Table 34. These estimates should be taken into account in establishing the training schedule for the new equipment training program.

TABLE 34. REQUIREMENTS FOR CVCC NEW EQUIPMENT TRAINING

1. Schedule time for training specific CITV functions and specific CCD map and navigation functions in blocks of 1.5 hours or less.
2. Schedule time for training specific CCD report and communications functions in blocks of 2 hours or less.
3. Schedule time blocks for training CITV tactical usage functions of 2.5 hours and 3 hours for CCD tactical usage functions.
4. Incorporate NETT philosophy of "explain and demonstrate" in the classroom followed by hands-on practice.
5. Build in some field training with real tanks into the training program.

Like the CVCC company training program, the new equipment training program should include classroom training, hands-on training and tactical exercise training. The company training program, strengthened by the recommendations presented in Table 33, may serve as a useful starting point for building a more extensive new equipment training program. Finally, realism demands some field training; thus, training using real tanks must also be incorporated into the program.

In conclusion, over the course of conducting this evaluation, three more general issues became increasingly salient. While these issues do not derive directly from the data reported here, they emerged during the process of the research as important training considerations and were the focal point of considerable discussion among the research staff. These issues are particularly related to fielding of technology-based equipment and are offered for subsequent consideration by the training development community.

The first issue concerns the tactical uses of new equipment under R & D and/or coming down the acquisition pipeline. While systems such as the CITV and the CCD have grown from a concept about how they would contribute to a soldier's or a unit's combat capability, the full range of tactical uses is not generally explicit or necessarily known. Tests such as the CVCC company evaluation provide a forum for observing how soldiers make use of the equipment in tactical situations and for discovering novel applications of the systems. However, there is a natural tension between how much explicit instruction on tactical usage should be provided and how much should be left unspecified for the participants to make explicit as the "tactical experts" participating in the equipment evaluation. This issue warrants consideration by the training development community in planning training in conjunction with testing or fielding new equipment.

A second issue relevant to technology-based equipment revolves around differences in background which may influence the ease with which soldiers are able to learn to operate new equipment and to use it effectively. For example, with complex electronic equipment prior computer experience (computer literacy and general computer savvy) may facilitate a soldier's ability to learn the system competently and quickly. In some cases, greater military experience may actually interfere with this ability since the more experienced soldier has a well established repertoire of skills and ways of operating in tactical situations. Training developers need to consider how individual differences among trainees may influence their learning and design training programs accordingly.

A third issue centers on the naturally occurring tradeoff decisions that must be made in designing a training program. Time and resources are always constrained, and becoming more so, while training requirements are becoming more complex and technology-based. Satisfactory resolution of these trade-offs must draw on

cost-effective training strategies (such as networked simulators) and clear specification of acceptable levels of training outcomes. Effectiveness of training programs must be operationalized by acceptable standards of performance so that the impact of resourcing decisions can be assessed. Design of cost effective training strategies along with explicit and accepted standards for mastery are critical challenges facing training developers today.

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APPENDIX A
Training Questionnaire

A B Wk Sim Dty Pos: TC Sim Call #A_____3-30

Training Evaluation

We are interested in your views about the training you received on the CITV and CCD. Please indicate your opinions separately for the CITV and CCD using the five-point rating scale provided.

1	2	3	4	5
Poor	Fair	Average	Good	Excellent

1. How adequate were the components of the training program in preparing you to operate the CITV and the CCD?

		CITV	CCD
CLASSROOM TRAINING:			
1a.	Classroom Sessions - Overall	_____	_____
1b.	Instructor's Presentation	_____	_____
1c.	Viewgraphs	_____	_____
1d.	Handouts	_____	_____
1e.	Examples of Tactical Equipment Use	_____	_____
HANDS ON SIMULATOR TRAINING:			
1f.	Hands On - Overall	_____	_____
1g.	RA Explanations	_____	_____
1h.	Hands On Training	_____	_____
1i.	Diagnostic Test	_____	_____

Explain reasons for "Poor" ratings, if any:_____

_____

_____

_____

_____

_____

2. How adequate were the tactical training exercises in preparing you to use the CITV and the CCD in a tactical situation?

1 Poor	2 Fair	3 Average	4 Good	5 Excellent

		CITV	CCD
2a.	Crew "Sandbox" Drills	____	____
2b.	Platoon Training Exercise	____	____
2c.	Company Training Exercise	____	____

3. How adequate was the opportunity for hands on practice using the equipment? (Use the rating scale from question #2.)

CITV ____ CCD ____

4. Considering the training program as a whole, how clear were the following?

1 Very Unclear	2 Somewhat Unclear	3 Neutral	4 Somewhat Clear	5 Very Clear

		CITV	CCD
4a.	Training Objectives (What you were expected to learn)	____	____
4b.	Information on how to operate the equipment	____	____
4c.	Information on how to use the equipment tactically	____	____
4d.	Feedback on how well you were performing DURING TRAINING	____	____

Explain reasons for "Poor" or "Very Unclear" ratings, if any:

_____

_____

_____

_____

5. Were there any CITV and CCD functions that you didn't use during Company practice? YES_____ NO_____

IF YES, WHICH ONES AND WHY?

6. Were you well enough prepared to perform the tasks required to be successful in executing the Company practice scenario?

7. Did the classroom instructor provide enough information about the operational concepts underlying the new equipment?

8. Do you have any other comments that would help us understand the quality of training you received?

9. Do you have any suggestions on how to improve the training program?

Additional Comments:

C 3-15 Wk Sim Dty Pos: TC Sim Call #A____

Training Evaluation

We are interested in your views about the training you received this week. Please indicate your opinions using the five-point rating scale provided.

1	2	3	4	5
Poor	**Fair**	**Average**	**Good**	**Excellent**

1. How adequate were the components of the training program in preparing you to operate the Simulator?

CLASSROOM TRAINING:

_____ 1a. Classroom Sessions - Overall

_____ 1b. Instructor's Presentation

_____ 1c. Viewgraphs

HANDS ON SIMULATOR TRAINING:

_____ 1d. Hands On - Overall

_____ 1e. RA Explanations

_____ 1f. Hands On Training

_____ 1g. Diagnostic Test

Explain reasons for "Poor" ratings, if any:_____

_____

_____

_____

_____

_____

_____

_____

2. How adequate were the tactical training exercises in preparing you to perform in a tactical situation?

1	2	3	4	5
Poor	Fair	Average	Good	Excellent

_____ 2a. TC Nav Skill Drills

_____ b. Crew "Sandbox" Drills

_____ 2c. Platoon Training Exercise

_____ 2d. Company Training Exercise

_____ 3. How adequate was the opportunity for hands on practice? (Use the rating scale from question #2.)

4. Considering the training program as a whole, how clear were the following?

1	2	3	4	5
Very Unclear	Somewhat Unclear	Neutral	Somewhat Clear	Very Clear

_____ 4a Training Objectives (What you were expected to learn)?

_____ 4b. Information on how to operate the Simulator?

_____ 4c. Feedback on how well you were performing DURING TRAINING?

Explain reasons for "Poor" or "Very Unclear" ratings, if any:

_____

_____

_____

_____

_____

_____

_____

5. Were you well enough prepared to perform the tasks required to be successful in executing the Company practice scenario?

6. Do you have any other comments that would help us understand the quality of training you received?

7. Do you have any suggestions on how to improve the training program?

Additional Comments:

A Wk Sim Dty Pos: TC Sim Call # A_____ 2-5

Training Time Needed for SIMNET-D

We are interested in how much time is required for tank commanders to become fully proficient in using all functions of the CITV and CCD. Based on your experience with our training program, do you feel training time in a study like this should be increased or decreased? Please rate classroom and individual hands-on training separately. For each listed item, place the number from the scale below which best reflects your opinion, in the appropriate column. For example, if you feel that classroom training time for a particular function should be decreased by half (compared to the time spent in this evaluation), enter "2" in the CLASSROOM column next to that function.

Less Time					More Time
1	2	3	4	5	6
1/4 As Much	1/2 As Much	No Change	1/4 As Much Again	1/2 As Much Again	Twice As Much Again

CITV FUNCTIONS	CLASSROOM	INDIVIDUAL
1. Auto Scan	_____	_____
2. Manual Search	_____	_____
3. Gun Line of Sight (GLOS)	_____	_____
4. Operational Mode (CITV/GPS switch)	_____	_____
5. Magnification (3X and 10X)	_____	_____
6. Sector Set	_____	_____
7. Scan Rate Set	_____	_____
8. Designate	_____	_____
9. Target Handoff	_____	_____
10. Kill Assessment	_____	_____
11. Target Stacking	_____	_____
12. Identification Friend or Foe	_____	_____

A 2-5 Training Time Needed for SIMNET-D

Less Time				More Time	
1 1/4 As Much	2 1/2 As Much	3 No Change	4 1/4 As Much Again	5 1/2 As Much Again	6 Twice As Much Again

CCD FUNCTIONS		CLASSROOM	INDIVIDUAL
13.	**CON** (Contact)	_____	_____
14.	**CFF** (Call For Fire)	_____	_____
15.	**MAP** "SCALE"	_____	_____
16.	**MAP** "POSTED ICONS"	_____	_____
17.	**MAP** "OVERLAYS"	_____	_____
18.	**MAP** "FEATURES" (GRID LINES, OBJECTS, ROADS, RIVERS, VEGETATION)	_____	_____
19.	**SCROLL** "ENABLED"	_____	_____
20.	**SCROLL** "LOCKED"	_____	_____
21.	**SCROLL** "CENTERED"	_____	_____
22.	**SCROLL** "OFF-CENTERED"	_____	_____
23.	**SCROLL** "MOVE"	_____	_____
24.	**REP** (Reports) "CONTACT"	_____	_____
25.	**REP** (Reports) "NBC"	_____	_____
26.	**REP** (Reports) "Call For Fire (CFF)"	_____	_____
27.	**REP** (Reports) "ADJUST"	_____	_____
28.	**REP** (Reports) "SPOT"	_____	_____

A 2-5 Training Time Needed for SIMNET-D

Less Time				More Time	
1 1/4 As Much	2 1/2 As Much	3 No Change	4 1/4 As Much Again	5 1/2 As Much Again	6 Twice As Much Again

		CLASSROOM	INDIVIDUAL
29.	**REP** (Reports) "SITREP"	_____	_____
30.	**REP** (Reports) "SHELL"	_____	_____
31.	**REP** (Reports) "INTEL"	_____	_____
32.	**RECEIVE** "CANCEL"	_____	_____
33.	**RECEIVE** "DELETE"	_____	_____
34.	**RECEIVE** "SHOW"	_____	_____
35.	**SEND** (Sending Reports)	_____	_____
36.	**NAV** "ROUTE DESIGNATION"	_____	_____
37.	**NAV** "FILES" (MAKE ACTIVE and DELETE)	_____	_____
38.	**NAV** "SEND"	_____	_____
39.	**NAV** "CLR FLD"	_____	_____
40.	Tactical employment of CITV	_____	_____
41.	Tactical employment of CCD	_____	_____
42.	Using the thumb control	_____	_____
43.	Using the touch panel	_____	_____
44.	Using the map functions to bring overlays into useful position on the display	_____	_____
45.	Finding a target with CITV and knowing where to place it on your CCD (for example in CFF)	_____	_____

A 2-5 Training Time Needed for SIMNET-D

Less Time				More Time	
1 1/4 As Much	2 1/2 As Much	3 No Change	4 1/4 As Much Again	5 1/2 As Much Again	6 Twice As Much Again

46. Finding a TRP in the CITV that you have posted to the map on the CCD _____ _____

47. Using the same scale, please estimate the time needed for SIMNET-D training overall, at the crew and unit levels.

Crew Training _____

Unit Training _____

48. Please provide any additional comments you might have on training time needed for SIMNET-D:

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B Wk Sim Dty Pos: TC Sim Call # A_____ 2-8

Training Time Needed for SIMNET-D

We are interested in how much time is required for tank commanders to become fully proficient in using all functions of the CITV and CCD. Based on your experience with our training program, do you feel training time in a study like this should be increased or decreased? Please rate classroom and individual hands-on training separately. For each listed item, place the number from the scale below which best reflects your opinion, in the appropriate column. For example, if you feel that classroom training time for a particular function should be decreased by half (compared to the time spent in this evaluation), enter "2" in the CLASSROOM column next to that function.

Less Time					More Time
1	2	3	4	5	6
1/4 As Much	1/2 As Much	No Change	1/4 As Much Again	1/2 As Much Again	Twice As Much Again

CITV FUNCTIONS		CLASSROOM	INDIVIDUAL
1.	Auto Scan	_____	_____
2.	Manual Search	_____	_____
3.	Gun Line of Sight (GLOS)	_____	_____
4.	Operational Mode (CITV/GPS switch)	_____	_____
5.	Magnification (3X and 10X)	_____	_____
6.	Sector Set	_____	_____
7.	Scan Rate Set	_____	_____
8.	Designate	_____	_____
9.	Target Handoff	_____	_____
10.	Kill Assessment	_____	_____

B 2-8 Training Time Needed for SIMNET-D

Less Time				More Time	
1 1/4 As Much	2 1/2 As Much	3 No Change	4 1/4 As Much Again	5 1/2 As Much Again	6 Twice As Much Again

CCD FUNCTIONS		CLASSROOM	INDIVIDUAL
11.	**CON** (Contact)	_____	_____
12.	**CFF** (Call For Fire)	_____	_____
13.	**MAP** "SCALE"	_____	_____
14.	**MAP** "POSTED ICONS"	_____	_____
15.	**SCROLL** "ENABLED"	_____	_____
16.	**SCROLL** "CENTERED"	_____	_____
17.	**REP** (Reports) "CONTACT"	_____	_____
18.	**REP** (Reports) "NBC"	_____	_____
19.	**REP** (Reports) "Call For Fire (CFF)"	_____	_____
20.	**REP** (Reports) "ADJUST"	_____	_____
21.	**REP** (Reports) "SPOT"	_____	_____
22.	**REP** (Reports) "SITREP"	_____	_____
23.	**REP** (Reports) "SHELL"	_____	_____
24.	**REP** (Reports) "INTEL"	_____	_____
25.	**NAV** "ROUTE DESIGNATION"	_____	_____
26.	**NAV** "FILES" (MAKE ACTIVE and ROUTE DELETE)	_____	_____
27.	**NAV** "CLR FLD"	_____	_____
28.	Tactical employment of CITV	_____	_____

B -Training Time Needed for SIMNET-D 2-8

Less Time					More Time
1	2	3	4	5	6
1/4 As Much	1/2 As Much	No Change	1/4 As Much Again	1/2 As Much Again	Twice As Much Again

		CLASSROOM	INDIVIDUAL
29.	Tactical employment of CCD	_____	_____
30.	Using the thumb control	_____	_____
31.	Finding a target with CITV and knowing where to place it on your CCD (for example in CFF)	_____	_____
32.	Finding a TRP in the CITV that you have posted to the map on the CCD	_____	_____

33. Using the same scale, please estimate the time needed for SIMNET-D training overall, at the crew and unit levels.

Crew Training _____

Unit Training _____

Please provide any additional comments you might have on training time needed for SIMNET-D.

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A Wk Sim Dty Pos: TC Sim Call # A_____ 2-5

Ease of Learning

Now that you have been trained to use both the CITV and the CCD, we would like you to help us understand how easy or difficult it is to learn to use these new pieces of equipment. Your views will assist training developers in planning the training that might eventually be provided to units who are transitioned to similar equipment in the future. Please review the functions listed below and indicate how easy it was to learn each of them. Use the 5 point scale provided to rate each of the functions.

1	2	3	4	5
Extremely Easy to Learn	Quite Easy to Learn	Neutral	Quite Difficult to Learn	Extremely Difficult to Learn

CITV Functions:

_____ 1. Auto Scan

_____ 2. Manual Search

_____ 3. Gun Line of Sight (GLOS)

_____ 4. Operational Mode (GPS versus CITV)

_____ 5. Magnification (3X and 10X)

_____ 6. Sector Set

_____ 7. Scan Rate Set

_____ 8. Designate

_____ 9. Target Handoff

_____ 10. Kill Assessment

_____ 11. Target Stacking

_____ 12. Identification Friend or Foe (IFF)

A 2-5 Ease of Learning

1	2	3	4	5
Extremely Easy to Learn	Quite Easy to Learn	Neutral	Quite Difficult to Learn	Extremely Difficult to Learn

CCD Functions:

_____ 13. **CON** (Contact)

_____ 14. **CFF** (Call For Fire)

_____ 15. **MAP** "SCALE"

_____ 16. **MAP** "POSTED ICONS"

_____ 17. **MAP** "OVERLAYS"

_____ 18. **MAP** "FEATURES" (Grid Lines, Objects, Roads, Rivers, Vegetation)

_____ 19. **SCROLL** "ENABLED"

_____ 20. **SCROLL** "LOCKED"

_____ 21. **SCROLL** "CENTERED"

_____ 22. **SCROLL** "OFF-CENTERED"

_____ 23. **SCROLL** "MOVE"

_____ 24. **REP** (Reports) "CONTACT

_____ 25. **REP** (Reports) "NBC"

_____ 26. **REP** (Reports) "Call For Fire (CFF)"

_____ 27. **REP** (Reports) "ADJUST"

_____ 28. **REP** (Reports) "SPOT"

_____ 29. **REP** (Reports) "SITREP"

_____ 30. **REP** (Reports) "SHELL"

_____ 31. **REP** (Reports) "INTEL"

_____ 32. **RECEIVE** (Receiving Reports)

A 2-5 Ease of Learning

1 Extremely Easy to Learn	2 Quite Easy to Learn	3 Neutral	4 Quite Difficult to Learn	5 Extremely Difficult to Learn

_____ 33. **RECEIVE** "SHOW"

_____ 34. **RECEIVE** "ACT"

_____ 35. **SEND** (Sending Reports)

_____ 36. **NAV** "ROUTE DESIGNATION"

_____ 37. **NAV** "FILES" (MAKE ACTIVE and DELETE)

_____ 38. **NAV** "CLR FLD"

_____ 39. **NAV** "SEND"

_____ 40. Tactical employment of CITV

_____ 41. Tactical employment of CCD

_____ 42. Using the thumb control

_____ 43. Using the touch panel

_____ 44. Using the map functions to bring overlays into useful position on the display

_____ 45. Finding a target with CITV and knowing where to place it on your CCD (for example, CFF).

_____ 46. Finding a TRP in the CITV that you have posted to the map on the CCD

47 Please provide any additional comments you might have on ease of learning.

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B Wk Sim Dty Pos TC Sim Call # A_____ 2-8

Ease of Learning

Now that you have been trained to use both the CITV and the CCD, we would like you to help us understand how easy or difficult it is to learn to use these new pieces of equipment. Your views will assist training developers in planning the training that might eventually be provided to units who are transitioned to similar equipment in the future. Please review the functions listed below and indicate how easy it was to learn each of them. Use the 5 point scale provided to rate each of the functions.

1	2	3	4	5
Extremely Easy to Learn	Quite Easy to Learn	Neutral	Quite Difficult to Learn	Extremely Difficult to Learn

CITV Functions:

_____ 1. Auto Scan

_____ 2. Manual Search

_____ 3. Gun Line of Sight (GLOS)

_____ 4. Operational Mode (GPS versus CITV)

_____ 5. Magnification (3X and 10X)

_____ 6. Sector Set

_____ 7. Scan Rate Set

_____ 8. Designate

_____ 9. Target Handoff

_____ 10 Kill Assessment

B 2-8 Ease of Learning

1	2	3	4	5
Extremely Easy to Learn	Quite Easy to Learn	Neutral	Quite Difficult to Learn	Extremely Difficult to Learn

CCD Functions:

_____ 11. CON (Contact)

_____ 12. CFF (Call For Fire)

_____ 13. MAP "SCALE"

_____ 14. MAP "POSTED ICONS"

_____ 15. SCROLL "ENABLED"

_____ 16. SCROLL "LOCKED"

_____ 17. SCROLL "CENTERED"

_____ 18. REP (Reports) "CONTACT"

_____ 19. REP (Reports) "NBC"

_____ 20. REP (Reports) "Call For Fire (CFF)"

_____ 21. REP (Reports) "ADJUST"

_____ 22. REP (Reports) "SPOT"

_____ 23. REP (Reports) "SITREP"

_____ 24. REP (Reports) "SHELL"

_____ 25. REP (Reports) "INTEL"

_____ 26. NAV "ROUTE DESIGNATION"

_____ 27. NAV "FILES" (MAKE ACTIVE and DELETE)

_____ 28. NAV "CLR FLD"

_____ 29. Tactical employment of CITV

_____ 30. Tactical employment of CCDB 2-8

Ease of Learning

1	2	3	4	5
Extremely Easy to Learn	Quite Easy to Learn	Neutral	Quite Difficult to Learn	Extremely Difficult to Learn

_____ 31. Using the thumb control

_____ 32. Finding a target with CITV and knowing where to place it on your CCD (for example, CFF)

_____ 33. Finding a TRP in the CITV that you have posted to the map on the CCD

Please provide any additional comments you might have on ease of learning.

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A Wk Sim Dty Pos: TC Sim Call # A_____ 2-5

Time to Train on New Equipment

Now that you have been trained on the CITV and CCD we'd like you to take it one step further. Suppose that you are asked to become a member of a New Equipment Training Team (NETT) and this team has the mission to develop the transition training, the program of instruction (POI), and to teach these new tasks to tankers already trained on the M1. How much time do you think would be needed to train the necessary skills to operate the tank in the field? For each task listed below, indicate your opinion by writing in the time required.

Please only write in times from **15 minutes to 8 hours, in 15 minute increments**. For example, if you think it would take two and a quarter hours to train a particular task, write "2 1/4" in the space for that task.

USING THE CITV

HOURS

_____ 1. Acquire targets with the CITV.

_____ 2. Determine most dangerous threat with the CITV.

_____ 3. Designate main gun to position of the CITV.

_____ 4. Hand off target to gunner.

_____ 5. Establish sectors of search or scan using **SECTOR SET**.

_____ 6. Regulate the rate of the CITV scan.

_____ 7. Maintain **platoon** sectors of responsibility with the CITV.

_____ 8. Maintain **company** sectors of responsibility with the CITV.

_____ 9. Determine identification of a target using **IFF**.

_____ 10. Stack targets using **Target Stack**.

_____ 11. Prepare Range Card using the CITV.

A 2-5 Time to Train on New Equipment

HOURS: 15 minutes to 8 hours in 15 minute increments

_____ 12. Determine orientation of the CITV, main gun and hull using the CITV orientation.

_____ 13. Use the CITV to input range into reports generated on the CCD.

_____ 14. Tactical employment of the CITV.

USING THE CCD

_____ 15. Determine your tank grid location using the CCD.

_____ 16. Determine your tank orientation using the CCD icon.

_____ 17. Maintain your tank orientation using the CCD icon.

_____ 18. Determine the grid location of other objects using the CCD.

_____ 19. Perform Map-Terrain association using the CCD.

_____ 20. Navigate from one way point to another using the **NAV** function of the CCD.

_____ 21. Maintain **platoon** formation using the CCD.

_____ 22. Maintain **company** formation using the CCD.

_____ 23. Reorient a **platoon** after reacting to enemy fire (e.g., air or artillery strikes) using the CCD.

_____ 24. Reorient a **company** after reacting to enemy fire (e.g., air or artillery strikes) using the CCD.

_____ 25. Prepare battlefield reports using the CCD.

_____ 26. Send battlefield reports using the CCD.

_____ 27. Relay battlefield reports with the CCD.

_____ 28. Receive battlefield reports with the CCD.

_____ 29. Receive a FRAGO on the CCD.

2-5 Time to Train on New Equipment

HOURS: 15 minutes to 8 hours in 15 minute increments

_____ 30. Issue (relay) a FRAGO with the CCD.

_____ 31. Establish graphic control points (CPs, LDs, etc.) using the CCD.

_____ 32. Occupy and monitor battle positions with the CCD.

_____ 33. Adjust **platoon** fires using the CCD.

_____ 34. Adjust **company** fires using the CCD.

_____ 35. Consolidate a **platoon** using the CCD.

_____ 36. Consolidate a **company** using the CCD.

_____ 37. Move under direct/indirect fires.

_____ 38. Conduct displacement at **platoon** level.

_____ 39. Conduct displacement at **company** level.

_____ 40. Control **platoon** fires using the CCD.

_____ 41. Control **company** fires using the CCD.

_____ 42. Control tactical movement of the **platoon** using the CCD.

_____ 43. Control tactical movement of the **company** using the CCD.

_____ 44. Tactical employment of the CCD at the **platoon** level.

_____ 45. Tactical employment of the CCD at the **company** level.

46. Please provide any additional comments you might have on training time for new equipment.

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B Wk Sim Dty Pos: TC Sim Call # A_____ 2-7

Time to Train on New Equipment

Now that you have been trained on the CITV and CCD we'd like you to take it one step further. Suppose that you are asked to become a member of a New Equipment Training Team (NETT) and this team has the mission to develop the transition training, the program of instruction (POI), and to teach these new tasks to tankers already trained on the M1. How much time do you think would be needed to train the necessary skills to operate the tank in the field? For each task listed below, indicate your opinion by writing in the time required.

Please only write in times from **15 minutes to 8 hours, in 15 minute increments**. For example, if you think it would take two and a quarter hours to train a particular task, write "2 1/4" in the space for that task.

USING THE CITV

HOURS: 15 minutes to 8 hours in 15 minute increments

_____ 1. Acquire targets with the CITV.

_____ 2. Determine most dangerous threat with the CITV.

_____ 3. Designate main gun to position of the CITV.

_____ 4. Hand off target to gunner.

_____ 5. Establish sectors of search or scan using **SECTOR SET**.

_____ 6. Regulate the rate of the CITV scan.

_____ 7. Maintain **platoon** sectors of responsibility with the CITV.

_____ 8. Maintain **company** sectors of responsibility with the CITV.

_____ 9. Prepare Range Card using the CITV.

_____ 10. Determine orientation of the CITV, main gun, and hull using the CITV orientation icon.

_____ 11. Tactical employment of the CITV.

USING THE CCD

HOURS: 15 minutes to 8 hours in 15 minute increments

_____ 12. Determine your tank grid location using the CCD.

_____ 13. Determine your tank orientation using the CCD icon.

_____ 14. Maintain your tank orientation using the CCD icon.

_____ 15. Determine the grid location of other objects using the CCD.

_____ 16. Navigate from one way point to another using the **NAV** function of the CCD.

_____ 17. Prepare battlefield reports using the CCD.

_____ 18. Adjust **platoon** fires using the CCD.

_____ 19. Adjust **company** fires using the CCD.

_____ 20. Consolidate a **platoon** using the CCD.

_____ 21. Consolidate a **company** using the CCD.

_____ 22. Conduct displacement at **platoon** level.

_____ 23. Conduct displacement at **company** level.

_____ 24. Control tactical movement of the **platoon** using the CCD.

_____ 25. Control tactical movement of the **company** using the CCD.

_____ 26. Tactical employment of the CCD at the **platoon** level.

_____ 27. Tactical employment of the CCD at the **company** level.

B 2-7 Time to Train on New Equipment

28. Please provide any additional comments you might have on training time for new equipment.

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A Wk Sim Dty Pos: TC Sim Call# A_____ 2-5

Type of Training for New Equipment

Now that you have been trained on the CITV and CCD we'd like you to take it one step further. Assume that the CITV and CCD are being fielded and you are a member of the New Equipment Training Team (NETT). This team has the mission to develop the transition training, the program of instruction (POI), and to teach these new tasks to tankers already trained on the M1. Do you think simulators provide adequate training in such a situation?

For each task listed below, place a checkmark under **SIMULATOR** if you think that task can be adequately trained in simulators like SIMNET and UCOFT. If you think the tasks could better be trained on a real tank, place a checkmark under **REAL TANK**. Check both columns if you think a combination is necessary.

		SIMULATOR	REAL TANK
USING THE CITV			
1.	Acquire targets with the CITV.	_____	_____
2.	Determine most dangerous threat with the CITV.	_____	_____
3.	Designate main gun to position of the CITV.	_____	_____
4.	Hand off target to gunner.	_____	_____
5.	Establish sectors of search or scan using **SECTOR SET**.	_____	_____
6.	Regulate the rate of the CITV scan.	_____	_____
7.	Maintain **platoon** sectors of responsibility with the CITV.	_____	_____
8.	Maintain **company** sectors of responsibility with the CITV.	_____	_____
9.	Determine identification of a target using **IFF**.	_____	_____

A 2-5 Type of Training for New Equipment

		SIMULATOR	REAL TANK
10.	Stack targets using **Target Stack.**	_____	_____
11.	Prepare Range Card using the CITV.	_____	_____
12.	Determine orientation of the CITV, main gun and hull using the CITV orientation icon.	_____	_____
13.	Use the CITV to input range into reports generated on the CITV.	_____	_____
14.	Tactical employment of the CITV.	_____	_____
USING THE CCD			
15.	Determine your tank grid location using the CCD.	_____	_____
16.	Determine your tank orientation using the CCD icon.	_____	_____
17.	Maintain your tank orientation using the CCD icon.	_____	_____
18.	Determine the grid location of other objects using the CCD.	_____	_____
19.	Perform Map-Terrain association using the CCD.	_____	_____
20.	Navigate from one point to another using the NAV function of the CCD.	_____	_____

A 2-5 Type of Training for New Equipment

		SIMULATOR	REAL TANK
21.	Maintain platoon formation using the CCD.	_____	_____
22.	Maintain company formation using the CCD.	_____	_____
23.	Reorient a platoon after reacting to enemy fire (e.g., air or artillery strikes) using the CCD.	_____	_____
24.	Reorient a company after reacting to enemy fire (e.g., air or artillery strikes) using the CCD.	_____	_____
25.	Prepare battlefield reports using the CCD.	_____	_____
26.	Send battlefield reports using the CCD.	_____	_____
27.	Relay a battlefield report with the CCD.	_____	_____
28.	Receive a battlefield report with the CCD.	_____	_____
29.	Receive a FRAGO on the CCD.	_____	_____
30.	Issue (relay) a FRAGO with the CCD.	_____	_____
31.	Establish and report graphic control points (CPs, LDs, etc.) using the CCD.	_____	_____
32.	Occupy and monitor battle positions with the CCD.	_____	_____

A 2-5 Type of Training for New Equipment

		SIMULATOR	REAL TANK
33.	Adjust platoon fires using the CCD.	_____	_____
34.	Adjust company fires using the CCD.	_____	_____
35.	Consolidate a platoon using the CCD.	_____	_____
36.	Consolidate a company using the CCD.	_____	_____
37.	Move under direct/ indirect fires.	_____	_____
38.	Conduct displacement at platoon level.	_____	_____
39.	Conduct displacement at company level.	_____	_____
40.	Control platoon fires.	_____	_____
41.	Control company fires.	_____	_____
42.	Control tactical movement of a platoon using the CCD.	_____	_____
43.	Control tactical movement of a company using the CCD.	_____	_____
44.	Tactical employment of the CCD at platoon level.	_____	_____
45.	Tactical employment of the CCD at company level.	_____	_____

A 2-5 Type of Training for New Equipment

46. For those tasks which you have checked **REAL TANK**, please write the number of the task as it appears on the questionnaire and briefly tell us why you made that choice, in the space provided below.

47. Please provide any additional comments you might have on type of training for new equipment.

B Wk Sim Dty Pos: TC Sim Call# A_____ 2-5

Type of Training for New Equipment

Now that you have been trained on the CITV and CCD we'd like you to take it one step further. Assume that the CITV and CCD are being fielded and you are a member of the New Equipment Training Team (NETT). This team has the mission to develop the transition training, the program of instruction (POI), and to teach these new tasks to tankers already trained on the M1. Do you think simulators provide adequate training in such a situation?

For each task listed below, place a checkmark under **SIMULATOR** if you think that task can be adequately trained in simulators like SIMNET and UCOFT. If you think the tasks could better be trained on a real tank, place a checkmark under **REAL TANK**. Check both columns if you think a combination is necessary.

		SIMULATOR	REAL TANK
USING THE CITV:			
1.	Acquire targets with the CITV.	_____	_____
2.	Determine most dangerous threat with the CITV.	_____	_____
3.	Designate main gun to position of the CITV.	_____	_____
4.	Hand off target to gunner.	_____	_____
5.	Establish sectors of search or scan using **SECTOR SET**.	_____	_____
6.	Regulate the rate of the CITV scan.	_____	_____
7.	Maintain **platoon** sectors of responsibility with the CITV.	_____	_____
8.	Maintain **company** sectors of responsibility with the CITV.	_____	_____

B 2-5 Type of Training for New Equipment

		SIMULATOR	REAL TANK
9.	Prepare Range Card using the CITV.	_____	_____
10.	Determine orientation of the CITV, main gun and hull using the CITV orientation icon.	_____	_____
11.	Tactical employment of the CITV.	_____	_____
USING THE CCD			
12.	Determine your tank grid location using the CCD.	_____	_____
13.	Determine your tank orientation using the CCD icon.	_____	_____
14.	Maintain your tank orientation using the CCD icon.	_____	_____
15.	Determine the grid location of other objects using the CCD.	_____	_____
16.	Navigate from one point to another using the NAV function of the CCD.	_____	_____
17.	Maintain platoon formation using the CCD.	_____	_____
18.	Maintain company formation using the CCD.	_____	_____
19.	Reorient a platoon after reacting to enemy fire (e.g., air or artillery strikes) using the CCD.	_____	_____

B 2-5 Type of Training for New Equipment

		SIMULATOR	REAL TANK
20.	Reorient a company after reacting to enemy fire (e.g., air or artillery strikes) using the CCD.	_____	_____
21.	Prepare battlefield reports using the CCD.	_____	_____
22.	Establish and report graphic control points (CPs, LDs, etc.)	_____	_____
23.	Adjust platoon fires using the CCD.	_____	_____
24.	Adjust company fires using the CCD.	_____	_____
25.	Consolidate a platoon using the CCD.	_____	_____
26.	Consolidate a company using the CCD.	_____	_____
27.	Move under direct/ indirect fires.	_____	_____
28.	Conduct displacement at platoon level.	_____	_____
29.	Conduct displacement at company level.	_____	_____
30.	Control tactical movement of a platoon using the CCD.	_____	_____
31.	Control tactical movement of a company using the CCD.	_____	_____
32.	Tactical employment of the CCD at platoon level.	_____	_____

B 2-5 Type of Training for New Equipment

	SIMULATOR	REAL TANK
33. Tactical employment of the CCD at company level.	_____	_____

34. For those tasks which you have checked **REAL TANK**, please write the number of the task as it appears on the questionnaire and briefly tell us why you made that choice, on the space provided below.

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35. Please provide any additional comments you might have on type of training for new equipment.

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APPENDIX B
Diagnostic Tests

CVC2 EVALUATION

Diagnostic Packet

At this time, we would like to take a look at how well our training assisted you in learning how to use SIMNET, the CITV, and the CCD. Right now, you will work through two diagnostics, one concerning SIMNET (in general) and the other concerning CITV. Later, we will work through a third diagnostic on the CCD after you've had the opportunity to practice on it.

The purpose of the diagnostics is to evaluate the quality of the training you've received up to this point. This is not an evaluation of you or a test of your ability to operate the equipment. We hope to use these diagnostics to improve our training for future research.

The diagnostic consists of a set of questions or problems asking you to use the equipment. First, I'll read the question or problem to you. Then, you'll have an opportunity to explain and show how you would use the equipment. Since we have limited time to go through the entire diagnostic, I may have to ask you to go on to the next question. Then we'll come back to any questions you didn't finish at the end.

Do you have any questions? Okay, if you're ready, then we'll begin.

(Note to RAs: If the soldier answers the item correctly, be sure to let him know he is correct (e.g. "That's right, let's go on to the next question".) If he exceeds the time limit, let him know you need to go to the next question, (e.g. "Let's stop and go on to the next question, we'll come back to it at the end").

The time limit is intended to promote a reasonable pace for the soldier and insure the diagnostic is finished within the allotted time. Try to stick to the time limits but in a low key way so the soldier doesn't feel rushed or anxious. The diagnostic is not intended to be a test of how fast they can perform BUT rather is intended to insure they can operate the equipment within a reasonable time frame.)

RA Name: _____

A WK: _____ SIM DUTY POS: _____ SIM CALL # _____

SIMNET DIAGNOSTIC

Notes to the RA:
- All answers are in bold print.
- Time limit for SIMNET questions is 1 minute 30 seconds.
- Make sure CITV tank icon is headed north.
- Make sure three enemy targets have been set in terrain for CITV training.
- Provide your TC with a protractor, scrap paper and pencil.
- Do not assist the TC with his answer.

GO	NO GO		
____	____	1.	What would the tank's heading in mils be if it were headed in a southwestern direction? (Note: may use a protractor.) **(answer can range anywhere between 3200 and 4800 mils.)**
____	____	2.	What direction is the tank headed if it has an azimuth of 2400 mils? **(in a south east direction.)**
____	____	3.	Orient the gun tube due East using the Grid Azimuth Indicator. - Check to see if CITV is in GPS mode (change if not). - Engage palm switch. - Press Grid Azimuth Indicator button. - Observe the azimuth change through the GPSE. - Slew gun tube to approx. 1600 mils by monitoring Grid Azimuth Indicator. - (RA) Check his azimuth reading when he is finished.
____	____	4.	Using the TURRET REFERENCE DISPLAY, put the gun tube over the back deck. - Check to make sure in GPS mode. - Engage palm switch. - Traverse gun tube while observing Turret Reference Display change. - Stop when gun tube is over back of tank.

B WK:____ Sim Duty Pos: _____ Sim Call #_____

CITV DIAGNOSTIC

(Note: Time limit for CITV questions is 1 minute 30 seconds).

GO NO GO

MANUAL SEARCH

____ ____ 1. Conduct a manual search, using CITV tank icon, of the left quadrant (8 o'clock to 11 o'clock).

- Press MANUAL SEARCH button.
- Engage palm switch.
- Traverse control handle.
- Monitor icon on CITV screen to ensure scanning from 8 to 11 o'clock.

AUTO SCAN & SECTOR SET

____ ____ 2. Set left and right boundaries (in that order) over right side of tank using the CITV icon.

- Press AUTO SCAN button.
- Slew CITV over to upper right corner of tank keeping palm switch engaged.
- Press Sector Set.
- Press LEFT arrow.
- Slew CITV over back right corner of tank keeping palm switch engaged.
- Press Sector Set.
- Press RIGHT arrow.

____ ____ 3. Again, set new left and right boundaries (in that order) using azimuths of 2800 and 3800 mils.

- Press GPS mode.
- Slew gun tube, while watching the Grid Azimuth Indicator change, to 2800 mils.
- Press CITV mode. CITV goes to GLOS.

** Be sure to allow CITV to line up with GLOS **

- Engage palm switch.
- Press AUTO SCAN.
- Press sector set.
- Press LEFT arrow.
- Press GPS mode.
- Slew gun tube, while watching the Grid Azimuth

Indicator change, to 3800 mils.
- Press CITV mode. CITV goes to GLOS.

GO NO GO

** Be sure to allow CITV to line up with GLOS **

- Engage palm switch.
- Press AUTO SCAN.
- Press sector set.
- Press RIGHT arrow.

* BOTH BOUNDARIES SHOULD NOW BE SET *

____ ____ 4. Using the previously set boundaries, slow down your rate of scan, ensuring you are in 3X and White Hot.

- Push Auto Scan.
- Push Rate.
- Push Down arrow.
- Make sure in 3X (large reticle).
- Make sure in White Hot.

____ ____ 5. Use your normal TC override.

- (RA) press CITV mode if not already there.
- To use normal TC override, TC should:
  1. Change Operational Mode to GPS.
  2. Depress palm switch and slew turret.

____ ____ 6. What CITV function can you use to view what you <u>can already see</u> out of the GPSE?

(the CITV GLOS).

____ ____ 7. Explain the three main features of the CITV TANK ICON.

- Bold line on tank represents the front of it.
- Bold line extending from center of tank is the gun tube.
- Dotted line extending from center of tank is the CITV line of sight.

____ ____ 8. Which display would you look at to indicate the tank's heading, the CITV tank icon, the Turret Reference Display or none of the above?

(Neither indicates direction.)

GO	NO GO		
____	____	9.	Choose an object in your CITV and DESIGNATE to it. - Identify an object with CITV. - Engage palm switch. - Press DESIGNATE button, keeping palm switch depressed. - RELEASE PALM SWITCH. (Important step where gunner is concerned).
____	____	10.	Which sight should you use to fire upon a target yourself, your GPSE or your CITV sight? (The GPSE. Never use the CITV sight to fire upon a target.)
____	____	11.	You were instructed not to fire upon a vehicle more than 2000 meters away. Use your lase function to get the distance of an enemy vehicle on the terrain. (The TC must leave CITV mode and go to GPS mode to lase on the enemy tank.)

RA Name: _____
A WK: _____ SIM DUTY POS: _____ SIM CALL # _____

CITV DIAGNOSTIC

(Note: Time limit for CITV questions is 1 minute 30 seconds).

GO NO GO

MANUAL SEARCH

____ ____ 1. Conduct a manual search, using CITV tank icon, of the left quadrant (8 o'clock to 11 o'clock).

- Press MANUAL SEARCH button.
- Engage palm switch.
- Traverse control handle.
- Monitor icon on CITV screen to ensure scanning from 8 to 11 o'clock.

AUTO SCAN & SECTOR SET

____ ____ 2. Set left and right boundaries (in that order) over right side of tank using the CITV icon.

- Press AUTO SCAN button.
- Slew CITV over to upper right corner of tank keeping palm switch engaged.
- Press Sector Set.
- Press LEFT arrow.
- Slew CITV over back right corner of tank keeping palm switch engaged.
- Press Sector Set.
- Press RIGHT arrow.

____ ____ 3. Again, set new left and right boundaries (in that order) using azimuths of 2800 and 3800 mils.

- Press GPS mode.
- Slew gun tube, while watching the Grid Azimuth Indicator change, to 2800 mils.
- Press CITV mode. CITV goes to GLOS.

** Be sure to allow CITV to line up with GLOS **

- Engage palm switch.
- Press AUTO SCAN.
- Press sector set.
- Press LEFT arrow.

GO NO GO

- Press GPS mode.
- Slew gun tube, while watching the Grid Azimuth Indicator change, to 3800 mils.
- Press CITV mode. CITV goes to GLOS.

** Be sure to allow CITV to line up with GLOS **

- Engage palm switch.
- Press AUTO SCAN.
- Press sector set.
- Press RIGHT arrow.

* BOTH BOUNDARIES SHOULD NOW BE SET *

____ ____ 4. Using the previously set boundaries, slow down your rate of scan, ensuring you are in 3X and White Hot.

- Push Auto Scan.
- Push Rate.
- Push Down arrow.
- Make sure in 3X (large reticle).
- Make sure in White Hot.

____ ____ 5. Use your normal TC override.

- (RA) press CITV mode if not already there.
- To use normal TC override, TC should:

  1. Change Operational Mode to GPS.
  2. Depress palm switch and slew turret.

____ ____ 6. What CITV function is redundant with the GPSE?

(the CITV GLOS).

____ ____ 7. Explain the three main features of the CITV TANK ICON.

- Bold line on tank represents the front of it.
- Bold line extending from center of tank is the gun tube.
- Dotted line extending from center of tank is the CITV line of sight.

GO NO GO

___ ___ 8. Which display would you look at to indicate the tank's heading, the CITV tank icon, the Turret Reference Display or none of the above?

(The CITV tank icon.)

___ ___ 9. Choose an object in your CITV and DESIGNATE to it.

- Identify an object with CITV.
- Engage palm switch.
- Press DESIGNATE button, keeping palm switch depressed.
- RELEASE PALM SWITCH. (Important step where gunner is concerned).

___ ___ 10. Identify a vehicle using CITV and demonstrate IFF.

- Lay CITV reticle on vehicle.
- Engage palm switch.
- Lase to the vehicle.
- Identify symbol in upper left corner of CITV.

___ ___ 11. Stack 2 targets in the terrain using MANUAL SEARCH.

- Identify first target with CITV (does not have to be aimed directly on target).
- Press TARGET STACK button.
- Engage palm switch.
- Lase.
- Press button #1.
- Identify a second target with CITV.
- Press TARGET STACK button.
- Engage palm switch.
- Lase.
- Press button #2.

___ ___ 12. You're in battle and you have just sighted a vehicle with your CITV. You use your IFF to identify. IFF has indicated that it is enemy. What do you do before engaging? (Do not use Target Stack.)

GO NO GO

- Press DESIGNATE.

KEY POINT ---> - Have your gunner <u>verify</u> the identification in daylight sight.

- Fire if it is enemy.

OR

- TC can verify the target himself & engage.

____ ____ 13. Which sight should you use to fire upon a target yourself, your GPSE or your CITV?

(The GPSE. <u>Never</u> use the CITV to fire upon at target.)

CVC2 EVALUATION

RA Name: _____
B WK: ____ SIM DUTY POS: _____ SIM CALL #: _____

CCD DIAGNOSTIC

Notes to RA: - Preset one 3-waypoint route into the system and save it.
- Do not assist the TC with his answers.
- Time limit for each question is two minutes.
- Remember: use SEND key only if you want to "Post to map".

GO NO GO

___ ___ 1. Point to the CCD "Information Center". Explain the information from left to right.

1. First number is the current date.
2. Time of day.
3. Tank's call sign.
4. Own vehicle heading in degrees.
5. Own-vehicle grid location.

___ ___ 2. Your driver has just identified a tank. Prepare a CCD contact report.

CON	*OR*	REP
1. Highlight CON		1. Highlight REP
a. what - "tank"		2. Highlight CON
b. where - locate on map.		a. what - "tank b. where - locate on map.

___ ___ 3. You have just identified a column of T72s. Prepare a CCD call for fire on the T72s.

CFF	*OR*	REP
1. Highlight CFF		1. Highlight REP
a. what - "tank"		2. Highlight CFF
b. where - locate on map.		a. what - tank b. where - locate on map.

___ ___ 4. You have just identified 1 tank and 1 PC at two separate locations. Prepare a CCD contact report, keeping both symbols on the map for for future reference.

GO NO GO

CON	*OR*	REP
1. Highlight CON		1. Highlight REP
a. what - tank & PC		2. Highlight CON
b. where - find grid at two locations		a. what - tank & PC b. where - find grid at two locations
2. Highlight SEND		3. Highlight SEND
3. "Post to Map"		4. "Post to Map"

___ ___ 5. Intelligence reports you misjudged the location of the T72 in the call for fire you prepared earlier. Prepare an adjust fire report so the the artillery fire is redirected 100 meters right and 200 meters up. Also, indicate that this adjustment will end the mission whether or not the T72s are destroyed.

1. Highlight REP
2. Highlight ADJUST
3. Highlight NEW
4. Enter "Right 100" in first "Shift" box
5. Enter "Add 200" in second "Shift" box
6. Highlight EOM

___ ___ 6. While attacking, you have just destroyed 20 T72's and damaged 1 T72 which were in a defensive position. Due to a radio malfunction, you are now delaying. Prepare a CCD spot report.

1. Highlight REP
2. Highlight SPOT
3. Highlight NEW
4. a. what - "tank"
   b. Dmge - 1
   c. Dest - 20
   d. where - input map grid
   e. heading - input or leave blank
5. Highlight NEXT
6. EN ACT - "defing"
7. Own ACT - "delay"
8. As of - "Now"
9. Highlight NEXT
10. Check to make sure summary info. correct

___ ___ 7. Adjust the map scale so it shows the largest area possible.

1. Highlight MAP
2. Highlight 1:250,000

GO NO GO

___ ___ 8. Fifteen minutes ago, you observed four artillery rounds falling at your location. Prepare the correct CCD report.

1. Highlight REP
2. Highlight SHELL
3. Highlight NEW
4. a. # - 4
   b. where - input map grid
   c. As of - -15

___ ___ 9. Create a three waypoint route.

1. Highlight NAV
2. Move cursor to WP1 if not already there
3. Input map grid
4. Move cursor to WP2
5. Input map grid
6. Move cursor to WP3
7. Input map grid

___ ___ 10. You want to put waypoint #4 of your route off the current map shown. Scroll your map to the left, lock it, and put WP4 somewhere in that area.

1. Highlight MAP
2. Highlight ENABLED
3. Scroll map to left.
4. Highlight LOCKED.
5. Highlight NAV
6. Move cursor to WP4
7. Input map grid.

___ ___ 11. Move the map the quickest possible way so your tank icon is back to the center.

1. Highlight MAP
2. Highlight CENTERED.

___ ___ 12. Send WP1 to your driver.

1. Highlight NAV.
2. Highlight diamond shape in front of WP1.

___ ___ 13. Now, remove WP4 from this route.

1. Highlight WP4.
2. Highlight CLEAR FIELD.

GO NO GO

___ ___ 14. Save this route in your route files.

1. Highlight SAVE

___ ___ 15. Delete an old route saved earlier in route files.

1. Highlight FILES.
2. Highlight the old file you want deleted.
3. Highlight DELETE.
4. When it asks you if you really want to delete it, indicate "Yes."

___ ___ 16. Approximately 15 minutes ago you were engaged in heavy enemy activity (a ground attack) and lost two members of your crew. Your FLOT is unknown. You plan no change in your action at the present time. Prepare a CCD report which gives this information.

1. Highlight REP
2. Highlight SITREP
3. Highlight NEW
4. a. As of - -15
   b. FLOT - Leave blank
   c. Enemy Act - "heavy"
   "gnd attack"
5. Highlight NEXT
6. Crit. short - "personnel"
7. Cdr intent - "no change"
8. Highlight NEXT
9. Check to make sure all information correct.

CVC2 EVALUATION

RA Name: _____
A WK: _____ SIM DUTY POS: _____ SIM CALL # ____

CCD DIAGNOSTIC

Notes to RA: - Preset in the CCD system a CONTACT, SPOT and SITREP with a few minutes between each.
- Preset one 3-waypoint route in to the system.
- Do not assist the TC with his answers.
- Time limit for each question is two minutes.
- TC can use either touch or thumb control.
- For acquiring grids, TC can either touch map or lase to the location in CITV mode.

GO NO GO

___ ___ 1. Point to the CCD "Information Center". Explain the information from left to right.

1. First number is the current date.
2. Time of day.
3. Tank's call sign.
4. Vehicle heading.
5. Own-vehicle grid location.

___ ___ 2. Your driver has just identified a tank. Prepare and send a CCD contact report to a higher commander.

CON	*OR*	REP
1. Touch CON		1. Touch REP
a. what - "tank"		2. Touch CON
b. where - touch map		a. what - "tank"
		b. where - touch map
2. Touch SEND		3. Touch SEND
3. Touch SEND		4. Touch SEND

___ ___ 3. You have just identified a column of T72s. Prepare and send a CCD call for fire on the T72s.

CFF	*OR*	REP
1. Touch CFF		1. Touch REP
a. what - "tank"		2. Touch CFF
b. where - touch map		a. what - tank
2. Touch SEND		b. where - touch map
3. Touch SEND		3. Touch SEND
		4. Touch SEND

GO NO GO

___ ___ 4. You have just identified 1 tank and 1 PC at two separate locations. Prepare and send a CCD contact report, posting both symbols on the map for future reference.

CON	*OR*	REP
1. Touch CON		1. Touch REP
a. what - tank & PC		2. Touch CON
b. where - touch map at two locations		a. what - tank & PC b. where - touch map at two locations
2. Touch SEND		3. Touch SEND
3. Touch "Post to Map"		4. Touch "Post to Map"
4. Touch SEND		5. Touch SEND

___ ___ 5. Intelligence reports you misjudged the location of the T72 in the call for fire you made earlier. Prepare and send an adjust fire report so the artillery fire is redirected 100 meters right and 200 meters up. Also, indicate this adjustment will end the mission whether or not the T72s are destroyed.

1. Touch REP
2. Touch ADJUST
3. Touch NEW
4. Enter "Right 100" in first "Shift" box
5. Enter "Add 200" in second "Shift" box
6. Touch EOM
7. Touch SEND
8. Touch SEND

___ ___ 6. While attacking, you have just destroyed 20 T72's and damaged 1 T72 which were in a defensive position. Due to radio problems, you are delaying as of now. Prepare and send a CCD spot report.

1. Touch REP
2. Touch SPOT
3. Touch NEW
4. a. what - "tank"
   b. Dmge - 1
   c. Dest - 20
   d. where - touch map
   e. heading - touch map or leave blank
5. Touch NEXT
6. EN ACT - "defend"

GO NO GO

7. Own ACT - "delay"
8. As of - "Now"
9. Touch NEXT
10. If all info. correct, touch SEND
11. Touch SEND

___ ___ 7. Adjust the map scale so it shows the largest area possible with all map features showing.

1. Touch MAP
2. Touch FEATURES
   a. Insure all features are highlighted.
   b. Touch BACK.
3. Touch 1:250,000

___ ___ 8. Fifteen minutes ago, you observed four artillery rounds falling at your location. Prepare and send the correct CCD report.

1. Touch REP
2. Touch SHELL
3. Touch NEW
4. a. # - 4
   b. where - touch map
   c. As of - -15
5. Touch SEND
6. Touch SEND

___ ___ 9. Create a three waypoint route.

1. Touch NAV
2. Move cursor to WP1 if not already there
3. Touch map
4. Move cursor to WP2
5. Touch map
6. Move cursor to WP3
7. Touch map

___ ___ 10. You want to put waypoint #4 of your route off the current map shown. Scroll your map to the left, lock it, and put WP4 somewhere in that area.

1. Touch MAP
2. Touch ENABLED
3. Scroll map to left.
4. Touch LOCKED.
5. Touch NAV
6. Move cursor to WP4
7. Touch map.

GO NO GO

___ ___ 11. Move the map the quickest possible way so your tank icon is back to the center.

1. Touch MAP
2. Touch CENTERED.

___ ___ 12. Send WP1 to your driver.

1. Touch NAV.
2. Touch diamond shape in front of WP1.

___ ___ 13. Now, remove WP4 from this route.

1. Highlight WP4.
2. Touch CLEAR FIELD.

___ ___ 14. Save this route and send it to your platoon or company.

1. Touch SAVE
2. Touch SEND
3. Touch SEND

___ ___ 15. Receive the most recently sent report, tell who it is from and the time it was sent. After posting the report on your tactical map, forward the report as appropriate.

1. Touch RECEIVE
2. Touch the first report in the queue.
3. Touch SHOW
4. Tell who the report is from, when it was sent, and the date it was sent.
5. Touch SEND
6. Touch POST TO MAP
7. Touch SEND

___ ___ 16. Place the cursor on a waypoint route that is in your files. Tell who the route is from and the time and date it was sent. Then delete it.

1. Touch NAV
2. Touch FILES
3. Touch a waypoint route that is in your file from another TC.

GO NO GO

4. Tell who sent the route and the time and date it was sent.
5. Touch DELETE.

___ ___ 17. Approximately 15 minutes ago you were engaged in heavy enemy activity (a ground attack) and lost two members of your crew. Your FLOT is unknown. You plan no change in your action at the present time. Prepare and send a report which gives this information.

1. Touch REP
2. Touch SITREP
3. Touch NEW
4. a. As of - -15
   b. FLOT - Leave blank
   c. Enemy Act - "heavy"
   "gnd attack"
5. Touch NEXT
6. Crit. short - "personnel"
7. Cdr intent - "no change"
8. Touch NEXT
9. If all info. correct, hit SEND
10. Touch SEND

APPENDIX C

A B C 3-28 Biographical Questionnaire FORM-O

A B C Wk 3-28 Sim Dty Pos: PL CC Sim Call # A_____

BIOGRAPHICAL QUESTIONNAIRE - FORM O

Name_____ SSN_____-_____-_____

1. Age _____ years 2. Current Army Rank _____

3. Military Specialty: **12A 12B 12C**

4. Total time in service as enlisted: _____ years/_____ months

5. Total time as commissioned: _____ years/_____ months

6. Total time in Armor (include Cavalry): _____ yrs/_____ months

What Armor vehicles have you been trained on, and how much experience have you had in each (list years/months):

7. **M1** _____ /_____ 10. **M551** _____ /_____

8. **M1A1** _____ /_____ 11. ( ) _____ /_____

9. **M60A3** _____ /_____ 12. ( ) _____ /_____

13. What is your present tank Duty Position (circle one)?

PL XO CC Other_____

How much experience do you have in each position (years/months)?

14. **TC** _____ / _____ 16. **CoCmdr** _____ / _____

15. **PLdr** _____ / _____ 17. Other _____ / _____

Which of the following formal military courses have you completed? (check all that apply):

18-22. ____ **AIT** ____ **PLDC** ____ **BNCOC** ____ **ANCOC** ____ **AOBC**

23-27. ____ **SPLC** ____ **AOAC** ____ **TCCC** ____ **JMOC** ____ **NBC**

28-31. ____ **CAS3** ____ **RANGER** ____ **AIRBORNE** ____ **OTHER** _____

32. How long has it been since you participated as a tanker in an actual field training exercise **(not counting NTC)**:_____ months?

33. How many times have you participated as a tanker in NTC exercises with a rotating unit? _____

34. How many months since your most recent NTC rotation? _____

35. How many hours have you previously spent on SIMNET? _____

36. How many months since the last time you used SIMNET? _____

37. Have you participated in previous new equipment evaluations n SIMNET (in this building)? _____ yes _____ no

If yes, which of the following equipment evaluations have you participated?

38-41 _____ POSNAV _____ IVIS _____ CITV _____Other_____

42. How many hours have you spent on UCOFT? _____

43. How many months since your last UCOFT experience? _____

44. Describe your previous experience with computers (check one):

_____ no experience at all

_____ limited experience

_____ moderate use

_____ considerable experience

45. Education:

_____ High School Diploma/GED

_____ Some College

_____ College Degree (BA/BS)

_____ Postgraduate work

46. What is the source of your commission?

_____ ROTC _____ OCS _____ USMA

47. How much experience have you had in TO&E units?
Please list years/months:

CONUS _____ / _____ USAREUR _____ / _____ KOREA_____/_____

48. How much experience have you had in TDA units?
Please list years/months:

_____ / _____

A B C 3-28 BIOGRAPHICAL QUESTIONNAIRE FORM-E

A B C Wk Sim Dty Pos: DVR GNR TC PS Sim Call # A_____
3-28

BIOGRAPHICAL QUESTIONNAIRE FORM - E

Name_____ SSN_____-_____-_____

1. Age _____ years 2. Current Army Rank _____

3. MOS: **19K** **19E** **Other:** MOS-_____,_____

4. Total time in service as enlisted: _____ years/_____ months

5. Total time in Armor (include Cavalry): _____ yrs/_____ months

What Armor vehicles have you been trained on, and how much experience have you had in each (list years/months):

6. **M1** _____ /_____ 9. **M551** _____ /_____

7. **M1A1** _____ /_____ 10. ( ) _____ /_____

8. **M60A3** _____ /_____ 11. ( ) _____ /_____

12. What is your present Duty Position: **LDR** **DVR** **GNR** **TC** **PS**

How much experience do you have in each position (years/months)?

13. **LDR** _____ / _____ 15. **GNR** _____ / _____ 17. **PS**_____/_____

14. **DVR** _____ / _____ 16. **TC** _____ / _____

Which of the following military courses have you completed? (check all that apply):

18-22. ____ **AIT** ____ **PLDC** ____ **BNCOC** ____ **ANCOC** ____ **SPLC**

23-27. ____ **TCCC** ____ **NBC** ____ **Ranger** ____ **Airborne** ____**Other**

28. How long has it been since you participated as a tanker in an actual field training exercise (**not counting NTC**):_____ months?

29. How many times have you participated as a tanker in NTC exercises with a rotating unit? _____

30. How many months since your most recent NTC rotation? _____

31. How many hours have you <u>previously</u> spent on SIMNET? _____

32. How many months since the last time you used SIMNET? _____

33. Have you participated in previous new equipment evaluations on SIMNET (in this building)? ____ yes ____ no

If yes, in which of the following equipment evaluations have you participated?

34-37. _____ POSNAV _____IVIS _____ CITV _____ Other_____

38. How many hours have you spent on UCOFT? _____

39. How many months since your last UCOFT experience? _____

40. Describe your previous experience with computers (check one):

_____ no experience at all

_____ limited experience

_____ moderate experience

_____ considerable experience

41. Education:

_____ High School Diploma/GED

_____ Some College

_____ College Degree (BA/BS)

_____ Postgraduate work

42. How much experience have you had in TO&E units?
Please list years/months:

CONUS_____/_____ **USAREUR**_____/_____ **KOREA**_____/_____

43. How much experience have you had in TDA units?
Please list years/months:

____/_____