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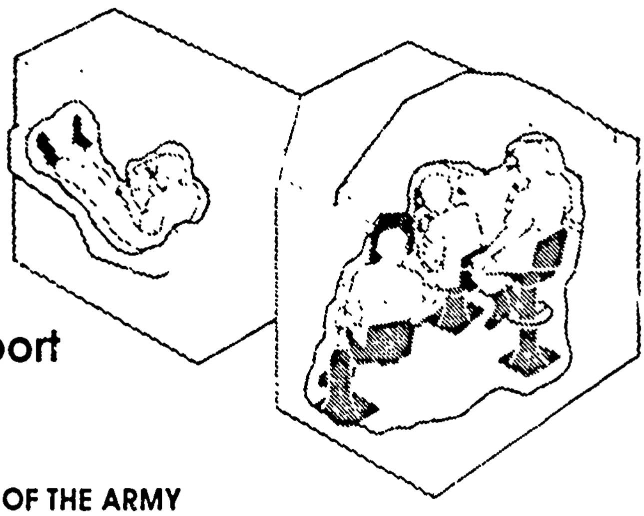
Close Combat Tactical Trainer (CCTT) Cost and Training Effectiveness Analysis (CTEA)

Volume II. Main Report

John L. Noble
Douglas R. Johnson



Final Report

DEPARTMENT OF THE ARMY

May 1991

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Final Report

Prepared by:	Certified by:	Approved by:
DARRELL W. COLLIER	RICHARD W. TRAGEMANN	DENNIS P. MALCOR
Director	Brigadier General, USA	Major General, GS
USATRAC-WSMR	Commander, USATRAC	DCST, TRADOC

DEPARTMENT OF THE ARMY
TRADOC Analysis Command
White Sands Missile Range, NM 88002-5502

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John L. Noble
Douglas R. Johnson

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13. ABSTRACT *(Maximum 200 words)*

The Close Combat Tactical Trainer (CCTT) Cost and Training Effectiveness Analysis (CTEA) addressed the training capabilities, and using the life cycle costs estimated potential cost paybacks of the proposed CCTT. The CCTT simulator trains armor and mechanized infantry units in Army Training Evaluation Program (ARTEP) Mission Training Plans (MTP) tasks. The analysis was conducted in support of a milestone I/II ASARC decision on CCTT. The analysis determined the CCTT has the potential to train tasks related to (1) command, control, and communication, (2) maneuver and navigation, and (3) teamwork and leadership. The CCTT has the potential to train, to a lesser degree certain procedures related to gunnery, target acquisition and driving the vehicle. Due to the fidelity of the surrogate system, SIMNET-T, there may be some adverse impacts on training these subordinate tasks. The higher fidelity CCTT has the potential to remedy this problem. The CCTT has the potential to be a cost and training effective addition to the Army's training program. It is likely that the active component (AC) portion of the CCTT life cycle cost (LCC) will be fully paid back during the service life for either a company/team (CO/TM) or battalion/task force (BN/TF) level acquisition. The extent of the pay back indicated by the analysis must be validated during CCTT testing.

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Close Combat Tactical Trainer (CCTT) Cost and Training Effectiveness Analysis (CTEA)

Study Gist

The Reason for Performing the Study was to address the training capabilities and, using the life cycle costs (LCC), estimate potential cost pay backs of the proposed CCTT. The CCTT is a simulator used to train armor and mechanized infantry units in Army Training Evaluation Program (ARTEP) Mission Training Plans (MTP) tasks. The analysis was conducted in support of a milestone I/II ASARC decision on CCTT.

The Principal Results were based on analysis performed on a surrogate system, SIMNET-T. Overall, the analysis determined the CCTT has the potential to train tasks related to (1) command, control, and communications, (2) maneuver and navigation, and (3) teamwork and leadership. The CCTT has the potential to train, to a lesser degree certain procedures related to gunnery, target acquisition, and driving the vehicle. Due to the fidelity of the surrogate system, SIMNET-T, there may be some adverse impacts on training these subordinate tasks. The higher fidelity CCTT has the potential to remedy this problem. The analysis indicates that the AC portion of the CCTT LCC will be fully paid back during the service life for either a company team (CO/TM) or battalion task force (BN TF) level acquisition. The CO/TM simulators account for all the savings. The BN TF CCTT does not add to the total savings. The extent of the payback indicated by the analysis must be validated during CCTT testing.

The Main Assumptions for this study were (1) the tasks identified as trained by the surrogate system, SIMNET-T, can be trained using the CCTT, (2) the training requirements as specified by the CCTT Training Device Requirement (TDR) can be met.

The Major Limitations were (1) performance data on the surrogate system, SIMNET-T, was primarily of a qualitative nature and consists of an assessment on the device's contribution to training, and (2) the training effectiveness of SIMNET-T was never established.

The Scope of the Study was to (1) analyze previous analyses performed on the SIMNET-T to determine the potential capabilities of the CCTT, (2) develop training strategies for armor and mechanized infantry battalions incorporating CCTT, and (3) using a CO/TM level fielding scheme, determine the resource "trade-offs" using the CCTT as compared to the baseline strategy without CCTT.

The Basic Approach was to obtain (1) those previous studies on the SIMNET-T system, (2) the CCTT TDR and system specifications, (3) CCTT cost data and (4) resource data relative to training. Using these data estimate the potential capability of the CCTT to train tasks. Using the surrogate system, SIMNET-T, develop combined arms training strategies (CATS) incorporating the CCTT. Using a CO/TM level fielding scheme, determine the resource "trade-offs" using the device as compared to a baseline strategy without CCTT. The value of the device will be estimated as a combination of resource savings, training benefits, and added value to the Army (intangibles).

The Study Sponsor was the US Army Training and Doctrine Command (TRADOC), ATTN: ATTG-C (Mr Hank Payne), Fort Monroe, Virginia 23651-5000

The Study Proponents were the US Army Armor School, ATTN: ATSB-TDN (Mr James N Cook), Fort Knox, KY 40121-5200 and the US Army Infantry School, ATTN: ATSH-TDS (Mr. Joseph Albrecht), Fort Benning, GA 31905.

The Study Agency was US Army TRADOC Analysis Command, ATTN: ATRC-WGC (Mr. John Noble/Mr Doug Johnson) DSN 258-3290, White Sands Missile Range, NM 88002-5502.

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Close Combat Tactical Trainer (CCTT) Cost and Training Effectiveness Analysis (CTEA) Final Report

Chapter 1. Introduction

This report contains the analysis conducted in support of a Close Combat Tactical Trainer (CCTT) Army System Acquisition Review Council (ASARC) milestone I/II. The CCTT is a system of computer-driven combat vehicle simulators. The simulators represent numerous vehicles including the M1A1 Abrams Tank, the M2 Bradley Fighting Vehicle, M3 Cavalry Fighting Vehicle, the Fire Support Team Vehicle, and battlefield weapon system emulators. These simulators work interactively and are similar both physically and functionally to the vehicles they simulate. Local area networks connect the simulators to one another. When viewed by soldiers who are using the system, the system's computers create a simulated battlefield. This provides soldiers with the illusion of moving and fighting over actual terrain. The soldier views this terrain while operating or riding inside a simulated vehicle. During an exercise the soldier employs simulated weapon systems mounted in or on the vehicle.

Purpose

The purpose of this analysis was twofold. First, it addressed the training capabilities of the proposed CCTT system. Second, using cost estimates to acquire and sustain the CCTT, it analyzed various cost trade-offs to pay back the cost of CCTT. The findings support a milestone I/II ASARC decision on CCTT. Additionally, this study set the groundwork for future analyses on CCTT. Much of the analysis in this phase is qualitative in nature, however, TRADOC requires that a quantitative assessment of CCTT systems effectiveness be conducted during Initial Operational Test and Evaluation (IOTE) in FY 96. This follow-on analysis will consist of a comprehensive CTEA as outlined in the TRADOC study program.

Background and Problem Statement

The ASARC decision will determine the scope of the CCTT acquisition program which will proceed to milestone III. The ASARC I/II decision is whether or not to commit approximately $171 million for full scale engineering development. The current acquisition program is for 546 simulators fielded to the company/team (CO/TM) level.

The CCTT is a follow-on system to the existing SIMNET-T. The SIMNET-T is a similar, but less capable, system developed by the Defense Advanced Research Project Agency (DARPA). SIMNET-T served as proof of concept for CCTT. CCTT, considered a major acquisition in terms of funding, requires a CTEA to support ASARC I/II. The ASARC is scheduled for 10 Jun 91. The TRADOC Analysis Command at White Sands Missile Range (TRAC-WSMR) was tasked to perform the analysis and produce the report required to support ASARC I/II CTEA requirement. At this stage of the CCTT acquisition program the simulators are conceptual.

There continues to be a growing reliance on the use of simulations and simulators as training devices both in the military and the private sector. The Army intends to capture the emerging simulation technology to support both single and multi-echelon training strategies of active and reserve forces. There is an expectation that these devices might reduce the resources now spent on field training. Reductions in Operating Tempo (OPTEMPO) can be significant benefit since the amount of resources available to support traditional field tactical training of all types is decreasing. The goal in training with CCTT is to maintain the existing levels of a unit's tactical skills and combat readiness. Field training is extremely resource intensive at the company and battalion levels. It is at these levels that training using simulation of tactical engagements with semi-independent opposing forces is most effective. Because the use of training devices is becoming more desirable, there may be a tendency to proliferate the number and type of the training aids, devices, simulators, and simulations (TADSS). These TADSS compete for increasingly limited resources (training time, dollars, personnel, etc.) while the benefits, in terms of training effectiveness or real costs, remain unknown. The proliferation of TADSS may also result in redundancy of systems available to training some skills/tasks. Such redundancies will create add-on costs, rather than savings, and thus reduce the funding available to support other training needs. The US Army Simulator/Simulation-Based Training (SIM2) Study now underway will address the issue of TADSS proliferation.

Study Issues

The following study issues were formulated to address these problems.

- What tasks can be trained using SIMNET-T?
- What additional tasks might CCTT train?
- What are the benefits of using CCTT to train?
- What are the resource requirements of using CCTT to train?
- What is the estimated life cycle cost (LCC) of CCTT?
- Will CCTT provide cost effective training?

Study Objectives and Essential Elements of Analysis (EEA)

The study issues as outlined above were translated into study objectives and EEA. The analysis was designed to answer these objectives. The objectives and EEA associated with this CTEA are:

Objective 1

Determine the training value and resource implications of integrating CCTT into the armor and mechanized infantry combined arms training strategies (CATS).

EEA 1

What is the capability of CCTT to provide training of mission training plan (MTP) tasks at company/team level?

EEA 2

What is the training value of CCTT in providing combined arms training for close combat units?

Objective 2

Compare the cost of training with and without CCTT and identify potential payback in OPTEMPO.

EEA 3

What are the estimated CCTT LCC?

EEA 4

What are the benefits and resource trade-offs as a result of incorporating CCTT into a branch CATS? What payback is required to fully payback CCTT? What is the projected payback during the service life of CCTT?

EEA 5

What are other resource implications associated with CCTT?

Scope

This study used earlier analyses on the system SIMNET-T to assess the training value of CCTT. From these studies a determination was made regarding the potential capabilities of the proposed CCTT. Determining the cost effectiveness of CCTT required that comparisons be made between the current and proposed training strategies. Comparisons included strategies for both armor and mechanized infantry battalions. The respective TRADOC schools developed these strategies for use in this CTEA. Training strategies represent the events units participate in accomplishing their annual training cycle. These strategies are further described in their relationship to the study alternatives. Assuming that CCTT will be used to supplement unit training, the cost analysis considered resource "trade-offs." These trade-offs for both active and reserve components centered around the planned deployment of CCTT in CO/TM units. The cost analysis focused on the CCTT LCC for CO/TM training and the payback implications associated with the assumptions that CCTT training will be an effective substitute for tasks associated with selected field training events. An excursion was conducted to examine the costs associated with an extended capability to train at the battalion level. Specifically the cost analysis addressed:

- A life cycle cost analysis for CO/TM (546 simulators) and Battalion level (958 simulators).
- An analysis to determine the percent of OPTEMPO funds required to payback the CCTT LCC
- A payback analysis to determine the reduction in OPTEMPO miles required to payback CCTT LCC during the 15-year service life.
- A break-even analysis to assess the implications of the potential reduction in OPTEMPO miles as provided by the Armor and Infantry Schools.
- A sensitivity analysis to determine the impact on payback of (1) a 10 year service life, (2) an increase in the CCTT LCC, and (3) and increase in the CCTT LCC as a result of the Army cost position.

Assumptions

The assumptions used in this analysis were:

The tasks identified as trained by the surrogate system, SIMNET-T could be trained using the CCTT.

The training requirements as specified by the CCTT training device requirement (TDR) can be met.

Limitations

The major limitations were: (1) performance data on the surrogate system, SIMNET-T, was primarily qualitative assessments on the device's contribution to training, and (2) the training effectiveness of SIMNET-T was never established.

Constraints

The scope of this study was constrained by two major factors. First, testing of the actual CCTT was not possible until the system is produced. Second, the schedule, as dictated by TRADOC to meet the 10 Jun 91 ASARC I/II, required the analysis to be complete by 18 May 91.

Alternatives

Initially the study considered five potential study alternatives: (1) The base case alternative using the current training strategy, with its present OPTEMPO and fielded training devices, (2) An alternative incorporating CCTT into the base case with the appropriate reductions in OPTEMPO and other training activities, (3) An alternative fielding SIMNET-T or improved version of SIMNET-T in lieu of CCTT, (4) An alternative fielding a degraded version of CCTT, and (5) An alternative incorporating embedded training devices on the actual equipment. Alternatives 3, 4, and 5 were eliminated from consideration for a number of reasons. These reasons are explained in the section on analysis of study alternatives. The remaining alternatives were the base case (Alternative #1) and the base case incorporating CCTT (Alternative #2). These two alternatives are described in more detail in the following sections.

Alternative 1 (Base Case)

The base case represents the current training strategy. This strategy is based on a building block type approach to training. It begins with training missions focused at the squad and platoon level. These missions are trained under the guidance of the platoon leader. Once the unit is proficient at platoon level missions, the platoons work together under the supervision of the company commander on company level missions. When the company becomes proficient at the company level missions, they work together as teams under the battalion commanders supervision on battalion level missions. Thus in this building block approach the platoons build to company level, and the companies build to battalion level. The platoon training is accomplished through a mixture of tactical exercises without troops (TEWT) and field training exercises (FTX) with both internal evaluations and external Army Training Evaluation Program (ARTEP). The company training is done through a mixture of TEWTs and FTXs that are internally and externally evaluated, command field exercises (CFX) and fire coordination exercises (FCX). The battalion level training is accomplished with the above exercises and deployment exercises (DEPEX).

Alternative 2 (CCTT)

Alternative 2 represents a training strategy where CCTT is incorporated into the base case training strategy. Incorporation of the CCTT is not designed to replace field training but rather to augment and enhance training allowing the unit to train to the same proficiency with increased efficiency. Training is at the same level with reduced OPTEMPO. This allows for less time spent in field training environment. The goal is to produce a savings in OPTEMPO without affecting the unit's proficiency. The training strategy also uses the building block approach. The strategy begins with squad and platoon level training missions, followed by company level training missions and then, under the battalion commanders supervision, battalion level training missions. While most of the events (TEWTs, FTXs, CFXs and FCXs) remain the same, the number of these events is reduced. At the platoon level, OPTEMPO reductions will occur as a result of the elimination of some FTXs. At the company and battalion level reductions in OPTEMPO will result from the elimination of CFXs. These field training events will be replaced with training events using the CCTT. Since CCTT will initially be fielded at company level and below, rationale for the elimination of the battalion-level CFX is based on the increased proficiency of lower echelon units requiring fewer larger battalion level exercises. The goal is to produce a savings in OPTEMPO without decreasing unit readiness. Table 1 contains the number of mile reductions projected for the active component (AC) traded off with the acquisition of CCTT. These projections must be validated by testing of CCTT.

Table 1. CCTT Mile Trade-Offs (Annual)

	Armor		Infantry	
Event	Total/Veh	Reductions	Total	Reductions
Company/TM	800	108	742	16
Battalion/TF	800	172	742	111

TDR

A TDR for CCTT was developed by the US Army Armor School. This document presents operational, technical, logistical, and cost information necessary for the development, procurement, and testing of training devices. The CCTT TDR, a formal Army requirement, commits the Army to a training device, simulator, or simulation acquisition. The TDR describes what the Army intends to build and how the device will meet the training needs. A condensed version of the TDR is included in appendix D. This version includes those areas that were used in support of this analysis.

Training Mission Profiles

The operational mode summary/mission profile (OMS/MP) for the CCTT is contained in the TDR. This paragraph presents a summary of the OMS/MP. The CCTT operates in both peacetime and wartime environments. Units requiring training with the device will schedule its use through the agency managing the device at a particular site. The proposed use of CCTT includes both institutional and unit training of the active Army, US Army Reserve (USAR), and the Army National Guard (NG). In addition, it can be used in joint operations training. The device is a unit level, crew through company, sustainment trainer. It is also designed for use at the institutional training bases at Ft. Benning and Ft. Knox. Training time and activities will vary; however, they are represented by four distinct events. These events are (1) set up and preventative maintenance, (2) initialization of exercise parameters, (3) training, and (4) standby and shut down. The specific tasks trained using CCTT are derived from the ARTEP MTP shown in table 2. These plans list the tasks to conduct tactical collective skills training. As a part task trainer, the CCTT simulation does not replicate all the conditions and standards of field training. These tasks however, are the focus of this analysis and will be the focus of future analyses since they become a "benchmark" with respect to the types of missions that can be trained on CCTT.

Table 2. CCTT Task List Documents

Manual	Unit
ARTEP 17-57-10-MTP	Scout Platoon
ARTEP 17-237-10-MTP	Tank Platoon
ARTEP 7-8-MTP	Infantry Platoon and Squad
ARTEP 71-1-MTP	The Tank and Mechanized Infantry Company and CO/TM
ARTEP 71-2-MTP	The Tank and Mechanized Infantry BN TF
FC 17-97-1-MTP	Regimental Cavalry Troop

Integrated Logistics Support Plan

The TDR contains a system support plan requiring a government owned, contractor operated, contractor logistic supported (CLS) operations. This CLS includes site management, operations, semi-automated forces operators, simulation system instruction, and simulation systems maintenance and logistics. This logistic support is for both the fixed and mobile versions of CCTT. The transportation requirements of the mobile version are considered a part of the CLS. This plan is similar to the one supporting the surrogate system, SIMNET-T. The cost effectiveness of this logistics support approach is yet to be determined.

Chapter 2: Methodology

This section describes the methodology used to conduct the CCTT CTEA. The analysis team performed a front-end analysis to determine the pertinent study issues. In deciding the alternatives to be examined, the study team considered the most likely CCTT type candidates. Two study alternatives were identified for analysis in this CTEA.

Approach

The method used to determine the potential effectiveness of CCTT was to analyze the capabilities of the prototype system, SIMNET-T, as determined by the findings of previous analyses. There were two reasons for this approach. First, twelve independent studies and analyses had been conducted on the prototype (SIMNET-T). The results extracted from these documents on the SIMNET-T system comprised the data analyzed. Second, testing of the objective system (CCTT) is not scheduled until IOTE in FY96 Consequently, performance data on the CCTT is not available for this study. Analysis of the additional training requirements of the CCTT included reviewing the TDR. Comparing the TDR task areas to the capabilities of the SIMNET-T system corroborates the capabilities of CCTT. An independent evaluation of the CCTT system specifications added validity to the data reflected in the TDR. The study integrated armor and infantry CATS into the context of the study alternatives. The CATS, CCTT baseline cost estimate (BCE), and fielding strategy for CCTT provided the data used in the cost analysis. Use of this data allowed for life cycle cost estimates (LCCE) for the CCTT alternative. Cost analysts performed sensitivitv analysis on key parameters associated with the CATS. This analysis determined the potential "paybacks" to the Army for using the training device. Additional insights obtained from the previous analyses, on the intangible benefits of training using devices provided information on the added value of CCTT. The criteria of choice for this analysis was an equal effectiveness and equal/variable cost. This approach was taken due to the limited amount of CCTT test data. The study assumes both training strategies produce equally trained soldiers, platoons, and CO/TMs. This CTEA report contains the integration of the findings of those analyses.

Analysis of Study Alternatives

Initially five alternatives were considered for inclusion in this CTEA. On the surface they all appeared to have merit but after an analysis of the alternatives, only the base case (alternative 1) and an alternate incorporating CCTT into the base case (alternative 2) proved to be viable for this analysis. The other three considered were eliminated for the following reasons:

The Alternative Fielding an Improved SIMNET-T

SIMNET-T was an advanced research project sponsored by the DARPA and the US Army. It has served its purpose as the test bed for the CCTT. The present SIMNET system represents ageing technology. As a test bed system it lacks the necessary software documentation and it was not engineered to meet Army requirements in areas of reliability, availability, and maintainability (RAM).

The Alternative Fielding a Degraded Version of CCTT

A degraded CCTT falls short of the training capability required if it were to be incorporated in the base case. It also fails to capture current emerging simulation technology.

The Alternative Incorporating Embedded Training Devices

A combination of the present state-of-the-art as well as the potential costs associated with this approach eliminated this alternative. Embedded training devices represent a future alternative to CCTT.

Sources of Data and Data Collection

The primary sources of data for this analysis were the Armor and Infantry schools, the Army Research Institute (ARI), Test and Experimentation Command (TEXCOM) and Potomac Systems Engineering (PSE). Each of these organizations had personnel experienced in training using SIMNET. In addition to the studies performed by these agencies, these experienced personnel provided insights with regard to the intangible benefits of using SIMNET to train.

Performance Analysis Methods

The performance analysis concentrated on reviewing existing literature in four main areas. These areas include the CCTT TDR, SIMNET studies, CCTT system specifications and intangible benefits of using SIMNET to train.

Review of the TDR

A current version of the TDR was obtained from the project manager for SIMNET. This document provided a comprehensive description of CCTT tasks required to train.

The tasks were categorized by functional area (e.g., maneuver).

The areas covered in TDR were matched with areas and trained using the SIMNET system.

Review of SIMNET-T Studies

Each document was summarized.

The strengths and limitations of each study were determined.

A search was conducted for most frequently stated SIMNET-T advantages and disadvantages. The specific findings for study each are listed in appendix A and in chapter 3 there are summaries of the findings for all twelve studies.

Review of CCTT System Specifications

System specifications were obtained.

System specifications were broken down into functional areas.

Analysts reviewed each specification to determine if it was accurate, too broad or too restrictive. The review also noted areas in the specifications that were not using state-of-the-art technology.

The results were provided to both TRADOC and Army Material Command (AMC) managers for incorporation in the request for proposal package.

Review of the Intangibles

A search was conducted for stated perceived or demonstrated general advantages and capabilities of simulators.

Specific advantages and capabilities of the CCTT were noted.

The intangibles were derived using a heuristic approach from all available data sources.

Cost Analysis Methodology

The cost analysis methodology consisted of three distinct efforts: (1) Development of data inputs, (2) Calculation of OPTEMPO savings to pay back the CCTT LCC, and (3) Calculation of break-even points (BEP) and net savings relative to the OPTEMPO reductions. Figure 1 shows the major segments of the analysis. The first major input is the CCTT BCE which provides the total LCC for the CCTT. Next the training resources manual (TRM) provides the basis for determining the cost savings per mile per battalion. The primary model feeding the TRM are the battalion level training model (BLTM) which outputs the equipment needed to perform training functions and the number of miles required by system in the unit at each readiness level. The other equipment in the unit which consumes resources are prorated against the major end item of the unit. The Cost and Economic Analysis Center (CEAC) provided the OPTEMPO factors based on petroleum, oil and lubricants (POL) consumption, repair parts and secondary item usage, and depot level maintenance repair. Since the TRM contains the BLTM resource requirements for a generic battalion, the resource implication of exercising the unit on a per mile basis can be determined. The factors from the model are directly applicable to this study. The last major input is the balanced force structure projected for the FY97 timeframe which is used to determine the total number of battalions serviced by the CCTT. These inputs are used to calculate the OPTEMPO funds required to pay back the CCTT LCC during its service life. A sensitivity analysis was conducted to determine the number of years it takes to achieve the BEP using current dollar savings to pay off the CCTT and to calculate the net savings of OPTEMPO funds during the service life of CCTT. Finally, a sensitivity analysis was conducted to address the impact of CCTT LCC growth and OPTEMPO funding changes on OPTEMPO mile reductions.

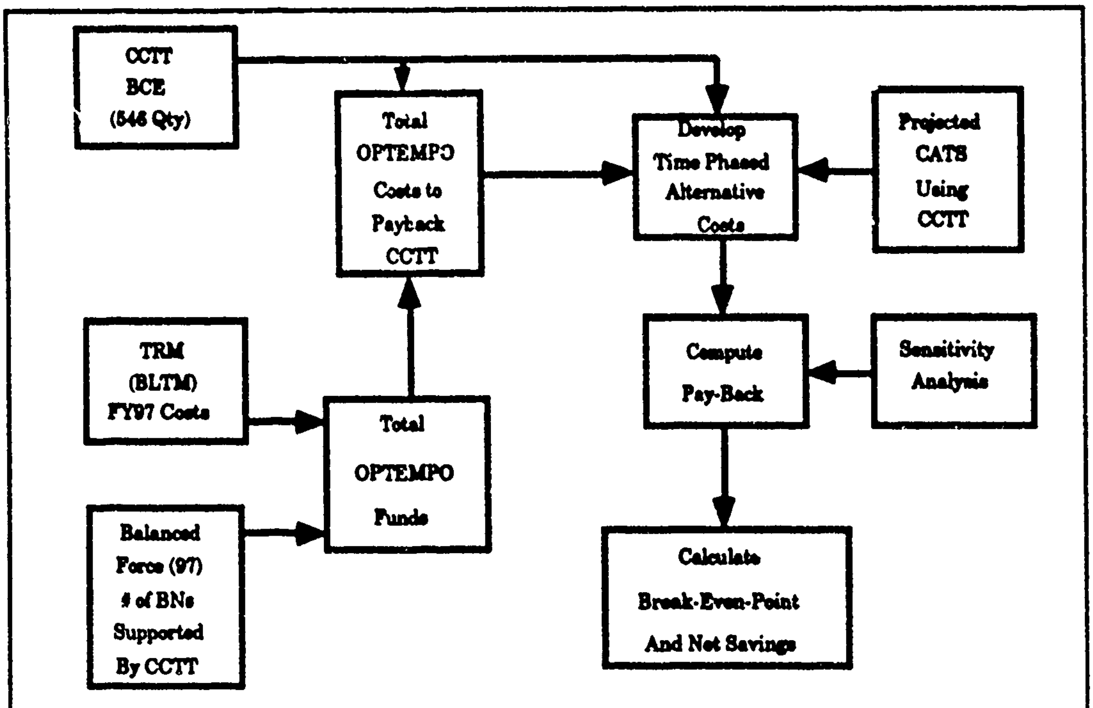

Figure 1. Cost Methodology

Cost Analysis Limitations

This analysis is based on the reductions in OPTEMPO miles required to pay back CCTT during its service life and savings/net costs associated with various levels of reductions in OPTEMPO miles. Table 3 contains the number of mile reductions projected for trade-off with the acquisition of CCTT. These projections must be validated by testing of CCTT.

Table 3. CCTT Mile Trade-Off (Annual)

	Armor		Infantry	
Unit	Total/VEH	Reductions	Total/VEH	Reductions
Company/Team	800	108	742	96
Battalion/TF	800	172	742	111

Cost Ground Rules and Assumptions

The cost analysis was conducted based on the following ground rules and assumptions. SIMNET-T is not included in the cost analysis (sunk costs).

CCTT service life is 15 years.

The cost of simulator upgrades or replacement due to new or product improvement program (PIP) weapon systems will be defrayed by the new or PIP system program.

Pay back occurs as the CCTT simulators are fielded in the supported battalions.

OPTEMPO savings is expressed in equivalent Tank OPTEMPO miles.

A command and control C^2 readiness level is assumed for the battalions utilizing CCTT.

OPTEMPO funds available for potential savings is based on FY(97) OPTEMPO funding levels for the balanced force supported by the CCTT.

Unit commanders will tradeoff within the total variable OPTEMPO funds (both maneuver and gunnery) available to optimize unit training.

Data Requirements to Support Analysis Methods

Data elements used to conduct the CTEA included:
- SIMNET-T related studies
- CCTT TDR
- CCTT System Specifications
- Armor/Infantry CCTT Training strategies
- CCTT BCE
- CCTT Basis of Issue Plan (BOIP)
- OPTEMPO Cost Factors

With the exception of quantitative test data, the amount of data available on the SIMNET-T was plentiful and readily available. Most of this data related to qualitative assessments of the training effectiveness of SIMNET. Data related to the BCE and CATS underwent several revisions. It was necessary for cost analysts to perform continuing updates to the LCCE associated with the CCTT alternative. The goal was to produce the most up to date cost analysis for compatibility with the ASARC milestone. The CCTT LCCE used was the validated BCE as of March 1991. The BOIP and the fielding plan used in the analysis is the same as in the BCE and based on the acquisition of 546 simulators. The TRM was provided by HQ DA. It uses current cost factors provided by the CEAC. This model provided the OPTEMPO cost per mile savings for the battalions using the CCTT. Draft CATS were provided by the Infantry and Armor schools. These were used to identify potential training event candidates for tradeoff with CCTT which will result in OPTEMPO savings.

Integration of Results/Selection of Preferred Alternative

The goal of the CTEA process is to provide decision makers with information to evaluate the merits of each study alternative and the likely effects of each choice. The alternatives in this CTEA are illuminated in the context of the study issues. This is done by showing several cost comparisons between the alternatives and also a qualitative assessment of the training effectiveness of the each alternative. The criterion of choice for the preferred alternative is that alternative which will best support the training mission of the Army. The factors include the cost of an alternative as well as the benefits derived from that alternative. This CTEA, not unlike other analyses, addresses many complex issues. Although this analysis takes an equal effectiveness and variable cost approach, the least costly alternative may not be the preferred. The preferred alternative is that alternative that best supports the Army training mission.

Chapter 3. Effectiveness Analysis Results

This section describes the results of the effectiveness analysis which focused on evaluating the performance of the CCTT prototype, SIMNET-T. The rationale behind this approach was that (1) No CCTT simulators have been developed and, therefore, no CCTT performance data is available, (2) SIMNET-T most closely represents CCTT, (3) Many studies have been conducted on the SIMNET system, and (4) It is assumed that the CCTT will be more effective than SIMNET-T since deficiencies and requirements noted during five years of SIMNET use will be valuable input to CCTT development. The data base for the effectiveness evaluation consisted of four components. These components were the TDR, the SIMNET-T studies, the CCTT system specification review and intangible benefits compiled from the SIMNET experience.

Analysis of Tasks CCTT Trains - TDR Review

The TDR lists the specific tasks the CCTT is required to train. According to the TDR training with CCTT parallels field training. It is based on the ARTEP MTP listed in table 4.

Table 4. Training Basis for CCTT

Branch	Level	Manual
CAVALRY	Scout Platoon	ARTEP 17-57-10-MTP
ARMOR	Tank Platoon	ARTEP 17-237-10-MTP
INFANTRY	Platoon	ARTEP 7-8-MTP
CAVALRY	Reg Cav Troop	FC 17-97-1-MTP
TANK MECH	Company Team	ARTEP 71-1-MTP
TANK MECH	Battalion TF	ARTEP 71-2-MTP

The manuals identify many tasks the units are required to perform. Of all the tasks identified in these manuals, 147 are included in the TDR as tasks the CCTT will be required to train. Analysis of the TDR tasks resulted in task groupings by functional area. These groupings are listed in table 5. Results of this analysis indicates that the CCTT will primarily be used as a maneuver trainer as over half of the task are contained in that group.

Table 5. CCTT TDR Task Groupings by Functional Area		
Area	Number of Tasks	Percent
ADA	9	6
C3	26	18
CSS	12	8
FIRE SPT	5	3
INTEL	8	6
MANEUVER	75	51
MCS	12	8
Total	147	100

Only a sub-set of the MTP tasks listed in the CCTT TDR will be tested during IOTE and these are listed in table 6 below. They are CO/TM level tasks contained in ARTEP 71-1. These tasks were selected for testing because the initial fielding of CCTT will be at company/team level and below.

Table 6. Tasks CCTT Trains (Planned for Testing During IOTE) Armor and Mechanized Infantry Company Team		
Functional Area	Task Number	Task
ADA	44-2-C001	Defend against air attack (passive)
ADA	44-2-C002	Defend against air attack (active)
C3	17-2-0101	Prepare for combat
CSS	17-2-0702	Perform tailgate resupply
CSS	17-2-0703	Perform service-station resupply
FIRE SPT	17-2-0401	Employ indirect fire in the offense
FIRE SPT	17-2-0402	Employ indirect fire in the defense
INTEL	17-2-0201	Maintain operation security
MANEUVER	17-2-0202	Perform reconnaissance
MANEUVER	17-2-0301	Perform tactical movement
MANEUVER	17-2-0302	Perform tactical road march
MANEUVER	17-2-0303	Perform passage of lines
MANEUVER	17-2-0304	Perform actions on contact
MANEUVER	17-2-0306	Support by fire
MANEUVER	17-2-0307	Occupy objective rally point
MANEUVER	17-2-0309	Perform ambush
MANEUVER	17-2-0311	Perform and attack by fire
MANEUVER	17-2-0321	Delay
MANEUVER	17-2-0325	Occupy assembly area
MANEUVER	17-2-0326	Assault an enemy position
MANEUVER	17-2-1021	Defend
MCS	17-2-0501	Breach an obstacle

Analysis of SIMNET-T Related Studies

The evaluation of SIMNET-T performance was accomplished by analysis of the studies conducted on SIMNET-T. The study titles and organizational agency used to support this CTEA are listed in table 7. While the scope of these studies varied, in general they addressed soldier perceptions of the training effectiveness, training value, and training realism of the SIMNET-T. Most of the studies focused on groups of tasks that might be trained using SIMNET-T. The task groups included both broad areas (e.g., maneuver) and specific subtasks. Several of the studies listed the specific tasks that the system trained. The data collected was qualitative and based on the perceptions of subject matter experts and students who had hands-on SIMNET training experience.

Table 7. Studies Used in Support of CCTT CTEA

Doc.#	Short Title	Study Agency
1	SIMNET Assessment of Perceptions I	TRAC-WSMR
2	SIMNET Assessment of Perceptions II	TRAC-WSMR
3	Concept Eval. Program of SIMNET	Armor Eng Bd
4	SIMNET Prelim. Tng. Dev. Study (PTDS)	Armor School
5	Institutional/USAIS/SIMNET (I&II)	USA Inf Sch
6	Institutional/USAIS/SIMNET (III&IV)	USA Inf Sch
7	Evaluation of SIMNET/Inf Officer Crs	USA Inf Sch
8	CCTT Force Dev. Testing & Exp. (FDTE)	TEXCOM CATC
9	Transfer of SIMNET Tng. in Armor Officer Basic (AOB)	US ARI
10	Indepent Verification Validation/SIMNET	PSE Inc
11	SIMNET Users' Guide (Armor)	Armor School
12	SIMNET Users' Guide (Mech.Inf.)	USA Inf Sch

Several of the studies listed benefits of training with SIMNET. They reported that SIMNET provides for (1) training without expending field training resources, (2) a maneuver area without the restrictions imposed on field training areas, and (3) repeated practice. From the unit trainer's point of view, SIMNET provides a means for practicing collective combat skills in a stressful environment. It was seen as a part-task training device supporting leader and staff training. The functional areas of command, control, communications, and maneuver are the emphasis of most exercises. These exercises, conducted under conditions that duplicate some of the "fog of war" and stress of combat, are at the platoon, CO/TM, and BN/TF level. Studies note that SIMNET does not, nor was intended to, support all of a unit's training requirements. For example, it is not a precision gunnery trainer. Table 8 compiles the general training areas addressed in each of the studies. An "X" in the table indicates that the study addressed training tasks in a major area.

Table 8. Summary of SIMNET Study Review

Study Title	Cmd-Ctl	Comms	Tac-Pln	Navigation	Maneuver	Gunnery	Leadership	Teamwork
1SIMNET PERCEPTIONS I	X	X				X		X
2SIMNET PERCEPTIONS II		X						X
3SIMNET CEP	X				X	X	X	X
4SIMNET PTDS	X				X		X	
5SIMNET EVAL INFSCH	X	X	X		X			X
6SIMNET EVAL INFSCH	X		X		X		X	
7SIMNET EVAL INFSCH	X	X		X	X	X		X
8CCTT PTDS	X	X		X	X		X	
9SIMNET AOB	X	X					X	X
10SIMNET I V&V		X			X	X		
11SIMNET USERS GUIDE ARMOR	X		X		X			X
12SIMNET USERS GUIDE INF	X	X	X		X			X

The review revealed that SIMNET-T was most often employed to train tasks in the following areas:

- Command and control
- Maneuver techniques
- Land navigation
- Tactical training
- Tactical planning
- Fire distribution
- Platoon gunnery procedures
- Reporting procedures
- Teamwork
- Leadership
  - Team building
  - Team coordination

The areas most frequently identified in SIMNET-T as training shortfalls were:

- Limited vision
- Visual presentations (beyond 1000 meters)
- Dismounted troop exercises
- Human factors including disorientation
- Negative training:
  - Unrealistic driving responses
  - Unrealistic loader procedures
  - Regarding crew safety procedures

These SIMNET-T training effectiveness results, with few exceptions, were based on the perceptions of subject matter experts and students who had experienced training in this device. While some evidence of training transfer is noted, the overall training effectiveness of SIMNET-T was never established.

In summary, based on analysis of the twelve SIMNET-T studies, it was concluded that the CCTT has the potential to provide for effective training in several broad areas. The primary tasks addressed during SIMNET-T training exercises can be grouped into the following areas:

- Command, control, and communications
- Maneuver and navigation
- Teamwork and leadership

The CCTT can be used to train, to a lesser degree, certain procedures related to gunnery, target acquisition and driving. Due to the fidelity of the surrogate system, SIMNET-T, there may be some adverse impacts on training these subordinate tasks. The higher fidelity offered by the CCTT has the potential to remedy this problem.

Results of CCTT System Specification Review (SSR)

The purpose of the SSR was to provide an independent assessment of the CCTT system specifications by a TRAC evaluation team. The purpose of this evaluation was to provide an objective assessment of the overall suitability of the specifications. Six areas were identified and assigned to team members who had a particular interest or expertise. The five functional areas were: command, control and logistics, weapon systems, vehicle mobility, graphics, and semi-automated forces (SAFOR). An evaluation of training effectiveness was performed by the RAND Corporation. Potomac Systems Engineering collated and coordinated all of the findings. The review generated 63 specific comments and 12 recommended rewrites. The results of the CCTT specification review identified the following problem areas:

Command, Control and Logistics

The specifications should require the simulation of interference and jamming.

The capability for semi-automated forces to exploit operations security weaknesses should be included in the specifications.

Description of unit maintenance and supply at each echelon are not included.

Supply vehicles should have the capability of becoming lost.

Dynamic terrain should be included as a basic requirement for CCTT.

Weapon Systems

There is no specification for the squad leader to be able to determine the range to a target.

The specification of the M1 and M2/M3 turret simulations does not provide enough details.

The description of the simulation of the TOW Missile needs improvement.

Vehicle Mobility

The specifications lack details on how aspects of terrain will affect vehicle mobility.

The soil types for specified training environments should be modeled.

Testing should be conducted to ensure simulated vehicles respond in "real world" fashion.

Specifications for modeling different soil types should be included.

Graphics

The limitation of 15 packets per second per vehicle may be too restrictive given current local area network (LAN) technology.

The use of two computers (host and graphics generator) may be too specific. Perhaps a single, multi-processor machine could be used.

The requirement for a 3500 meter "gaming area" may adversely impact the requirement to train collective skills for "tactical navigation, movement" etc.

The image resolution requirements appear to be less than currently available in SIMNET.

Image generation requirements for polygon throughput are lower than currently available with off the shelf systems.

Detection requirements do not include the criteria for determining success.

SAFOR

Requirements for the SAFOR in the TDR are too brief. The system specifications need much more detailed requirements in the areas of tactics, doctrine, equipment, and structure. This detail is needed for the both threat and friendly SAFOR.

Training Effectiveness

The training management capability needs to be enhanced.

The criteria used to determine level of "training realism" are not specified.

The capability to "browse" system data should be added as a requirement.

Detailed information on the SSR is at appendix C.

Analysis of Intangible Benefits of Using CCTT to Train

There is value in using CCTT in both armor and infantry units. This value is evident by the reductions in platoon and CO/TM level OPTEMPO as shown by both armor and infantry schools. Both schools produced CATS incorporating the CCTT. In addition, CCTT has potential intangible benefits which may not be quantifiable by cost savings or cost avoidance. These benefits include:

- Continuous training
- Range relief
- Efficient use of ranges
- Health and safety factors
- Environmental aspects
- Reserve readiness
- Efficient feedback of training activities

With the fielding of CCTT, OPTEMPO miles will be reduced which will provide for longer combat vehicle life. With reduced field training, a like reduction in field training accidents should occur. In addition CCTT may decrease the amount of environmental damage caused by maneuver. Since training devices have inherent increased availability, CCTT should provide increased familiarity by crews. This is especially true for reserve components which have limited exposure to the actual equipment. Using the CCTT the unit can sustain many repetitions of an event. These repetitions can be accomplished very quickly allowing for immediate correction of problem areas. The multiple locations of the CCTT, near the troops, eliminates time enroute to and from the training areas. Finally, the opposing force associated with CCTT is more doctrinally correct and the opposing force size can be modified to meet the training mission.

If the decision is to continue development, further analysis should be conducted to quantitatively determine the ability of CCTT to train certain tasks. The "benchmark tasks" have been identified in the Test and Evaluation Master Plan (TEMP). The ability of analysts to measure group performance of tasks will remain complicated both by internal and external factors. However, efforts should be made to obtain this quantitative data.

Summary of Results

Overall, based on the surrogate system SIMNET-T, the CCTT has the potential to train ARTEP MTP tasks related to (1) command, control, and communication, (2) maneuver and navigation, and (3) teamwork and leadership.

The CCTT may train, to a lesser degree, some procedures related to gunnery, target acquisition, and driving a vehicle. However, due to the fidelity of the current SIMNET-T, analysis shows some of these lesser trained tasks might have negative impacts. The CCTT has the potential to overcome these negative impacts during its initial development.

When built and tested, the capability of CCTT to train individual and collective tasks effectively will be better defined. Based on analysis of a prototype system (SIMNET-T), the TDR, and the Army's experience with training via simulation, CCTT shows good potential in training the ARTEP MTP tasks listed in the TDR. While it may only partially train some tasks the device was never intended as a replacement for all field training. Field training using the actual equipment remains an important of each CATS.

Quantification of CCTT's value is shown by OPTEMPO savings shown in the revised CATS (Armor/Infantry). These schools incorporated CCTT and reduced other training activities. The element not captured in the resource analysis is the intangible "added value" to the Army. While this value may be clear, it remains unmeasurable in precise cost savings or cost avoidance. Part of the "payback" the Army receives from CCTT is trained soldiers, platoons and CO/TMs. The decision about the cost effectiveness of this device may well remain in the area of "added value." The added value areas of CCTT includes: (1) convenient access to training, (2) relief on training areas, (3) efficient use of training areas, (4) health and safety factors, (5) environmental aspects, (6) reserve readiness and (7) efficient feedback of training activities.

Conclusions

CCTT shows potential to be a training effective addition to the Army's training program. If the ASARC decision is to continue development, further analysis on CCTT should be considered to address quantitatively the issues of the ability of CCTT to train specific tasks. The TEMP identifies the "benchmark tasks" for testing during IOTE.

The ability of analysts to measure group performance of these tasks remains complicated both by internal and external factors. However, efforts by the analytical community should be made to address the CCTT's training effectiveness in a quantitative manner.

Chapter 4: Cost Analysis

Introduction

Purpose

This chapter presents the cost analysis portion of the CCTT CTEA conducted in support of the milestone IIA/IIB ASARC for the CCTT program.

Background and Statement of the Problem

The CCTT is both a supplement to and substitute for maneuver training. SIMNET-T, the forerunner of CCTT, has many deficiencies which will be corrected in CCTT. As a result of these design deficiencies and limited testing on SIMNET-T only insights that have been gained into the extent CCTT training can be substituted for maneuver training in the field are considered. The CCTT is competing with other major combat and combat service support systems for funding. Both training effectiveness and cost savings realized by substitution of CCTT training for OPTEMPO miles are significant input to the CCTT milestones IIA/IIB ASARC decision.

Objective

The objective of the cost analysis effort was to compare the cost of training with and without CCTT and to identify implications associated with payback with OPTEMPO.

Scope

The scope of this analysis included comparing the training and pay back implications associated with training wit . and without CCTT. The analysis addressed:

An LCC analysis for CO/TM (546 simulators) and an extended capability BN TF (958 simulators).

A payback analysis to determine the reduction in AC OPTEMPO miles required to payback AC CCTT LCC during the 15-year service life and the reduction in RC OPTEMPO miles required to payback the RC LCC during its service life.

A break-even analysis to assess the implications of the potential reduction in OPTEMPO miles as provided by the Armor and Infantry schools.

A sensitivity analysis to determine the impact on payback of: 1) a 10-year service life, 2) an increase in the CCTT LCC and 3) an increase in the CCTT LCC as a result of the Army cost position (ACP).

Cost Data

The CCTT LCCE used is the draft BCE as of March 1991. The BCE does not reflect the ACP since it was not available at the time of completion of this report.

The BOIP and the fielding plan used in the analysis is the same as in the BCE and based on the acquisition of 546 simulators.

The TRM was provided by HQ DA (DAMO-TR) using the latest cost factors from the CEAC. This model provided the OPTEMPO cost per mile savings for the battalions serviced by the CCTT.

Draft CATS were provided by the Infantry and Armor schools and were used to identify potential trade-offs by using CCTT which result in OPTEMPO savings.

Alternatives

The training alternatives compared in the study were:

Alternative 1 (Base Case). The base case represents the current training strategy. It includes all field training events defined in the training strategies (CATS) and the associated resources required to accomplish these events annually.

Alternative 2 (CCTT). Alternative 2 represents a training strategy which incorporates CCTT into the basecase which augments and enhances training, allowing units to train to the same skill level with reduced OPTEMPO. Table 9 contains the number of mile reductions projected for the trade-off with the acquisition of CCTT for the AC. These projections must be validated by testing of CCTT. The reserve component (RC) has not projected a reduction of OPTEMPO miles with the fielding of CCTT.

Table 9. Field Training Tradeoff Miles

	Active Component			
	Armor		Infantry	
Unit	Total/Veh	Reduction	Total/ Veh	Reduction
Company/Team	800	108	742	96
Battalion/TF	800	172	742	111

Cost Methodology

The cost analysis methodology consisted of three distinct efforts: (1) Development of data inputs, (2) Calculation of OPTEMPO savings to payback the CCTT LCC, and (3) Calculation of BEP and net savings relative to the OPTEMPO reductions. Figure 2 shows the major segments of the analysis. The first major input is the CCTT BCE which provides the total LCC for the CCTT. The basis of issue for the BCE is for 546 simulators in support of the company team field training for the AC and the RC. Next, the TRM provides the basis for determining the cost savings per mile per battalion. A detailed explanation of the TRM and the outputs used in the analysis are in appendix B. The primary model feeding the TRM are the BLTM which outputs the equipment needed to perform training functions and the number of miles required, by system, in the unit to attain each readiness level. The other equipment in the unit which consumes resources are prorated against the major end item of the unit. The CEAC furnishes the model with the OPTEMPO factors based on POL consumption, repair parts and secondary item usage, and depot level maintenance repair. The TRM contains the BLTM for a generic battalion, and the BLTM can show the resource implication of exercising the unit on a per mile basis. The factors from the model are directly applicable to this study. The last major input is the balanced force structure projected for the FY97 time frame for the AC (table 10) which is used to determine the total number of battalions serviced by the CCTT. The projected RC force structure in FY97 and beyond is 55 battalions (39 tank, 16 Bradley Fighting Vehicle (BFV)). These inputs support the LCC payback and sensitivity analysis previously discussed in the cost analysis scope.

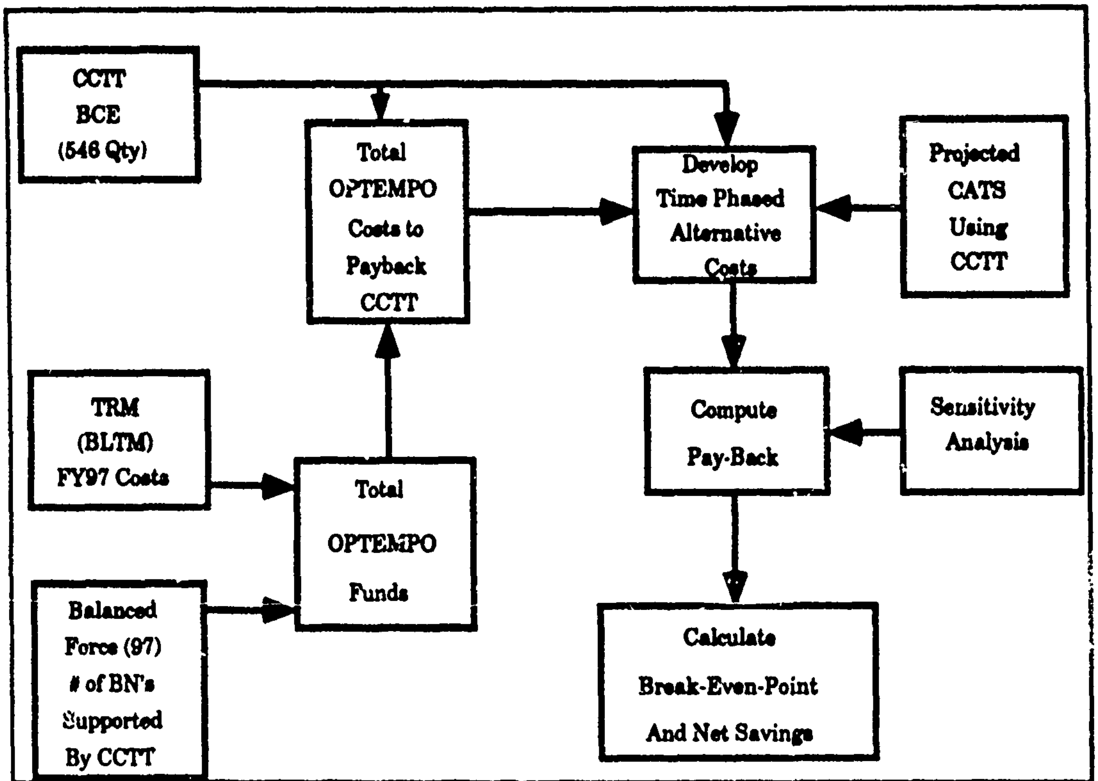

Figure 2. CCTT-CTEA Cost Methodology

Table 10. FY97 Balanced Force - Active Component Number of Battalions & Squadrons Supported by CCTT (132 Simulators)

FY	Location	Tnk Bns	Mech Inf Bns	Div Cav Sqdn	Reg Cav Sqdn
96	Hood (1 Cav)	(Test Period - No OPTEMPO Tradeoff)			
96	Jackson (Tk MB)				
96	Jackson (BFV MB)				
97	Hood (1 Cav)	5	4	1	0
98	Knox (194 AB)	1	1	.25	0
99	Benning (197IB)	1	1	.25	0
99	Riley (1ID)	3	3	1	0
99	USAREUR Site 3	6	6	1	0
99	Stewart (24ID)	4	5	1	0
99	USAREUR Site 2	0	0	0	3
00	Bliss (3rd ACR)	0	0	0	3
00	Polk (5ID)	3	3	1	0
00	Carson (4ID)	3	3	1	0
00	USAREUR Site 1	6	6	1	0
00	EUSA	2	2	1	0
	Total	34	34	8.5	6

Cost Analysis Results

Cost Analysis Limitations

This analysis is based on the reductions in OPTEMPO miles required to pay back CCTT during its service life and savings/net costs associated with various levels of reductions in OPTEMPO miles. Field training trade-off projections have been indicated in table 9 as potential reductions by the Infantry School and the Armor School but have not been approved by TRADOC or HQ DA.

Ground Rules/Assumptions

SIMNET-T is not included in the cost analysis (sunk cost).

Both the AC and RC OPTEMPO miles will be considered separately for potential payback. The CCTT service life is 15 years.

The cost of simulator upgrades or replacement will be included in the new or PIP system costs.

Pay back occurs as the CCTT simulators are fielded in the supported battalions.

While equivalent percent reductions are required for all vehicles, OPTEMPO savings are expressed for tank miles only.

Costs are presented in constant FY92 and in current dollars. Costs prior to FY91 are considered sunk while those in FY91 are costs to complete.

A C-2 readiness level is assumed for the battalions utilizing CCTT. This is 800 OPTEMPO miles per tank per year for the AC and 288 OPTEMPO miles per tank per year for the RC.

OPTEMPO funds available for potential savings are based on FY97 OPTEMPO funding levels for the projected active and reserve force supported by the CCTT.

Total OPTEMPO funds include those for both maneuver and gunnery. Trade-offs consider the total funds available.

CO/TM Cost Analysis

LCC Analysis. The CCTT LCCE used in this analysis is the CO/TM CCTT BCE. The BCE is based on 432 AC simulators located at fixed sites and 114 RC simulators located in mobile units. Figure 3 shows LCC in constant FY92 dollars broken out by AC costs and RC costs time-phased through the 15-year system life. The data shows the initial delivery in FY97 and the phase-out of each simulator after 15 years. Appendix B shows detailed costs by activity from the CCTT BCE for the BOIP of 546 simulators for the AC and the RC company team training. The data is shown in both BY92 constant and current dollars time-phased over the system life.

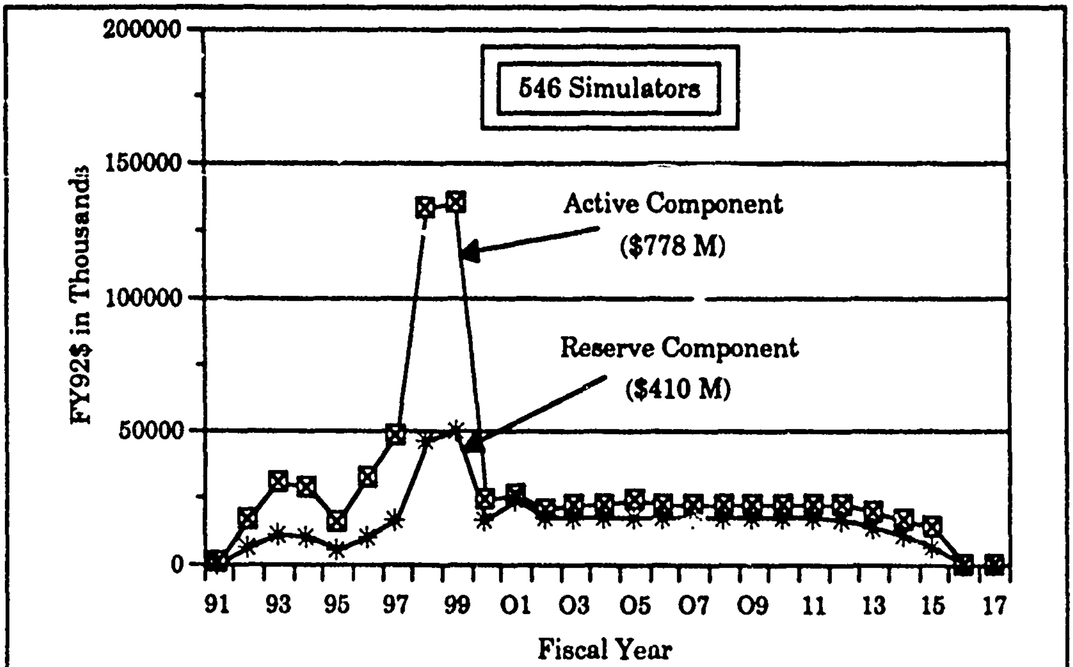

Figure 3. CCTT Life Cycle Costs

The CCTT LCCE is additionally broken out in table 2 according to major cost activities: 1.0 Development, 2.0 Production, 3.0 Military Construction, 4.0 Fielding and 5.0 Sustainment. Sustainment is further broken out by the constituent appropriations. The RC, while constituting only 21 percent of the total simulators, represents 35 percent of the total LCCE. The RC sustainment cost is 43 percent of the total sustainment cost. While Operations and Maintenance Army (OMA) costs are the largest part of the sustainment cost in both components, the RC OMA cost represents 85 percent of RC sustainment compared to 65 percent in the AC OMA. The difference is the large cost for travel and transportation required by the mobile units in the RC.

The difference is the large cost for travel and transportation required by the mobile units in the RC.

Table 1. CCTT Life Cycle Costs (Constant FY92 Million $)					
Cost Element	Total	RC	Percent of Total	AC	Percent of Total
Simulators	546	114	21	432	79
Total	$1,188	$410	35	$778	65
1.0 Dev	171	40	23	131	77
2.0 Prod	362	102	28	260	72
3.0 MCA	41	0	0	41	100
4.0 Field	2	2	100	0	0
5.0 Sust	612	265	43	347	57
OMA	444	227		217	
Prod	160	40		121	
MPA	9	0		9	

Payback Analysis. The payback analysis was conducted to determine how many OPTEMPO miles, expressed in equivalent tank miles, must be traded off by the AC and RC to pay for their respective portion of the CCTT LCC during the 15-year service life. Also, this analysis addressed the implication of the projected OPTEMPO mile trade-offs provided by the Armor and Infantry Schools on payback of the AC portion of the CCTT LCC. The RC has no projection for OPTEMPO mile trade-offs.

Figure 4 indicates the AC will have to trade off 61 (7.6 percent) of the 800 tank miles to pay back the AC CCTT LCC in 15 years. The 108 tank and 96 BFV miles projected by the Armor and Infantry Schools will provide a breakeven by year 2006 with a total end of life (EOL) savings of $771 million (current dollars). Payback for the RC portion (figure 5) of the CCTT LCC by the EOL will require 45 (15.6 percent) of its 288 tank miles per year.

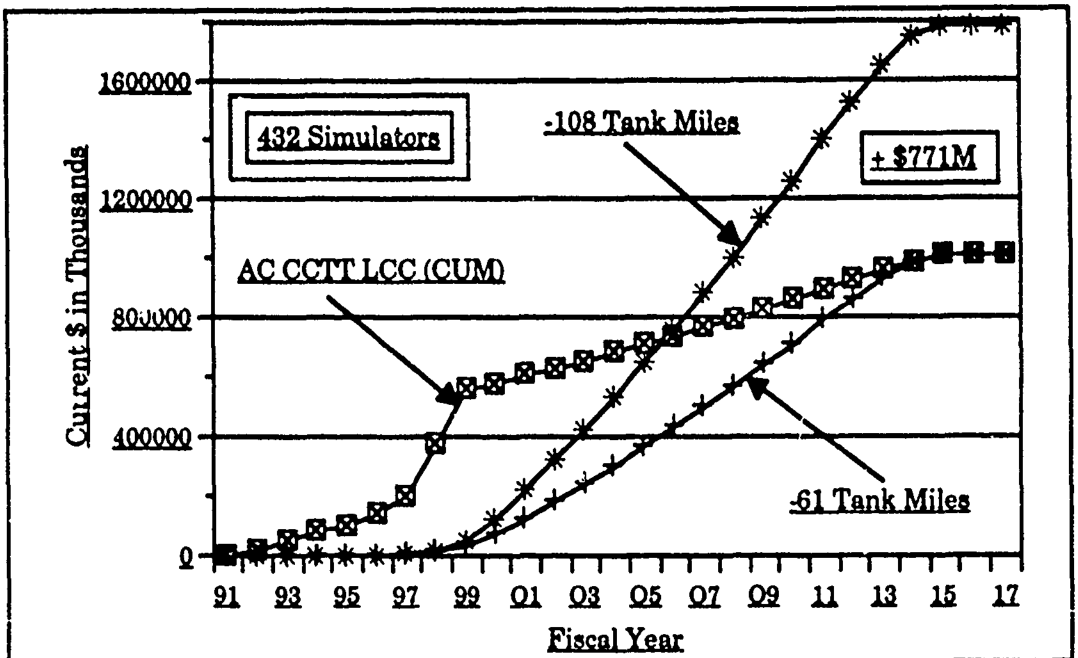

Figure 4. CCTT AC LCC Versus AC OPTEMP

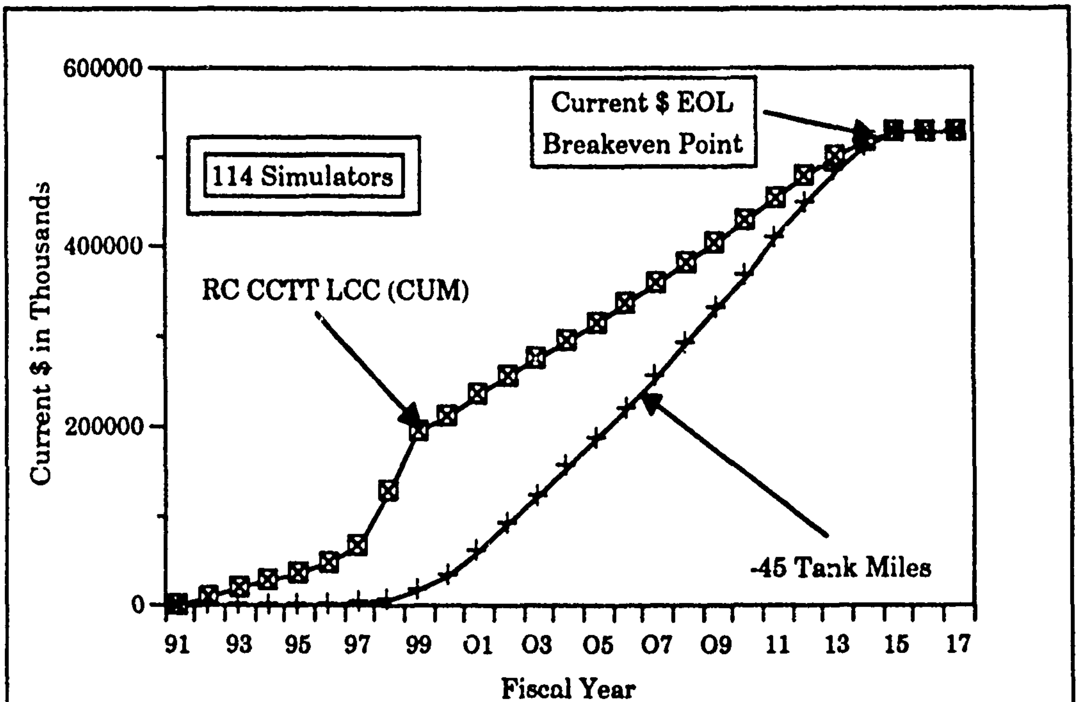

Figure 5. CCTT RC LCC Versus RC OPTEMP

BN TF Excursion

LCC Analysis. A rough order of magnitude (ROM) LCCE was developed in cordination with PM TRADE to extend the training capability of the AC to a BN TF level while still acquiring the Platoon Set training capability for the RC. The ROM estimate was based on 844 fixed site simulators for the AC and 114 mobile simulators for the RC. The ROM estimate for both the AC BN level and RC CO/TM training capability is $2.1 billion (constant FY92 dollars). The AC and RC portion of the ROM estimate is $1.7 and $.4 billion, respectively.

Payback Analysis. The number of tank OPTEMPO miles required to fully pay back the AC BN TF level ROM estimate during the 15-year service life was identified. The implication of OPTEMPO mile trade-offs projected by the Armor and Infantry Schools for an AC CCTT BN TF level training capability was also addressed. The payback for the RC was the same as in the CO/TM payback analysis and is not discussed further under this excursion. Figure 6 indicates the AC will have to trade-off 114 (14.3 percent) of its 800 miles per tank per year to pay back the AC portion of the BN TF level ROM estimate. The Armor and Infantry Schools projected 172 Tank and 111 BFV OPTEMPO miles (table 9) could be traded off if a BN TF level training capability is acquired. A trade-off of 172 (21.5 percent) of the 800 tank miles and 111 (15 percent) of the 742 BFV miles provided a breakeven for the AC BN TF level ROM estimate at year 2009 with an EOL savings of $715 million current dollars.

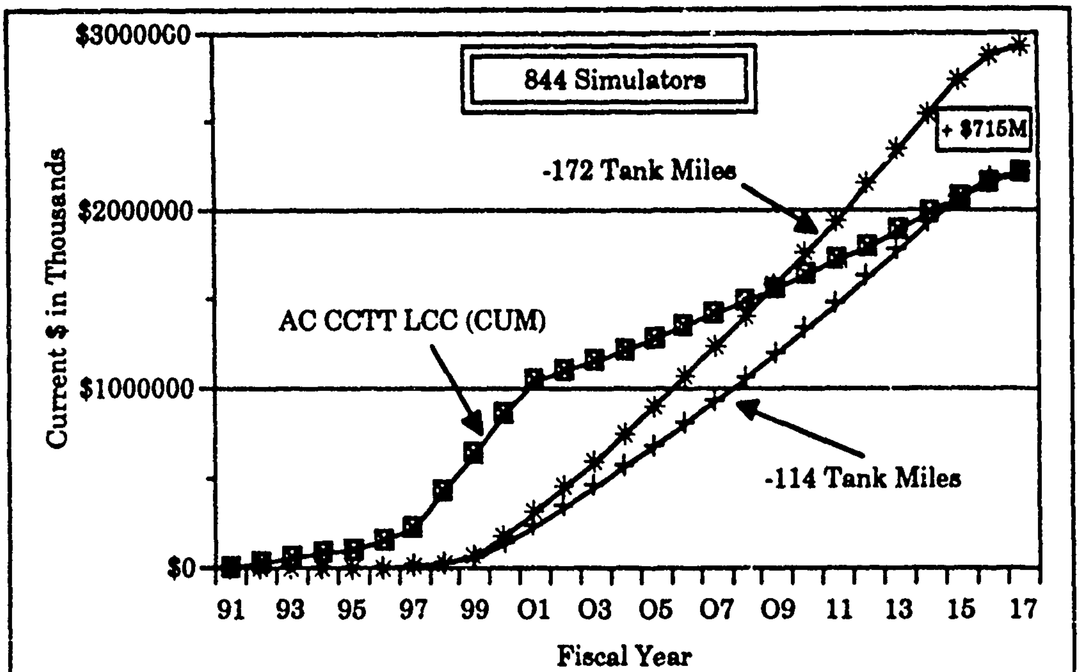

Figure 6. CCTT AC LCC Versus AC OPTEMP

Sensitivity Analysis

A breakeven analysis was conducted to determine the number of OPTEMPO miles required to pay back the CO/TM LCC for the AC and RC in a ten-year service life. The calculations show that a 70-mile reduction is required to pay back the AC portion of the LCC by the tenth year of operations and 50 miles for the RC LCC.

Another analysis was conducted to determine the sensitivity of OPTEMPO savings resulting from cost growth of the CO/TM CCTT program. For every one percent increase in CCTT LCC a reduction of about one OPTEMPO mile is required to pay back CCTT during its service life.

Since no approved ACP was available, an analysis was conducted to determine the impact on OPTEMPO miles for an increase/decrease in the ACP from the BCE.

Findings CO/TM (545 Simulators)

LCC Analysis. Total LCCE is $1.19 billion (FY92 constant) with $0.41 billion RC and $0.78 billion being the AC.

The RC, with only 21 percent of the simulators, represents 35 percent of the LCCE. The RC sustainment cost is largely OMA costs driven by the heavy travel and transportation requirements of the mobile units.

Payback Analysis. A trade-off of 61 miles per tank or 7.6 percent of the AC 800 miles per tank per year is required to fully payback the AC portion of the CCTT LCC during the 15-year service life. The 108 mile trade-off projected by the Armor School for a CCTT CO/TM training capability will provide a breakeven in year 2006 with an end of life savings of $771 million.

The RC portion of the CCTT will require 45 OPTEMPO miles per tank annually. This represents 15.6 percent of the RCs annual OPTEMPO tank miles. In terms of OPTEMPO percentage, this is twice that of the AC OPTEMPO miles required to payback a CCTT CO/TM training capability.

Findings BN TF Excursion (958 Simulators)

LCC Analysis. The total ROM for a BN TF level (844 simulators) for the AC and CO/TM (114 simulators) for the RC is $2.1 billion (FY92 constant dollars). The BN TF level capability for the AC is $1.7 billion and the CO/TM for the RC is $0.4 billion.

Payback Analysis. A trade-off of 114 miles per tank per year or 14.3 percent of the 800 tank miles per year is required to fully pay back the AC portion of the CCTT during the 15-year service life. The payback required for the RC portion of the ROM estimate is unchanged from that in the CO/TM analysis, 45 miles or 15.6 percent of the 288 tank miles per year.

The 172 tank and 111 BFV mile trade-offs projected by the Armor and Infantry Schools for a CCTT BN TF level training capability will provide a break-even in year 2009 and a $715 million end of life savings.

Summary and Conclusions

The analysis indicates that the AC portion of the CCTT LCC will be fully paid back during the service life for either a CO/TM or BN TF level acquisition.

The CO/TM simulators account for all of the savings. The BN TF CCTT pays back the LCC but doesn't contribute to additional savings.

The extent of the payback indicated by the analysis must be validated during CCTT testing.

Chapter 5. Findings and Conclusions

This section contains a summary of the findings of this CTEA. The study results are first shown in the context of answers to the study objectives and EEA. The study findings are then summarized. The final paragraph contains the study conclusion and some ideas related to future analysis on CCTT.

Answers to Objectives and EEAs

Objective 1: Determine the training value and resource implications of integrating CCTT into the armor and mechanized infantry CATS.

Overall, based on the surrogate system SIMNET-T, the CCTT has potential to train ARTEP MTP tasks related to (a) command, control, and communication, (b) maneuver and navigation, and (c) teamwork and leadership.

It is likely that a 70 OPTEMPO mile reduction in the AC CO/TM training program will pay back the AC LCC within the system life.

EEA 1: What is the capability of CCTT to provide training of MTP tasks at CO/TM level?

EEA 2: What is the training value of CCTT in providing combined arms training for close combat units?

When produced and tested, the capability of CCTT to train individual and collective tasks effectively will be better defined.

Based on analysis of a prototype system (SIMNET-T), the TDR, and the Army's experience with training via simulation. CCTT shows good potential in training CO/TM level ARTEP MTP tasks fully or partly.

Objective 2: Compare the cost of training with and without CCTT to identify the potential payback in OPTEMPO.

See Cost Analysis, chapter 4.

EEA 3: What are the estimated CCTT LCCs?

See Cost Analysis, chapter 4.

EEA 4: What are the benefits and resource trade-offs as a result of incorporating CCTT into a branch CATS ? What is the projected payback during the service life of CCTT? What is the time required to fully payback CCTT LCCE?

Total CCTT LCC (15 years) - A reduction of 93 miles per tank per year is required.

AC only (15 years) - A reduction of 60 miles per tank per year is required.

The Infantry/Armor School projected 70-mile reduction will break even for AC in 10 years with a 75 percent payback of total CCTT LCC at 15 years.

EEA 5: What are the budget implications of CCTT? What is the projected reduction in OPTEMPO dollars? How do CCTT costs compare to potential payback?

EEA 6: What are the armor and infantry impacts (OPTEMPO) associated with CCTT utilization?

See Cost Analysis, chapter 4.

EEA 7: What are the other resource implications associated with CCTT?

Quantification of CCTT's value is shown by OPTEMPO savings shown in the revised CATS (Armor/Infantry). These schools incorporated CCTT and reduced other training activities. The element not captured in the resource analysis is the intangible "added value" to the Army. While this value may be clear, it remains unmeasurable in precise cost savings or cost avoidance. Part of the "payback" the Army receives from CCTT is trained soldiers, platoons, and CO/TMs. The uncertainty about the cost and training effectiveness of this device may well remain in the area of "added value". The added value areas of CCTT includes: (a) convenient access to training, (b) relief on training, (c) efficient use of ranges, (d) health and safety factors, (e) environmental aspects, (f) reserve readiness, and (g) efficient feedback of training activities.

Effectiveness Findings

Overall, based primarily on the surrogate system SIMNET-T, the CCTT can train ARTEP MTP tasks related to (1) command, control, and communication, (2) maneuver and navigation, and (3) teamwork and leadership.

To a lesser degree, the CCTT may train some procedures related to gunnery, target acquisition, and driving. Due to the fidelity of the current SIMNET-T some of these less trainable tasks might have negative impacts. The CCTT has the potential to overcome these negative impacts during its initial development.

Cost Findings

Company/Team (545 Simulators)

LCC Analysis

Total LCCE is $1.19 billion (FY92 constant) with $0.41 billion RC and $0.78 billion being the AC.

The RC, with only 21 percent of the simulators, represents 35 percent of the LCCE. The RC sustainment cost is largely OMA costs driven by the heavy travel and transportation requirements of the mobile units.

Payback Analysis

A trade-off of 61 miles per tank or 7.6 percent of the AC 800 miles per tank per year is required to fully payback the AC portion of the CCTT LCC during the 15-year service life. The 108 mile trade-off projected by the Armor School for a CCTT CO/TM training capability will provide a breakeven in year 2006 with an end of life savings of $771 million.

The RC portion of the CCTT will require 45 OPTEMPO miles per tank annually. This represents 15.6 percent of the RCs annual OPTEMPO tank miles. In terms of OPTEMPO percentage, this is twice that of the AC OPTEMPO miles required to payback a CCTT CO/TM training capability.

Battalion Task Force Excursion (958 Simulators)

LCC Analysis

The total ROM for a Bn TF level (844 simulators) for the AC and CO/TM (114 simulators) for the RC is $2.1 billion (FY92 constant dollars). The Bn TF level capability for the AC is $1.7 billion and the CO/TM for the RC is $0.4 billion.

Payback Analysis

A trade-off of 114 miles per tank per year or 14.3% of the 800 tank miles per year is required to fully pay back the AC portion of the CCTT during the 15-year service life. The payback required for the RC portion of the ROM estimate is unchanged from that in the CO/TM analysis, 45 miles or 15.6% of the 288 tank miles.

The 172 tank and 111 BFV mile trade-offs projected by the Armor and Infantry Schools for a CCTT Bn TF level training capability will provide a break-even in year 2009 and a $715 million end of life savings.

Summary and Conclusions

The capability of the CCTT to train individual and collective tasks effectively will not be known with certainty until the device is built and tested. Analysis based upon a surrogate system (SIMNET-T), the requirements/specifications of the TDR, and the Army's experience with training via simulation would indicate that CCTT has the potential to train ARTEP MTP tasks fully or partly. The CCTT is designed to augment traditional training in the field. The CCTT shows potential to be an effective training addition to the Army's training program.

The present value of the CCTT can be quantified in terms of OPTEMPO savings as indicated by revised CATS (Armor/Infantry) incorporating CCTT and reducing other training activities. The element that is not captured in this resource analysis is the "added value" to the Army. This value is evident but unquantifiable in terms of precise cost savings or cost avoidance. The real "payback" of this system is trained soldiers/companies/teams and not dollars. The added value of CCTT includes: (1) convenient access to training, (2) relief on training areas, (3) efficient use of ranges, (4) health and safety factors, (5) environmental aspects, (6) reserve readiness and (7) efficient feedback of training activities.

The analysis indicates that the AC portion of the CCTT LCC will be fully paid back during the service life for either a CO/TM or Bn TF level acquisition.

The CO/TM simulators account for all of the saving. The Bn TF CCTT pays back the LCC but doesn't contribute to additional savings.

The extent of the payback indicated by the analysis must be validated during CCTT testing.

If the decision is to continue development, further analysis should be conducted to quantitatively determine the ability of CCTT to train certain tasks. The "benchmark tasks" have been identified in the TEMP. The ability of analysts to measure group performance of tasks will remain complicated both by internal and external factors. However, efforts should be made to obtain this quantitative data.

Appendix A: Performance Analysis Supporting Data

This appendix contains summaries of the analyses used to support the performance analysis of CCTT. It includes ten reports about the SIMNET system and two users guides related to SIMNET. In general, the results of these analyses indicate the major areas that can be trained using SIMNET. Some of the studies indicate specific tasks that can be trained using the system. It is important to note that with few exceptions all of the information related to SIMNET training effectiveness is qualitative in nature. The data was based on the perceptations of subject matter experts and students who had experienced training in SIMNET.

SIMNET Assessment of Perceptions I

TITLE: *Simulation Networking (SIMNET) Assessment of Perceptions*
PROPONENT: TRAC-WSMR, ATRC-WHA
PUBLICATION DATE: January 1988

Purpose

To prove preliminary soldier perceptions on the SIMNET device to Army agencies and activities responsible for SIMNET development.

Description

This report presents an assessment of soldier perceptions on the SIMNET training device. The study objectives were to determine soldier perceptions of SIMNET as they relate to functional performance of M1 crew tasks and to determine how realistic the visual and aural presentations of the simulator were.

Objective

To determine soldier perceptions of functional performance of M1 crew tasks and to determine how realistic the visual and aural presentations of the simulator were.

Comments

The exercise from which data were collected provided an environment from which only the general perceptual trends about SIMNET may be reported. Perceptions I were gathered from the 100th Training Division (USAR) when twenty-six soldiers were training at Fort Knox during September 1986.

Findings

The SIMNET was well received by the soldiers with respect to teaching crew team work and platoon coordination.

It was perceived as adequately simulating some crew duty tasks, various time-lags, some main gun effects, overall handling ability, and inter- and intra-crew communications.

It was not clearly adequate in some main gun simulations.

It was not adequate as a gunnery or driver trainer. The loader station was also not adequate.

Most of the negative comments on SIMNET concerned the graphic/visual sentations. The SIMNET visuals were perceived as adequately enabling performance of duty tasks and realistic simulation of combat operations. The visuals were perceived as inadequate in terms of terrain feature fidelity, depth perception, and target identification. The visual system for vehicle recognition needs upgrading

The SIMNET sound system was very well received. Both communications and combat/driving sounds were perceived as being realistic.

A specific concern regarding negative training feedback was identified which must be addressed by those who would use SIMNET in training scenarios. The simulator provided a false sense of well-being and security. This may lead to operational practices which are contrary to doctrine.

SIMNET Assessment of Perceptions II

TITLE: *Simulation Networking SIMNET-Assessment of Perceptions II*
PROPONENT: TRAC-WSMR, ATRC-WHA
PUBLICATION DATE: January 1988

Purpose

To determine soldier perceptions about SIMNET training as used in preparation for the Canadian Army Trophy (CAT).

Description

This report presents an assessment of soldier perceptions on the SIMNET training device. The study objectives were to determine soldier perceptions of SIMNET as they relate to functional performance of M1 crew tasks and to determine how realistic the visual and aural presentations of the simulator were.

Objective

To determine soldier perceptions of functional performance of M1 crew tasks and to determine how realistic the visual and aural presentations of the simulator were.

Comments

The exercise from which data were collected provided information to determine general perceptual trends about SIMNET. Perceptions II were gathered during the preparation for the CAT. These data were collected from 145 soldiers at Grafenwoehr, Germany in May 1987.

Findings

The SIMNET was well received by the soldiers as an approach to teamwork training. SIMNET was perceived as needing improvement to adequately simulate the crew duty positions.

Even though the SIMNET visuals were generally perceived as adequately enabling performance of duty tasks and realistic simulation of combat operations, specific comment sheet results identify inadequacies in terms of terrain feature fidelity, depth perception, and target identification.

The SIMNET sound system was well received. Both driving sounds and combat sounds were perceived as being realistic.

Some comments indicated that the simulator provided a "false sense of well being," especially for untrained soldiers.

Concept Evaluation Program of SIMNET

TITLE: *Concept Evaluation Program of Simulation Networking (SIMNET)*
PROPONENT: USA Armor and Engineer Board
PUBLICATION DATE: March 1988

Objective

To evaluate the capability of SIMNET to support platoon-level command and control exercises and to assess the potential of SIMNET to train selected individual and collective platoon-level tasks.

Findings

The SIMNET group had a higher average score after both the pre- and post-training situational training exercises. The SIMNET group improved their average group score by 13 percentage points while the Baseline group improved their average group score by six percentage points. The SIMNET group improved from an average of 73 percent GOs on the pretraining STX to an average of 84 percent on the post-training STX. The baseline group improved from an average of 59 percent Gos to 65 percent.

Test players felt that SIMNET was useful at training platoons in troop leading procedures, command and control, land navigation, and teamwork.

These players cited the ability to place platoons in stressful situations and keep pressure on the platoon being trained throughout an exercise as one of the system's advantages.

SIMNET PTDS

TITLE: *Simulation Networking Preliminary Training Developments Study*
PROPONENT: US Army Armor Center and School, Fort Knox, KY
PUBLICATION DATE: April 1988

Purpose

To determine the effectiveness of SIMNET as a training device for platoon level training. Additionally, the effect of SIMNET concept evaluation program (CEP) on company team ARTEPs was investigated.

Description

The scope of the study was confined to surveying and testing eight M1 platoons from Fort Hood, TX, during the SIMNET CEP conducted by the US Army Armor and Engineer Board and surveying the soldiers after their company team ARTEPs. During the CEP, four platoons were trained on SIMNET, two at a time, at Fort Knox, KY, while four conducted field training at Fort Hood, TX. The platoons also performed three missions (movement to contact, hasty attack, and hasty defense) before training (pretest) and after training (post-test) at Fort Hood, TX. The eight platoons then participated in their company team ARTEPs. Observations, survey responses, and performance scores were obtained during the SIMNET CEP and the ARTEPs.

Findings

SIMNET training increases field exercise platoon performance.

SIMNET training improves command and control, leadership, and maneuver tasks.

SIMNET cannot be used to train tasks related to dismounted troops, obstacles, air attack, or using smoke.

Simulated speed for the M1 tank is unrealistically fast.

SIMNET visual presentations of vehicles beyond 1000 meters and terrain are inadequate.

SIMNET adequately portrays vehicle and battlefield sounds.

New platoon leaders, platoon sergeants, and tank commanders become more confident in their leadership ability after training on SIMNET.

SIMNET training improved command and control, platoon movement, teamwork, and fire distribution performance on the ARTEP.

Institutional/USAIS/SIMNET (I&II)

TITLE: *Evaluation of Institutional / USAIS use of SIMNET-T (Phases I & II)*
PROPONENT: USA Infantry School
PUBLICATION DATE: January 1989

Objective

To assess the capability of the SIMNET system to train individual/leader/collective tasks that support Bradley Fighting Vehicle training.

NOTE: Phase I tasks were performed by USAIS study group personnel. They developed the study plan to evaluate SIMNET. Phase II (training on SIMNET) was conducted by 24 Bradley SME who were provided SIMNET specific training by the study group.

Findings

SME ratings of the tasks identified by the study group were quite high, with fifteen of seventeen tasks being rated as highly trainable to fully trainable.

SME ratings of SIMNET's adequacy to train tactical missions were very high with the four missions (100 percent) being rated as adequate to very adequate.

SIMNET's plan view display (PVD) is an effective after action review tool as well as an effective aid to training.

The SIMNET does not present any significant negative training aspects.

Institutional/USAIS/SIMNET (III&IV)

TITLE: *Evaluation of Institutional / USAIS use of SIMNET-T (Phases III & IV)*
PROPONENT: USA Infantry School
PUBLICATION DATE: September 1989

Objective

To assess the capability of the SIMNET system to train individual and collective tasks that support Bradley Fighting Vehicle training.

NOTE: Phase III tasks were associated with development of training plans, field scenarios, and data collection instruments. Phase IV (training on SIMNET) was conducted by 72 students randomly selected from three BCC classes.

Findings

SIMNET-trained students performed as well or better than the field-trained students on platoon leader and lead vehicle subtasks and standards.

SIMNET-trained student ratings of SIMNET's utility in preparing for task performance were high with ten of twelve subtasks being rated as prepared well to very well.

A majority of SIMNET-trained students (60.3 percent) and field-trained students (63.3 percent) responded that not enough time was allotted to SIMNET in the tactics portion of the Bradley Commander Course (BCC).

Evaluation of SIMNET/Inf Officer Courses

TITLE: *Evaluation of SIMNET Integration into the Infantry Officer Advance Course (IOAC)*
PROPONENT: USA Infantry School
PUBLICATION DATE: Memorandum for AC, USAIS December 1989

Objective

To summarize results of the SIMNET integration internal test conducted with IOAC Class 5-89.

Findings

Students who received SIMNET supported instruction in planning and execution of the defense performed at least as well as non-SIMNET students in preparing and presenting a defense operations order.

Students who received SIMNET supported instruction in planning and execution of the defense rated the training as effective to very effective.

Students who received SIMNET supported instruction rated SIMNET's after action review (AAR) capability and overall effectiveness as an aid to training as effective to very effective.

However, students who were trained without SIMNET rated their training higher than SIMNET trained students on planning the defense.

CCTT FDTE

TITLE: *Close Combat Tactical Trainer (CCTT) Force Development Testing and Experimentation (FDTE)*
PROPONENT: TEXCOM Combined Arms Test Center
PUBLICATION DATE: August 1990

Purpose

To evaluate the training transfer capability of SIMNET concepts and technology. The test results will support a special in-process review decision concerning production of a company and/or team set of CCTT simulators for use in the subsequently scheduled initial operational test and evaluation.

Description

The FDTE was conducted from 29 Jan through 16 Mar 90 at Fort Hood, Texas, and Fort Knox, Kentucky. This was designed to investigate training transfer as a proof-of-principle for using SIMNET technology in collective training. Each platoon underwent a pretraining evaluation at Fort Hood followed by a five day period of SIMNET training at Fort Knox. After completion of SIMNET training, the platoon returned to Fort Hood for evaluation.

Comments

This FDTE demonstrated favorable training transfer is sufficient to support a milestone II decision.

Findings

Test results show a statistically significant improvement in platoon performance of subtask standards after SIMNET training.

When an opportunity existed to improve performance from the pretraining to the posttraining exercise at the subtask standard level, tank platoons improved 69 percent of the time and mechanized infantry platoons improved 67 percent of the time. Tank platoons sustained satisfactory performance 91 percent of the time. Mechanized infantry platoons sustained satisfactory performance 96 percent of the time.

Soldier acceptance of SIMNET was moderately positive.

The most compelling soldier recommendations for improvement focused primarily on graphics resolution (terrain) and problems of crew disorientation.

Army Research Institute Studies (Two Studies)

TITLE: *Transfer of SIMNET Training in the Armor Officer Basic Course (AOB)*
PROPONENT: US Army Research Institute for the Behavioral and Social Sciences
PUBLICATION DATE: September 1990

Purpose

To assess the results of SIMNET training for officers in an institutional training setting, supplementing other test results that use intact units.

Objective

To assess the results of SIMNET training for officers in a school setting.

Description

A quasi-experimental comparison was made between AOB classes before and after the SIMNET training was added. Dependent variables were derived from instructor ratings on AOB students that are kept in class records. The specific objectives were: (a) to find changes in how the mounted tactical training (MTT) field training was conducted, (b) to estimate transfer from the additional tactical training to student performance as leaders in MTT field exercises, and (c) to gauge the ultimate impact of the additional training on the final evaluation of the quality of tactical leadership for AOB course graduates.

Comments

Many factors were present in the AOB Course to affect the results of training. Close examination of all the available evidence supports the following main conclusions:

Findings

Elementary contact exercises given early in the MTT field training were reduced in number after SIMNET and high mobility multipurpose wheeled vehicle (HMMWV) tactical training were added to the AOB course.

Additional tactical training produced positive transfer of training to the performance of AOB students acting in leader positions in platoon-level MTT exercises. The transfer did not occur in the initial classes trained in SIMNET, but increased gradually in subsequent classes.

Improved student performance in the MTT enabled instructors to begin advanced exercises at an earlier point in the field training, and to complete a larger number of these exercises.

The increases in student performance and advanced training were accompanied by indications of a parallel increase in the judged quality of tactical leadership for AOB graduates.

Team chiefs gradually improved their techniques in conducting this training as they gained experience from training successive platoons. The improvement in SIMNET training, rather than HMMWV training, appeared to be responsible for much of the increases in performance, advanced training, and graduate quality that were obtained. This conclusion must be regarded cautiously within constraints on interference imposed by quasi-experimental results, and requires further confirmation.

Gains in MTT performance in the amount of advanced training and in graduate quality can be attributed to improved SIMNET training.

Observations also suggested that SIMNET training became more effective as the AOB instructors gained experience training students in the SIMNET.

TITLE: *Assessing the Capabilities of Training Simulations: A Method and Simulation Networking (SIMNET) Application*
PROPONENT: US Army Research Institute for the Behavioral and Social Sciences
PUBLICATION DATE: June 1990

Purpose

TEXCOM requested this analysis to support FDTE, using SIMNET as a surrogate for the CCTT.

Description

The method described in this report provides a comprehensive approach to assessing the capabilities of existing training devices and simulations. Application of the method resulted in detailed analysis of ARTEP MTP standards that can be met and subtasks and tasks that can be performed in SIMNET.

Findings

The utility and accuracy of the SIMNET assessment and the degree to which it can be extended to the CCTT will be addressed further following completion of TEXCOM's effort. This assessment produced results that met TEXCOM's near-term requirements and were in general agreement at the task level with results in the SIMNET Users' Guide. The assessment method also provides a means to identify key tasks for training effectiveness and transfer of training research, as well as a framework for developing measures of performance for collective training in combined arms simulations. These applications are being examined in an ongoing ARI research program.

Independent Verification Validation/SIMNET

TITLE: *Independent Verification and Validation (IV&V) of the SIMNET Model*
PROPONENT: Potomac Systems Engineering, Inc.
PUBLICATION DATE: October 1990

Purpose

This final report constitutes the final deliverable of the PSE Delivery Order Response for the IV&V of SIMNET.

Description

This report integrates the findings of the year-long IV&V effort conducted on SIMNET. The report consists of two parts: the main body, which is contained in the document, and the appendixes, which consist of the seven subtask reports published during the course of the study. The main body of the report discusses the overall findings and conclusions in general terms and refers the reader to the appropriate appendix(es) for detailed discussion. The main body of this report addresses a key issue of concern to the government -- the synergism between individual elements of the model. The subtask reports published to date have focused on the fairly narrow set of issues which comprise the IV&V subtasks. Section 3 of this report identifies those issues from the previous reports which impact the model as a whole and which describe, in general terms, the interrelationships that can affect model performance.

Comments

To adequately address the issues in the statement of work (SOW), PSE needed to acquire an in-depth knowledge of the entire SIMNET model. In doing so, they discovered additional issues of which the government should be made aware. From the point of view of an operational training system, PSE believes that the current SIMNET documentation is deficient in the following areas:

There is no code level documentation. There are no flowcharts, subroutine listings or data dictionaries. The description of the code logic is very limited and inconsistent.

The in-code documentation is limited and inconsistent. In-code documentation is useful in helping programmers working on the code to understand the intended functioning of the code at a detailed level.

The documentation does not reflect the latest versions of the code.

The following is a quote from this report, "Based on the tone of the IV&V reports, some may perceive that PSE has a negative opinion of SIMNET. However, this perception is far from accurate. The IV&V reports have focused on SIMNET's problems and shortcomings and, therefore, they can be perceived as a criticism of the model as a whole. In fact, the PSE personnel who have worked on the IV&V effort have been very impressed with what has been accomplished to date. SIMNET is an excellent training device."

SIMNET User's Guide (Armor)

TITLE: *SIMNET Users Guide*
PROPONENT: US Army Armor School
PUBLICATION DATE: April 1989

Purpose

To support integration of SIMNET into unit training programs. Its intended audience is armor and mechanized infantry unit leaders at platoon, company/team, and battalion/task force levels. These leaders use it to assist in planning, conducting, and evaluating SIMNET exercises to meet unit training needs.

Description

This guide provides a general description of the SIMNET system followed by a description of how SIMNET can be used to support unit training. Assessments of the collective tasks that can be trained in SIMNET and suggestions for approaches to training them are provided in the appendixes. Appendixes A through C present task assessments in a format based on ARTEP MT at platoon, company/team, and battalion/task force levels. Remaining appendixes address specific capabilities, limitations, and requirements of SIMNET training and discuss a platoon-level SIMNET training exercise.

Comments

The ratings in the guide describe the degree to which tasks could be performed with SIMNET, rather than the degree to which they could be trained. In developing the ratings, the analysts felt that they could address performance capabilities more accurately than training capabilities. This guide is not intended to stand alone. It does not provide complete details on operating the components of the SIMNET system. Unit leaders use this guide in conjunction with orientations, crew manuals, operator's guides, and other materials available at each SIMNET site. They should also use it in conjunction with other materials guiding unit training programs, such as ARTEP MTPs.

Findings

Assessments of the collective tasks that can be trained in SIMNET and suggestions for approaches to training them are provided in the appendixes.

There is no set way to train in SIMNET; it is dependent on the creativity and imagination of unit leaders.

SIMNET training must be developed to take advantage of the capabilities and work around the limitation of the system.

It is most useful in training command, control, tactical movement, and synchronization of direct and indirect fires.

The number of differences between simulators and actual combat vehicles limits the tasks that can be trained.

SIMNET Users' Guide (Mech Infantry)

TITLE: *SIMNET Users' Guide*
PROPONENT: USA Infantry Center and School
PUBLICATION DATE: April 1989

Objective

To support integration of SIMNET into unit training programs.

Findings

SIMNET capabilities and limitations.

It provides a capability to practice command, control, and synchronization under realistic time and distance factors down to crew level.

It has the ability to train the basic mounted tasks and train unit fire distribution.

It provides a dedicated semi-automated opposing force that operates with thread doctrine for units to fight against.

There are no dismounted capabilities in the current SIMNET.

There is limited terrain resolution, and the terrain is not dynamic.

Summary

SIMNET provides for (1) resource savings, (2) training without expending field training resources, (3) a large maneuver space without many of the restrictions that impact on field training, and (4) repeated practice. In summary the following items are noted.

From the unit trainer's point of view, SIMNET is designed to provide a means for practicing collective combat skills in a stressful environment.

SIMNET is a part-task trainer that supports leader/commander/staff training in command, control, and tactical movement at platoon, company/team, and battalion/task force levels, under conditions that duplicate some of the "fog of war" and stress of combat.

SIMNET is not designed to support all of a unit's training requirements; for example, it is not a precision gunnery trainer.

SIMNET is an evolving system. Improvements are planned, and are being added to the system as they become available. The information presented in this briefing only describes SIMNET capabilities as of the publication dates of each reference.

A careful review of the SIMNET related documents indicates that this training device was most effect when employed to train in the following task areas:

- Command and control
- Maneuver techniques
- Tactical training
- Fire distribution
- Land navigation
- Reporting procedures
- Team building
- Leadership

The most frequently identified training effectiveness shortfalls were:

- Visual presentations (beyond 1000 meters)
- Unrealistic driving responses
- Dismounted troop exercises
- Failure to follow safety procedures (no real danger)
- Human factors including disorientation

It is important to note that with few exceptions all of the information related to SIMNET training effectiveness was based on the perceptations of subject matter experts and students who had experienced training in this device.

Things that SIMNET trains well:

- Command and control
- Land navigation
- Reporting procedures
- Team coordination
- Tactical planning
- Maneuver techniques
- Platoon gunnery
- Reporting
- Teamwork

Important SIMNET shortfalls

- Limited vision
- Negative training:
  - For drivers & loaders
  - Regarding crew safety procedures

Appendix B: Training Resource Model

Training Resource Model

CCTT Baseline Cost Estimate Summary for 546 simulators

Rough Order of Magnitude (ROM) Cost for 958 simulators

Training Resource Model

1. <u>TRM Overview</u>. The Training Resource Model (TRM) is a personal computer based model which estimates the training dollar impact of changes in Resource Level (RL), Authorized Level of Organization, and Operating Tempo (OPTEMPO) for a given force structure. The TRM has been used by DAMO-TR for several years as a budgetary input tool. It has logged an impressive track record of accurately predicting reported RL and budget consumption as functions of available OPTEMPO.

2. <u>Major Components in TRM Methodology</u>. This model is fed by many other models; primarily the Battalion Level Training Models (BLTMs). There are presently 232 BLTMs used in the TRM. The TRM can be considered a "roll-up" of the training requirements in the BLTMs, the force structure in the Force Accounting System (FAS), and costs from various sources as required (see Figure 1).

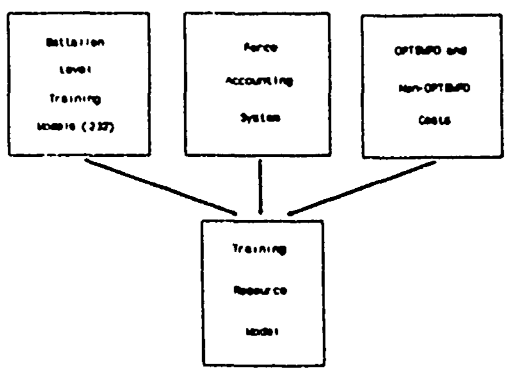

Figure 1
Major Components of the TRM

3. <u>Readiness Level Versus Miles/Hours</u>. The BLTMs output equipment needed to perform training functions, and the number of miles and hours required to produce increasing levels of training readiness (RL). These RLs go from C0 to C4, with different miles or hours required by system in the unit. For instance, if an armor battalion needs to be trained to a resource level of C0, it might require the M1A1 to travel a total of 997 miles per year. Conversely, if only 580 miles are available, the unit will probably train to no higher level than C4. An example of the a BLTM (M1A1 BN) is shown at Table 1.

Equipment Rollup (By Miles)
BLTM Name: M1A1.1

Average OPTEMPO Miles by Item
And Training Readiness Level

LIN	Veh-Eq Item	#/BN	C0	C1	C2	C3	C4
C32887	Steam Cleaner	1	256	253	258	249	245
C76335	CFV, M3	6	1392	1132	1114	951	869
D10741	Carr, Mort M106	6	610	482	497	436	377
D11538	Carr, CP M577	8	438	375	367	344	310
D12087	Carr, Personnel	13	630	544	508	425	352
J46252	Genr, 5KW & (-)	13	390	299	280	232	196
K24862	Htr, Duct 250K	5	343	287	265	240	207
R50681	Recy, M88	7	839	675	612	532	453
T13237	Tank, M1A1	58	997	820	800	661	580
T39586	HEMMT	23	3331	2988	2783	2565	2297
T61494	HMMWV	24	7341	7201	7483	6871	6681
X40009	Trk, 1 1/2 Ton	25	5352	5205	5022	4571	4158
X40794	Trk, 5 Ton	7	4660	4340	4188	3826	3517

Table 1
M1A1 BLTM OPTEMPO Mileage

4. <u>FAS Force Structure Used in TRM</u>. Specific units in the FAS (Modified Tables of Organization and Equipment, or MTOEs) are identified by Unit Identification Code (UIC). A cross match is done from the UIC in the FAS to a generic BLTM. Each BLTM represents a "family" of similar units. This family can be thought of as representing a Standard Requirement Code (SRC), or Table of Organization and Equipment (TOE). Within the Army, a single TOE may represent many MTOEs. In a manner similar to the TOE/MTOE relationship, a single BLTM may represent the training in many UICs (see Figure 2).

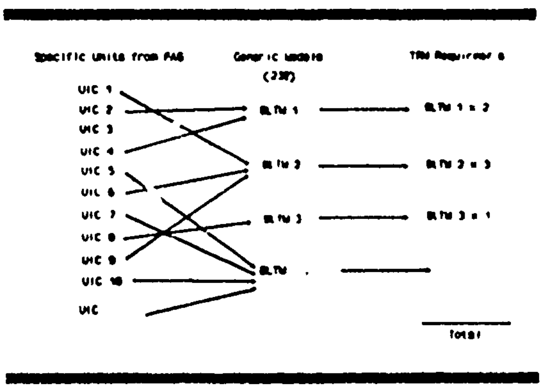

Figure 2
Force Structure Used In TRM

5. <u>Cost Data Sources</u>. The cost factors included in the TRM are derived from various sources, but the primary source of interest to the CCTT study is the Cost and Economic Analysis Center (CEAC). CEAC is the quality control agency for all costs within the Army. CEAC furnishes the model with OPTEMPO factors based on POL consumption, repair parts and secondary item usage, and depot level maintenance repair. The sources of CEAC's cost factors include the Operating and Support Management Information System (OSMIS), Army Master Data File (AMDF), Provisioning Master Record (PMR) and Materiel Category Code (MATCAT).

6. <u>Major Equipment Versus Ancillary Equipment in Units</u>. The other equipment in the unit which consume resources are prorated against the major end item of the unit. In the example above, that would be the M1A1. This is logically sound, since if the M1A1 were to be used for training, other pieces of equipment in the unit would also have to be used, and would consume resources as well. By this logic, the consumption of the unit is not limited to the tank, but also includes other equipment required to exercise the tank. Table 2 shows the cost of the other ancillary equipment for an example BLTM (M1A1). There is an additional 5% surcharge to account for other, smaller equipment that is not captured in the BLTM equipment list.

Equipment Rollup (By Miles)
BLTM Name: M1A1.1

BLTM OPTEMPO Costs by Item
and Resource Level

LIN	Veh-Eq Item	#/BN	$/Mi(Hr)	C0	C1	C2	C3	C4
C32887	Steam Cleaner	1	$5.17	$1	$1	$1	$1	$1
C76335	CFV, M3	6	$51.19	$427	$348	$342	$292	$267
D10741	Carr, Mort M106	6	$5.65	$21	$16	$17	$15	$13
D11538	Carr, CP M577	8	$6.67	$23	$20	$20	$18	$17
D12087	Carr, Personnel	13	$8.04	$66	$57	$53	$44	$37
J46252	Genr, 5KW & (-)	13	$1.35	$7	$5	$5	$4	$3
K24862	Htr, Duct 250K	5	$.76	$1	$1	$1	$1	$1
R50681	Recy, M88	7	$77.11	$453	$364	$330	$287	$245
T13237	Tank, M1A1	58	$134.93	$7,801	$6,416	$6,264	$5,174	$4,539
T39586	HEMMT	23	$1.38	$106	$95	$88	$81	$73
T61494	HMMWV	24	$.29	$51	$50	$52	$48	$46
X40009	Trk, 1 1/2 Ton	25	$1.02	$136	$133	$128	$117	$106
X40794	Trk, 5 Ton	7	$1.07	$35	$33	$31	$29	$26
FY91 Constant Dollars In Thousands				$9,129	$7,540	$7,333	$6,111	$5,374
1.05 Scaling Factor (other equipment)				$9,585	$7,917	$7,700	$6,417	$5,642
FY92 Constant Dollars In Thousands				$9,978	$8,241	$8,015	$6,680	$5,874

Table 2
BLTM OPTEMPO Costs (/Yr)

7. Non-OPTEMPO Costs in TRM. Other cost factors in the TRM account for budgetary needs of the units, but are not used in the CCTT study because they are not OPTEMPO driven. They can be considered "fixed" costs from the standpoint of changing the number of miles the end item of the unit is used. These factors include such things as class II and IV supplies, contractual services peculiar to the unit, civilian pay, and miscellaneous travel.

8. Cost per Mile/Hour. Since the TRM contains the BLTM for a generic battalion, and that BLTM can show the resource implication exercising the unit on a per mile/hour basis, the factors from the model are directly applicable to the CCTT study. The CCTT study can easily identify the cost savings of a reduction of miles in the unit.

9. Summary. CCTT uses OPTEMPO factors from the TRM which are track directly to the cost inputs from CEAC (per unit costs in Table 1). For CCTT, Non-OPTEMPO costs are not used. The primary function of TRM for this study are prorating ancillary equipment usage within the appropriate BLTM against the main end item, and to a lesser degree defining the RL as a function of OPTEMPO of the unit.

FS: 1000 JUL 89 FAS COST: 1000 02/91 CEAC	TRAINING RESOURCE MODEL BLTM PROGRAM ANALYSIS	BLTM: 1000 OCT 90 VER INFL: 1000 FY 91 $
BLTM TYPE: M1A1.1 DIV TYPE:	OPT: DESC: TANK (M1A1)	MACOM: SRC:17235J430

FY: 97	< Thousands $ > << C0 >>	<< C1 >>	<< C2 >>	<< C3 >>	<< C4 >>
REPAIR PARTS	8,753	7,223	7,026	5,851	5,144
POL	376	316	307	260	230
SCALE COSTS	456	377	367	306	269
TOTAL	9,585	7,916	7,700	6,417	5,643

$7,700 * 1.041 = $8,015 FY92 Const

/ 46,423 Miles = $173 (Full BLTM)

$6,264 * 1.041 = $6,518 FY92 Const

/ 46,423 Miles = $140 (Tank Only)

DATE: 04/11/91 TRAINING RESOURCE MODEL PAGE: 1
FS: 1000 JUL 89 FAS BLTM COST ANALYSIS BLTM: 1000 OCT 90 VER
COST: 1000 02/91 CEAC INFL: 1000 FY 91 $

FY: 97 MACOM: ARMY BLTM NAME: M1A1.1

Lin	Desc	< Thousands $ > < C0 >	< C1 >	< C2 >	< C3 >	< C4 >
*CLTSM	COLTSIM	0	0	0	0	0
*SMNET	SIMNET	0	0	0	0	0
*TWGSS	TWGSS	0	0	0	0	0
*UCOFT	UCOFT	0	0	0	0	0
C32887	STEAM CLEANER	1	1	1	1	1
C76335	CFV, M3	427	348	342	292	267
D10741	CARR, MORT M106	21	16	17	15	13
D11538	CARR, CP M577	23	20	20	18	17
D12087	CARR, PERS M113	66	57	53	44	37
J46252	GENR, 5KW & (-)	7	5	5	4	3
K24862	HTR, DUCT 250K	1	1	1	1	1
R50681	RECY VEH, M88	453	364	331	287	245
T13168	TANK, M1A1	7,801	6,416	6,264	5,174	4,539
T59278	HEMMT	106	95	88	81	73
T61494	HMMWV	51	50	52	48	46
X40009	TRK, 2 1/2 TON	136	133	128	117	106
X40794	TRUCK, 5 TON	35	33	31	29	26
		9,128	7,539	7,333	6,111	5,374

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SET: 1000 TRAINING RESOURCE MODEL DESC: OCT 90 VER
BLTM MODEL COMPOSITION

MACOM: ARMY
BLTM TYPE: M1A1.1 OPTION: SRC: 17235J430
BLTM DESC: TANK (M1A1) DIV TYPE: SCALE: 1.05

EQUIPMENT		OPTEMPO		
		Readiness Level	Avg. Optempo	Total Optempo
LIN:	T13168			
DESCRIPTION:	TANK, M1A1	C0	997	57,814
USE TYPE:	M	C1	820	47,554
DENSITY:	58	C2	800	46,423
COST - POL:	4.39	C3	661	38,344
COST - Parts:	59.00	C4	580	33,640

SCR: 233 04/11/91

Version: 1000	TRAINING RESOURCE MODEL COST FACTOR TABLE	Desc: 02/91 CEAC
DOLLARS: FY 90 CONSTANT	Macom: ARMY	FY: 89

LIN	DESCRIPTION	USE M/H	Total	ORG PARTS	DS PARTS	GS PARTS
T13168	TANK, M1A1	M	63.39	59.00	0.00	0.00

LIN	DESCRIPTION	USE M/H	Total	DLR/ SPARES	POL	LIN SCALE
T13168	TANK, M1A1	M	63.39	0.00	4.39	0.00

Version: 1000	TRAINING RESOURCE MODEL COST FACTOR TABLE	Desc: 02/91 CEAC
DOLLARS: FY 90 CONSTANT	Macom: ARMY	FY: 97

LIN	DESCRIPTION	USE M/H	Total	ORG PARTS	DS PARTS	GS PARTS
T13168	TANK, M1A1	M	134.93	29.99	0.00	0.00

LIN	DESCRIPTION	USE M/H	Total	DLR/ SPARES	POL	LIN SCALE
T13168	TANK, M1A1	M	134.93	100.00	4.94	0.00

FS: 1000 JUL 89 FAS COST: 1000 02/91 CEAC	TRAINING RESOURCE MODEL BLTM PROGRAM ANALYSIS	BLTM: 1000 OCT 90 VER INFL: 1000 FY 91 $
BLTM TYPE: BFV.1 DIV TYPE: HVY	OPT: DESC: MECH INFANTRY (BFV)	MACOM: SRC:07245J410

FY: 97	< Thousands $ >				
	<< C0 >>	<< C1 >>	<< C2 >>	<< C3 >>	<< C4 >>
REPAIR PARTS	4,280	3,463	3,244	2,589	2,217
POL	104	88	83	70	60
SCALE COSTS	219	178	166	133	114
TOTAL	4,603	3,729	3,493	2,792	2,391

$3,493 * 1.041 = $3,636 FY92 Const

/ 40,068 Mi = $91 (Full BLTM)

$2,360 * 1.041 = $2,457 FY92 Const

/ 40,068 Mi = $61 (BFV Only)

DATE: 04/11/91 TRAINING RESOURCE MODEL PAGE: 1
FS: 1000 JUL 89 FAS BLTM COST ANALYSIS BLTM: 1000 OCT 90 VER
COST: 1000 02/91 CEAC INFL: 1000 FY 91 $

FY: 97 MACOM: ARMY BLTM NAME: BFV.1

Lin	Desc	< Thousands $ > < C0 >	< C1 >	< C2 >	< C3 >	< C4 >
* PGS	PGS	0	0	0	0	0
*BTGMS	BGMTS	0	0	0	0	0
*UCOFT	UCOFT	0	0	0	0	0
C32887	STEAM CLEANER	1	1	1	1	1
C40499	BSCO	0	0	0	0	0
C76335	CFV, M3	405	325	333	278	247
D10741	CARR, MORT M106	24	20	20	18	15
D11538	CARR, CP M577	21	18	19	17	16
E56896	ITV, M901	215	181	173	150	125
F40375	IFV, M2A2	3,215	2,565	2,360	1,841	1,568
J46252	GENR, 5KW & (-)	12	9	8	8	6
K24862	HTR, DUCT 250K	0	0	0	0	0
R50681	RECY VEH, M88	221	188	179	139	117
T61494	HMMWV	33	28	28	25	23
X40009	TRK, 2 1/2 TON	107	99	95	84	76
X40794	TRUCK, 5 TON	5	5	5	5	5
X40794	TRUCK, 5 TON	124	111	105	93	80
Z44650	MOTORCYCLE	0	0	0	0	0
		4,383	3,550	3,326	2,659	2,279

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SET: 1000 TRAINING RESOURCE MODEL DESC: OCT 90 VER
BLTM MODEL COMPOSITION

MACOM: ARMY
BLTM TYPE: BFV.1 OPTION: SRC: 07245J410
BLTM DESC: MECH INFANTRY (BFV) DIV TYPE: HVY SCALE: 1.05

EQUIPMENT		OPTEMPO		
		Readiness Level	Avg. Optempo	Total Optempo
LIN:	F40375	C0	1011	54,583
DESCRIPTION:	IFV, M2A2	C1	806	43,540
USE TYPE:	M	C2	742	40,068
DENSITY:	54	C3	579	31,244
COST - POL:	0.78	C4	493	26,611
COST - Parts:	58.00			

SCR: 233 04/11/91

FS: 1000 JUL 89 FAS COST: 1000 02/91 CEAC	TRAINING RESOURCE MODEL BLTM PROGRAM ANALYSIS	BLTM: 1000 OCT 90 VER INFL: 1000 FY 91 $

BLTM TYPE: AACACR.1 OPT: MACOM:
DIV TYPE: EAD DESC: ARMORED CAV (ACR) SRC:17055J320

FY: 97 < Thousands $ >

	<< C0 >>	<< C1 >>	<< C2 >>	<< C3 >>	<< C4 >>
REPAIR PARTS	12,497	10,947	9,401	7,458	6,153
POL	473	418	362	291	244
SCALE COSTS	649	568	488	387	320
TOTAL	13,619	11,933	10,251	8,136	6,717

$10,251 * 1.041 = $10,671 FY92 Const

/ 50,877 Mi = $210 (Full BLTM)

$6,865 * 1.041 = $7,146 FY92 Const

/ 50,877 Mi = $140 (Tank Only)

DATE: 04/11/91 TRAINING RESOURCE MODEL PAGE: 1
FS: 1000 JUL 89 FAS BLTM COST ANALYSIS BLTM: 1000 OCT 90 VER
COST: 1000 02/91 CEAC INFL: 1000 FY 91 $

FY: 97 MACOM: ARMY BLTM NAME: AACACR.1

Lin	Desc	< Thousands $ > < C0 >	< C1 >	< C2 >	< C3 >	< C4 >
C10908	FAASV	87	80	67	55	43
C76335	CFV, M3	1,990	1,729	1,500	1,203	986
D10741	CARR, MORT M106	45	42	37	31	26
D11538	CARR, CP M577	55	52	48	41	41
D12087	CARR, PERS M113	160	153	146	129	126
K57667	HOWITZER, 155 SP	150	131	109	81	62
L43664	AVLB	158	145	147	141	128
R50681	RECY VEH, M88	640	570	490	375	329
T13168	TANK, M1A1	9,283	8,079	6,865	5,387	4,374
T59278	HEMMT	36	34	32	29	27
T59346	CUCV	10	10	10	9	9
T61494	HMMWV	29	29	28	25	24
X40009	TRK, 2 1/2 TON	145	140	125	108	96
X40794	TRUCK, 5 TON	149	141	127	107	96
X59326	TRACTOR, 5 TON	31	31	32	30	29
		12,968	11,366	9,763	7,751	6,396

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SET: 1000 — TRAINING RESOURCE MODEL — DESC: OCT 90 VER

BLTM MODEL COMPOSITION

MACOM: ARMY
BLTM TYPE: AACACR.1 — OPTION: — SRC: 17055J320
BLTM DESC: ARMORED CAV (ACR) — DIV TYPE: EAD — SCALE: 1.05

E Q U I P M E N T	O P T E M P O		
	Readiness Level	Avg. Optempo	Total Optempo
LIN: T13168			
DESCRIPTION: TANK, M1A1	C0	1678	68,802
USE TYPE: M	C1	1460	59,872
DENSITY: 41	C2	1241	50,877
COST - POL: 4.39	C3	974	39,926
COST - Parts: 59.00	C4	791	32,419

SCR: 233 — 04/11/91

FS: 1000 JUL 89 FAS COST: 1000 02/91 CEAC	TRAINING RESOURCE MODEL BLTM PROGRAM ANALYSIS	BLTM: 1000 OCT 90 VER INFL: 1000 FY 91 $

BLTM TYPE: ARCAV_AH1HVY OPT: MACCM:
DIV TYPE: HVY DESC: CAVALRY SQDN (AH-1) SRC:17385L268

FY: 97 < Thousands $ >

	<< C0 >>	<< C1 >>	<< C2 >>	<< C3 >>	<< C4 >>
REPAIR PARTS	7,810	6,529	6,272	5,720	5,306
POL	198	171	167	151	142
SCALE COSTS	400	335	322	294	272
TOTAL	8,408	7,035	6,761	6,165	5,720

$6,761 * 1.041 = $7,038 FY92 Const

/ 52,792 Mi = $133 (Full BLTM)

$2,702 * 1.041 = $2,813 FY92 Const

/ 52,792 Mi = $53 (M3 Only)

$3,110 * 1.041 = $3,238 FY92 Const

/ 52,792 Mi = $61 (M3A2 Only)

DATE: 04/11/91 TRAINING RESOURCE MODEL PAGE: 1
FS: 1000 JUL 89 FAS BLTM COST ANALYSIS BLTM: 1000 OCT 90 VER
COST: 1000 02/91 CEAC INFL: 1000 FY 91 $

FY: 97 MACOM: ARMY BLTM NAME: ARCAV_AH1HVY

Lin	Desc	< Thousands $ > < C0 >	< C1 >	< C2 >	< C3 >	< C4 >
C18234	CARRIER, M113A3	60	50	48	44	40
C32887	STEAM CLEANER	13	12	11	10	10
C36151	CRANE, 7 1/2 TON	4	4	4	3	3
C76335	CAV FIGHTING VEH:M3	3,381	2,817	2,702	2,471	2,289
D10741	CARRIER, MORT:M106	56	47	45	41	38
D11538	CARRIER, CP M577	90	74	72	65	60
F60530	CFV, M3A2	3,891	3,242	3,110	2,843	2,634
H31110	HEL,OH58C	0	0	0	0	0
J35492	GENR, OVER 5KW	9	8	7	7	6
J46252	GENR, 5KW & BELOW	56	48	47	41	38
K24862	HEATER, DUCT	3	3	3	2	2
K29694	HEL,AH-1	0	0	0	0	0
K31795	HEL,UH-1	0	0	0	0	0
R50681	RECY VEH, MED M88	260	217	210	177	165
T00216	AH-1 SIMULATOR (2B33)	0	0	0	0	0
T48944	FORKLIFT	6	5	5	5	5
T59278	HEMTT W/CRANE	34	32	32	29	28
T59346	CUCV M1008A1	6	6	6	5	5
T61494	HMMWV	27	26	26	23	23
X00456	UH1/OH58 SIMULATOR	0	0	0	0	0
X40009	TRUCK, 2 1/2 TON	94	91	93	87	86
X40009	TRUCK, 2 1/2 TON	7	6	6	5	4
X40794	TRK, 5T M939 SERIES	13	13	12	12	11
		8,010	6,701	6,439	5,870	5,447

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SET: 1000 TRAINING RESOURCE MODEL DESC: OCT 90 VER
BLTM MODEL COMPOSITION

MACOM: ARMY
BLTM TYPE: ARCAV_AH1HVY OPTION: 3 SRC: 17385L268
BLTM DESC: CAVALRY SQDN (AH-1) DIV TYPE: HVY SCALE: 1.05

EQUIPMENT		OPTEMPO		
		Readiness Level	Avg. Optempo	Total Optempo
LIN:	C76335			
DESCRIPTION:	CAV FIGHTING VEH:M	C0	1651	66,048
USE TYPE:	M	C1	1376	55,040
DENSITY:	40	C2	1320	52,792
COST - POL:	0.72	C3	1207	48,268
COST - Parts:	13.00	C4	1118	44,712

SCR: 233 04/11/91

[F2] Find [F4] Edit [F7] Add [F9] Delete [Esc] Return

SET: 1000 TRAINING RESOURCE MODEL DESC: OCT 90 VER
BLTM MODEL COMPOSITION

MACOM: ARMY
BLTM TYPE: ARCAV_AH1HVY OPTION: 3 SRC: 17385L268
BLTM DESC: CAVALRY SQDN (AH-1) DIV TYPE: HVY SCALE: 1.05

EQUIPMENT		OPTEMPO		
		Readiness Level	Avg. Optempo	Total Optempo
LIN:	F60530			
DESCRIPTION:	CFV, M3A2	C0	1651	66,048
USE TYPE:	M	C1	1376	55,040
DENSITY:	40	C2	1320	52,792
COST - POL:	0.78	C3	1207	48,268
COST - Parts:	58.00	C4	1118	44,712

SCR: 233 04/11/91

APPENDIX I-2

CCTT BCE for 546 simulators.

The CCTT BCE used in the CTEA was validated in March 1991 and was provided by the CCTT program manager at PM-TRADE. This BCE will be updated with the Army cost position (ACP) when it is completed and approved. The BCE basis of issue plan (BOIP) is for 546 simulators, 432 for the AC and 114 for the RC. This BOIP supports the company/team field training in the AC and the RC. The RC simulators are fielded in mobile units which travel to reserve training sites on a rotating basis. The AC simulators are located in fixed training sites. Costs in this summary are divided into both the RC and the AC costs. This summary of the BCE is broken out by major cost activity, 1.0 Development, 2.0 Production, 3.0 Military construction, 4.0 Fielding and 5.0 Sustainment. These cost activities are generally associated with a single appropriation except sustainment which has three appropriations. The costs are time-phased over the system life and shown in both constant FY 92 and in current dollars.

CCTT ROM for 958 simulators.

A ROM estimate for 958 simulators was done as an excursion to determine the costs required to have a battalion level field training capability. This estimate was conducted by TRAC-WSMR resource analysis directorate with assistance by PM- TRADE. The methodology is consistant with the BCE and the cost formats are the same as used above in the summary of the BCE for 546 simulators. The additional 412 simulators are used in the AC fixed sites adding the capability to train at the battalion level.

4/11/1991 CCTT BCE (546 Qty)
Millions of Dollars

Fiscal Year:	Total	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Total BCE $FY92 Constant	$1,187.8	.4	22.5	40.2	37.7	21.1	42.1	63.9	178.9	184.1	39.7	[illegible]	37.2	39.1	39.1
1.0 Dev	$170.5	.3	22.5	40.2	37.7	21.1	32.3	5.2	2.8	2.8	2.8	2.8			
2.0 Prod	$361.7							52.9	155.0	153.8					
3.0 MCA	$40.9						2.9	2.9	17.4	17.7					
4.0 Fielding	$2.4							.8	.8	.8					
5.0 Sust	$612.3	.1					6.9	2.1	2.9	9.0	36.9	46.3	37.2	39.1	39.1
OMA	$443.8							1.7	2.5	8.5	28.6	38.0	28.9	28.9	28.9
PROC	$159.7						6.9				7.9	7.9	7.9	9.8	9.8
MPA	$8.8	.1						.5	.5	.5	.5	.5	.5	.5	.5
Total BCE Current	$1,528.9	.4	23.1	42.8	41.5	24.1	50.1	80.7	234.2	248.8	40.7	52.0	40.8	44.4	45.9
1.0 Dev	$189.2	.3	23.1	42.8	41.5	24.1	38.1	6.3	3.5	3.6	2.9	3.0			
2.0 Prod	$478.9							67.1	203.3	208.6					
3.0 MCA	$53.8						3.5	3.7	22.7	23.9					
4.0 Fielding	$3.0							1.0	1.0	1.0					
5.0 Sust	$803.9	.1					8.5	2.6	3.7	11.6	37.9	49.0	40.8	44.4	45.9
OMA	$569.9							2.0	3.1	11.0	29.0	39.8	31.3	32.4	33.5
PROC	$222.3						8.5				8.4	8.7	9.0	11.6	12.0
MPA	$11.8	.1						.6	.6	.6	.5	.5	.5	.5	.5
RC $FY92 Constant	$410.0	.1	5.9	10.4	9.7	5.5	10.2	16.0	46.0	49.7	16.1	23.7	17.0	17.0	17.0
1.0 Dev	$39.8	.1	5.9	10.4	9.7	5.5	8.2								
2.0 Prod	$102.1							14.3	43.9	43.9					
3.0 MCA	$.0														
4.0 Fielding	$2.4							.8	.8	.8					
5.0 Sust	$265.7						2.0	.9	1.3	5.0	16.1	23.7	17.0	17.0	17.0
OMA	$226.9							.9	1.3	5.0	13.8	21.4	14.7	14.7	14.7
PROC	$38.8						2.0				2.3	2.3	2.3	2.3	2.3
MPA	$.0														
RC Current	$526.4	.1	6.1	11.1	10.7	6.3	12.1	20.2	60.2	67.0	16.5	25.0	18.6	19.2	19.9
1.0 Dev	$43.9	.1	6.1	11.1	10.7	6.3	9.7								
2.0 Prod	$135.2							18.1	57.6	59.5					
3.0 MCA	$.0														
4.0 Fielding	$3.0							1.0	1.0	1.0					
5.0 Sust	$344.2						2.5	1.1	1.6	6.5	16.5	25.0	18.6	19.2	19.9
OMA	$290.6							1.1	1.6	6.5	14.0	22.4	15.9	16.5	17.0
PROC	$53.6						2.5				2.5	2.5	2.6	2.7	2.8
MPA	$.0														
AC $FY92 Constant	$777.8	.3	16.6	29.8	28.0	15.6	31.9	47.9	132.9	134.4	23.6	25.4	20.2	22.1	22.1
1.0 Dev	$130.7	.2	16.6	29.8	28.0	15.6	24.1	5.2	2.8	2.8	2.8	2.8			
2.0 Prod	$259.6							38.6	111.1	109.9					
3.0 MCA	$40.9						2.9	2.9	17.4	17.7					
4.0 Fielding	$.0														
5.0 Sust	$346.6	.1					4.9	1.2	1.6	4.0	20.8	22.6	20.2	22.1	22.1
OMA	$216.9							.8	1.2	3.5	14.8	16.6	14.2	14.2	14.2
PROC	$120.9						4.9				5.6	5.6	5.6	7.5	7.5
MPA	$8.8	.1						.5	.5	.5	.5	.5	.5	.5	.5
AC Current	$1,002.6	.3	17.1	31.7	30.9	17.8	38.0	60.5	174.8	181.7	24.3	27.0	22.2	25.2	26.1
1.0 Dev	$145.4	.2	17.1	31.7	30.9	17.8	28.4	6.3	3.5	3.6	2.9	3.0			
2.0 Prod	$343.7							49.0	145.7	149.0					
3.0 MCA	$53.8						3.5	3.7	22.7	23.9					
4.0 Fielding	$.0														
5.0 Sust	$459.7	.1					6.1	1.5	2.1	5.2	21.4	24.0	22.2	25.2	26.1
OMA	$279.3							.9	1.5	4.5	15.0	17.4	15.4	15.9	16.4
PROC	$168.7						6.1				6.0	6.2	6.4	8.8	9.1
MPA	$11.8	.1						.6	.6	.6	.5	.5	.5	.5	.5

4/11/1991 CCTT BCE (546 Qty)
Millions of Dollars

Fiscal Year:	05	06	07	08	09	10	11	12	13	14	15	16	17
Total BCE $FY92 Constant	41.0	39.1	39.1	39.1	39.1	39.1	39.1	38.0	33.2	26.6	19.2		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	41.0	39.1	39.1	39.1	39.1	39.1	39.1	38.0	33.2	26.6	19.2		
OMA	28.9	28.9	28.9	28.9	28.9	28.9	28.9	27.7	23.0	16.4	9.0		
PROC	11.7	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8		
MPA	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5		
Total BCE Current	49.9	49.1	50.8	52.5	54.3	56.2	58.1	58.3	52.9	44.0	33.1		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	49.9	49.1	50.8	52.5	54.3	56.2	58.1	58.3	52.9	44.0	33.1		
OMA	34.6	35.8	37.0	38.2	39.5	40.9	42.3	42.0	36.0	26.5	15.0		
PROC	14.8	12.8	13.2	13.7	14.1	14.6	15.1	15.6	16.2	16.7	17.3		
MPA	.6	.6	.6	.6	.6	.7	.7	.7	.8	.8	.8		
RC $FY92 Constant	17.0	17.0	17.0	17.0	17.0	17.0	17.0	16.4	13.8	10.5	6.0		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	17.0	17.0	17.0	17.0	17.0	17.0	17.0	16.4	13.8	10.5	6.0		
OMA	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.1	11.5	8.2	3.7		
PROC	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3		
MPA													
RC Current	20.3	21.2	21.9	22.7	23.5	24.3	25.1	25.0	21.8	17.2	10.3		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	20.5	21.2	21.9	22.7	23.5	24.3	25.1	25.0	21.8	17.2	10.3		
OMA	17.6	18.2	18.8	19.5	20.1	20.8	21.5	21.4	18.0	13.3	6.2		
PROC	2.9	3.0	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.9	4.1		
MPA													
AC $FY92 Constant	24.0	22.1	22.1	22.1	22.1	22.1	22.1	21.6	19.4	16.1	13.2		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	24.0	22.1	22.1	22.1	22.1	22.1	22.1	21.6	19.4	16.1	13.2		
OMA	14.2	14.2	14.2	14.2	14.2	14.2	14.2	13.6	11.5	0.2	5.3		
PROC	9.4	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5		
MPA	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5		
AC Current	29.4	27.9	28.9	29.8	30.9	31.9	33.0	33.3	31.1	26.8	22.8		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	29.4	27.9	28.9	29.8	30.9	31.9	33.0	33.3	31.1	26.8	22.8		
OMA	17.0	17.5	18.1	18.8	19.4	20.1	20.7	20.6	18.0	13.2	8.8		
PROC	11.9	9.8	10.1	10.5	10.8	11.2	11.6	12.0	12.4	12.8	13.2		
MPA	.6	.6	.6	.6	.6	.7	.7	.7	.8	.8	.8		

4/11/1991 UCTT BCE (958 Qty)
Millions of Dollars

Fiscal Year:	Total	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Total BCE $FY92 Constant	$2,109.0	.6	22.5	40.2	37.7	21.1	47.3	80.0	202.2	202.7	222.0	188.9	68.0	69.9	69.9
1.0 Dev	$170.5	.3	22.5	40.2	37.7	21.1	32.3	5.2	2.8	2.8	2.8	2.8			
2.0 Prod	$626.5							62.9	158.7	153.6	151.2	100.1			
3.0 MCA	$78.0						8.0	7.2	34.3	28.5					
4.0 Fielding	$2.4							.8	.8	.8					
5.0 Sust	$1,231.6	.1					7.0	3.9	5.6	17.0	68.0	86.0	68.0	69.9	69.9
OMA	$936.0							3.5	5.2	16.6	53.8	71.8	53.8	53.8	53.8
PROC	$285.9						7.0				13.8	13.8	13.8	15.7	15.7
MPA	$9.7	.1						.5	.5	.5	.5	.5	.5	.5	.5
Total BCE Current	$2,732.3	.4	23.1	42.8	41.5	24.1	56.4	100.9	264.5	273.5	234.2	204.6	74.6	79.4	82.1
1.0 Dev	$189.2	.3	23.1	42.8	41.5	24.1	38.1	6.3	3.5	3.6	2.9	3.0			
2.0 Prod	$768.5							79.8	208.1	208.3	161.6	110.6			
3.0 MCA	$102.1						9.8	9.1	44.8	38.5					
4.0 Fielding	$3.0							1.0	1.0	1.0					
5.0 Sust	$1,669.5	.1					8.6	4.8	7.1	22.1	69.8	91.0	74.6	79.4	82.1
OMA	$1,243.7							4.2	6.5	21.4	54.5	75.3	58.3	60.3	62.4
PROC	$412.3						8.6				14.8	15.3	15.8	18.6	19.2
MPA	$13.5	.1						.6	.6	.6	.5	.5	.5	.5	.5
RC $FY92 Constant	$410.0	.1	5.9	10.4	9.7	5.5	10.2	16.0	46.0	49.7	16.1	23.7	17.0	17.0	17.0
1.0 Dev	$39.8	.1	5.9	10.4	9.7	5.5	8.2								
2.0 Prod	$102.1							14.3	43.9	43.9					
3.0 MCA	$.0														
4.0 Fielding	$2.4							.8	8	.8					
5.0 Sust	$265.7						2.0	.9	1.3	5.0	16.1	23.7	17.0	17.0	17.0
OMA	$226.9							.9	1.3	5.0	13.8	21.4	14.7	14.7	14.7
PROC	$38.8						2.0				2.3	2.3	2.3	2.3	2.3
MPA	$.0														
RC Current	$526.4	.1	6.1	11.1	10.7	6.3	12.1	20.2	60.2	67.0	16.5	25.0	18.6	19.2	19.9
1.0 Dev	$43.9	.1	6.1	11.1	10.7	6.3	9.7								
2.0 Prod	$155.2							18.1	57.6	59.5					
3.0 MCA	$.0														
4.0 Fielding	$3.0							1.0	1.0	1.0					
5.0 Sust	$344.2						2.5	1.1	1.6	6.5	16.5	25.0	18.6	19.2	19.9
OMA	$290.6							1.1	1.6	6.5	14.0	22.4	15.9	16.5	17.0
PROC	$53.6						2.5				2.5	2.5	2.6	2.7	2.8
MPA	$.0														
AC $FY92 Constant	$1,699.0	.3	16.6	29.8	28.0	15.6	37.1	64.0	156.2	153.0	205.9	165.2	51.0	52.9	52.9
1.0 Dev	$130.7	.2	16.6	29.8	28.0	15.6	24.1	5.2	2.8	2.8	2.8	2.8			
2.0 Prod	$526.4							48.6	114.8	109.7	151.2	100.1			
3.0 MCA	$78.0						8.0	7.2	34.3	28.5					
4.0 Fielding	$.0														
5.0 Sust	$965.9	.1					5.0	3.0	4.3	12.0	51.9	62.3	51.0	52.9	52.9
OMA	$709.1							2.6	3.9	11.6	40.6	50.4	39.1	39.1	39.1
PROC	$247.1						5.0				11.5	11.5	11.5	13.4	13.4
MPA	$9.7	.1						.5	.5	.5	.5	.5	.5	.5	.5
AC Current	$2,205.9	.3	17.1	31.7	30.9	17.8	44.3	80.7	204.3	206.5	217.8	179.6	56.0	60.2	62.2
1.0 Dev	$145.4	.2	17.1	31.7	30.9	17.8	28.4	6.3	3.5	3.6	2.9	3.0			
2.0 Prod	$633.2							61.6	150.6	148.8	161.6	110.6			
3.0 MCA	$102.1						9.8	9.1	44.8	38.5					
4.0 Fielding	$.0														
5.0 Sust	$1,325.3	.1					6.1	3.7	5.4	15.6	53.3	66.0	56.0	60.2	62.2
OMA	$953.1							3.1	4.9	15.0	40.5	52.8	42.6	43.8	45.3
PROC	$358.7						6.1				12.3	12.7	13.1	15.8	16.4
MPA	$13.5	.1						.6	.6	.6	.5	.5	.5	.5	.5

4/11/1991 CCTT BCE (958 Qty)

Millions of Dollars

Fiscal Year:	05	06	07	08	09	10	11	12	13	14	15	16	17
Total BCE $FY92 Constant	71.8	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	67.8	58.6	45.7	32.3
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	71.8	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	67.8	58.6	45.7	32.3
OMA	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	53.8	51.7	42.5	29.6	16.2
PROC	17.6	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
MPA	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Total BCE Current	87.3	87.8	90.7	93.8	97.0	100.3	103.7	107.3	110.9	111.3	99.7	80.7	59.5
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	87.3	87.8	90.7	93.8	97.0	100.3	103.7	107.3	110.9	111.3	99.7	80.7	59.5
OMA	64.5	66.7	68.9	71.3	73.7	76.2	78.8	81.5	84.2	83.7	71.1	51.2	29.0
PROC	22.3	20.5	21.2	21.9	22.7	23.5	24.3	25.1	25.9	26.8	27.7	28.7	29.6
MPA	.6	.6	.6	.6	.6	.7	.7	.7	.8	.8	.8	.8	.9
RC $FY92 Constant	17.0	17.0	17.0	17.0	17.0	17.0	17.0	16.4	13.8	10.5	6.0		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	17.0	17.0	17.0	17.0	17.0	17.0	17.0	16.4	13.8	10.5	6.0		
OMA	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.1	11.5	8.2	3.7		
PROC	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3		
MPA													
RC Current	20.5	21.2	21.9	22.7	23.5	24.3	25.1	25.0	21.8	17.2	10.3		
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	20.5	21.2	21.9	22.7	23.5	24.3	25.1	25.0	21.8	17.2	10.3		
OMA	17.6	18.2	18.8	19.5	20.1	20.8	21.5	21.4	18.0	13.3	6.2		
PROC	2.9	3.0	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.9	4.1		
MPA													
AC $FY92 Constant	54.8	52.9	52.9	52.9	52.9	52.9	52.9	53.5	56.1	57.3	52.6	45.7	32.3
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	54.8	52.9	52.9	52.9	52.9	52.9	52.9	53.5	56.1	57.3	52.6	45.7	32.3
OMA	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.7	42.3	43.5	38.8	29.6	16.2
PROC	15.3	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	15.7	15.7
MPA	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
AC Current	66.8	66.5	68.8	71.1	73.6	76.1	78.7	82.2	89.1	94.1	89.4	80.7	59.5
1.0 Dev													
2.0 Prod													
3.0 MCA													
4.0 Fielding													
5.0 Sust	66.8	66.5	68.8	71.1	73.6	76.1	78.7	82.2	89.1	94.1	89.4	80.7	59.5
OMA	46.8	48.4	50.1	51.8	53.6	55.4	57.3	60.1	66.2	70.6	64.9	51.2	29.0
PROC	19.3	17.5	18.1	18.7	19.4	20.0	20.7	21.4	22.1	22.9	23.7	28.7	29.6
MPA	.6	.6	.6	.6	.6	.7	.7	.7	.8	.8	.8	.8	.9

Appendix C. CCTT System Specification Review

This appendix contains the specific comments related to the TRAC sponsored CCTT SSR. The review was conducted by personnel from TRAC, AMSAA, PSE and RAND.

Summary of Comments from Review Team

Num	Para	Page	General Comments
1	N/A	N/A	All preplanned product improvement (P3I) items should be clearly identified as such.
2	N/A	N/A	Include a glossary of terms, (e.g., "real-time"), and acronyms (e.g., close air support (CAS)).
3	N/A	N/A	Paragraph 5e (7) of the TDR requires the play of KIA, WIA, and MIA, but this requirement is not addressed in the CCTT specifications.
4	N/A	N/A	The tactical air control party (TACP) vehicle described in paragraph 5e (10) of the TDR is not mentioned in the CCTT specifications.
5	N/A	N/A	Dynamic terrain (paragraph 3.9.f.(1) in the CCTT specifications) should be a basic requirement and not a P3I item.
6	N/A	N/A	Smoke (paragraph 3.9.f (4) in the CCTT specifications) should be a basic requirement and not a P3I item.
7	N/A	N/A	An air defense work station (paragraph 3.9 h in the CCTT specifications) should be a basic requirement and not a P3I item.

Num	Para	Page	Comment
8	N/A	N/A	Include the CCTT specifications descriptions of the operation of unit maintenance and supply at each echelon.
9	N/A	N/A	Paragraph 5b (7) of TDR requires simulation of interference and jamming but this is not mentioned in the CCTT specifications.
10	N/A	N/A	CCTT specifications should include a capability for SAFOR to exploit operations security (OPSEC) weaknesses.

Num	Para	Page	Specific Comments
11	11	3.2.1.2.1	Rewrite "Damage and Failure" paragraph to reflect IV&V findings on damage and failure rates, to reflect MTBF as a function of the age of the system and to describe the methodology for calculating combat damage due to indirect fires. (Rewritten paragraph at attachment #1.)
12	13	3.2.1.2.4	Rewrite "Repair" paragraph to reflect IV&V findings on repair rates. (Rewritten paragraph at attachment #2.)
13	25, 26	3.7.1.b-g	Paragraph references 3.7.1.3 thru 3.7.1.9 are incorrect. They should be 3.7.1.2 thru 3.7.1.8.
14	26	3.7.1.1	Include a capability to represent all classes of supply and the involvement of echelons in the supply process. Also, include a capability for supply vehicles to become lost. Also, delete requirement that combat service support (CSS) console provide estimated arrival time for all vehicles.

Num	Para	Page	Specific Comments
15	29	3.7.1.5	Current appendix C to CCTT specifications does not contain flight time data for mortars. (Provide firing data and munitions effectiveness data in an appropriate appendix.)
16	30	3.7.1.6	Rewrite paragraph to include a description of the methodology for determining impact points for artillery. (Rewritten paragraph at attachment #3.)
17	30	3.7.1.7	Rewrite paragraph to delete references to CAS workstation controlling rotary wing aircraft, and to include a description of the methodology for determining impact points for CAS munitions. (Rewritten paragraph at attachment #4.)
18	32	3.7.2	Add requirement for a capability to "browse" system data.
19	35	3.7.2.5	System must accept a unique identifier for each module that can be linked to specific crews and units.
20	35	3.7.2.5.a-l	Data is too restrictive.
21	44	3.7.3.3.1.g	Delete (Detailed specifications for a chair are not needed).
22	47	3.7.4.1	Limitation of 15 packets per second per vehicle may be too restrictive with current LAN technology.
23	49	3.7.7	Rewrite "SAFOR" paragraph to better incorporate SAFOR requirements contained in the TDR. (Rewritten paragraph at attachment #5.)

Num	Para	Page	Specific Comments
24	53	3.7.8.2.1	Rewrite "M1, M1A1, M1AL Hull" paragraph to specify performance based requirements and to describe requirements for representing the effects of moving over rough terrain. (Rewritten paragraph at attachment #6.)
25	53	3.7.8.2.2	Rewrite "M1, M1A1, M1A2 Turret" paragraph to specify performance based requirements. (Rewritten paragraph at attachment #7.)
26	54	3.7.8.2.4	Rewrite "M1, M1A1, M1A2 Ballistics" paragraph to provide approved data or an approved data source for unclassified Ph and Pk data suitable for CCTT training purposes. (Rewritten paragraph at attachment #8.)
27	54	3.7.8.2.4.a/b	Indicate which vehicle has a 120mm gun and which has a 105mm gun.
28	54	3.7.8.2.4.b	Verify alphanumeric designation of 105mm gun rounds.
29	56	3.7.8.2.7	In line 6 of first paragraph insert word "their" before word "own".
30	76	3.7.9.2.1	Rewrite "BFV Hull" paragraph to specify performance based requirements, and accurately state source for M2/M3 operational system algorithms. Also include a requirement for representing the effects of moving over rough terrain. (Rewritten paragraph at attachment #9.)
31	77	3.7.9.2.2	Rewrite "BFV Turret" paragraph to specify set of performance based requirements. (Rewritten paragraph at attachment #10.)

Num	Para	Page	Specific Comments
32	77	3.7.9.2.4	Rewrite "BFV Ballistics" paragraph to specify the version of the TOW missile to be simulated and to provide performance based requirements. (Rewritten paragraph at attachment #11.)
33	90	3.7.10.2.1	This paragraph was to be rewritten. During the rewrite process, a number of related issues were identified. Resolution of these issues will require government guidance. Mr. Jennings will discuss the issues with PM TRADE on 7 March during his visit to Orlando, FL.
34	91	3.7.10.2.1	Current appendix C to CCTT specifications does not contain firing table data. Delete reference to appendix C and provide appropriate data.
35	91	3.7.10.2.1	"Table III-VII" is not contained in current version of CCTT specifications. Delete reference to table and provide appropriate firing rate data.
36	96	3.7.11	Include attrition and failure specifications for the fire support team vehicles (FIST-V).
37	98	3.7.11.2.3	Rewrite "FIST-V Ballistics" paragraph to provide approved data or, an approved source for unclassified Ph and Pk data suitable for CCTT training purposes. (Rewritten paragraph at attachment #8.)
38	110	3.7.12	Include attrition and failure specifications for the improved TOW vehicle (ITV).
39	111	3.7.12.2.3	Rewrite "ITV Ballistics" paragraph to provide approved data, or an approved source for unclassified Ph and Pk data suitable for CCTT training purposes. (Rewritten paragraph at attachment #8).

Num	Para	Page	Specific Comments
40	121	3.7.13	Include attrition and failure specifications for the armored personnel carrier (APC).
41	122	3.7.13.2.3	Rewrite "M113 Ballistics" paragraph to provide approved data, or an approved source for unclassified Ph and Pk data suitable for CCTT training purposes. (Rewritten paragraph at attachment #8.)
42	137	3.9	Scrub list of P3I CCTT specifying items to ensure the list includes all P3I items contained in TDR.
43	137	3.9	Highlight those P3I items in the CCTT specifications that are additional items over and above those P3I items contained in the TDR.
44	161	4.8.9.d-h	Sub paragraphs do not pertain to subject of parent paragraph (4.8.9). Move sub paragraphs d-h to proper place. Provide new sub paragraphs to amplify paragraph 4.8.9.
45	A-3	30.1.1.3	Use of two computers may be too specific. There is no reason why a single, multi-processor machine could not be used.
46	A-5	30.2.1	Use of term "real-time may be misleading. From a graphics engineering standpoint, "real-time" refers to a 24 frame per second update rate.
47	A-8	30.2.1.1.2.3	Line 6 implies all soil types available in the real world should be modeled. Probably too general a statement.
48	A-8	30.2.1.1.2.5	(Line 3) this statement may not be realistic, not all targets burn upon being hit. Deletion of phase "(i.e., burning)" and deletion of last sentence will enhance clarity and accuracy of this paragraph.

Num	Para	Page	Specific Comments
49	A-11	30.2.1.2.2.2	Indicate flare illumination is a P3I requirement.
50	A-12	30.2.1.2.4.3.2	Indicate effect of weapons on terrain is a P3I requirement.
51	A-14	30.2.1.1.5.2.1	Rewrite "Surface Contact and Soil Type" paragraph to include specification for modeling different soil types. (Rewritten paragraph at attachment #12.)
52	A-15	30.2.1.3.2	Image resolution requirements appear to be different than what other sections require.
53	A-26	30.2.1.7	Detection criteria in this paragraph and elsewhere do not include the criteria for determining success.
54	A-26	30.2.1.7.1	Image resolution requirements appear to require less capability than what is currently available in SIMNET.
55	A-36	30.2.1.7.6.1	Requirements for image resolution contained herein, requirements for anti-aliasing (30.7.1.2.1), and requirements for gaming area (30.2.1.2.5.4) do not appear to be properly balanced.
56	A-40	30.3.4	Change "30.1" to "30.2".
57	A-43	30.7.1.1	Image generation requirements for polygon throughput are lower than currently available with off the shelf systems.
58	A-43	30.7.1.1	Change "30.2.1.3.11.1" to "30.2.1.5.1".
59	A-51	Table A-1	Table is incomplete and the information the table does contain is not clear or understandable.

Num	Para	Page	Specific Comments
60	A-56	30.7.4.2.3	Requirements in this paragraph and in 30.7.4.3.2 for use of photographic imagery are unclear and confusing.
61	A-57	30.7.4.3.1	Requirements for multiple levels of detail could be used to extend the gaming area beyond 3500 meters.
62	A-60	30.7.6	Requirement for five technicians to align scopes is unclear.

The following paragraphs were developed by the CCTT SSR Team and submitted to the CCTT PM for consideration and inclusion in the CCTT system specifications.

Damage and Failure

The M1, M1A1, M1A2, M2A1, M2A2, M3A1, M3A2,M981 FIST-V, M901 ITV, M113 APC,and HMMWV simulation modules shall be subject to three categories of failures, which are:

Combat damage
Stochastic failure
Deterministic failure

Crews shall be made aware of the failures only to the extent that the lights, gauges, sounds, and visual observation instruments as specified herein allow. Information discernible only through this equipment shall be provided to the crews. There shall be no additional information provided to the crews. Combat damage is the damage inflicted when a vehicle, aircraft, receive either direct or indirect fire from opposing or friendly forces during the battle simulation. For direct fire, the location of the hit, the type of ammunition used, the velocity at impact, and damage probabilities shall determine which failures occur. The number of hit locations modeled shall be sufficient to differentiate between areas on the vehicle which have significantly different damage probabilities (for example it shall be possible to differentiate between damage caused by a hit to the side of the turret as opposed to a hit to the top of the turret). For indirect fire, damage shall be based upon the distance from the target vehicle to the impact point of each round, the type of round (e.g. 120mm or 155mm, conventional munitions or improved conventional munitions), and the type of fusing (quick or variable time fuse).

Hit locations for indirect fire shall be modeled to differentiate, as a minimum, between bursts which occur nearest to the front, sides, rear or top of the target vehicle.

Combat damages shall include the percent of crew killed or wounded as well as vehicle damage sustained. Several different failures shall be possible at a given hit location and the occurrence of a particular failure shall be based on the probability given for each failure at that particular hit location. The contractor shall derive tables of unclassified damage probabilities which are representative of actual damage which could be sustained by a given type of hit. These damage probabilities will be reviewed and approved by the government prior to inclusion in CCTT.

A stochastic failure occurs when the vehicle or equipment fails on its own as a result of normal wear and tear, not through crew error or combat damage. The occurrence of a failure shall be determined stochastically based upon the parameters of the underlying failure probability distribution which shall be specified by the government. CCTT shall have the capability to model different failure probability parameters to simulate the increased probability of failure for older vehicles. The selection of vehicle age at exercise initiation shall determine the failure parameters to be used during that exercise. Typical probability distributions which may be specified include the log-normal and exponential. Stochastic failures degrade the performance of the unit as well as warn of potential deterministic failures.

Deterministic failures are failures that occur due to resource depletion or improper action. Deterministic failures include, but are not limited to, mismanaged fuel and/or ammunition, collisions, thrown tracks (resulting from improper high speeds on soft surfaces, and attempting steep inclines beyond the capability of the system), resource depletion, and ignored stochastic warnings by crews of the various vehicles listed above. The simulation of the time to complete repairs is discussed in paragraph 3.2.1.2.4. The simulation of combat damage for dismounted infantry is discussed in paragraph 3.7.10.2.1.

Repair

Repairs for CCTT shall be classified into two categories: a) Self-repairs which represent those repairs that the crew can perform on their own without assistance, and b) Repairs via the unit maintenance collection point (UMCP) simulation in which the crew must request repair support from a higher echelon and arrange a rendezvous with a repair maintenance vehicle. The time to complete repairs shall be determined stochastically by time to repair parameters and underlying probability distributions specified by the government.

Self-repairs shall commence automatically upon occurrence of those damages to the vehicle and shall represent repairs that a crew could accomplish themselves. The following are examples of self-repairs:

- Repairing thrown tracks
- Replacing damaged vision blocks
- Replacing damaged radio antennas

Repairs via the UMCP shall occur when a vehicle subsystem fails and cannot be fixed through self-repairs. The vehicle crew shall determine the damage, relay the information to the UMCP, and arrange a rendezvous with a repair maintenance vehicle. If during the repair, either the damaged vehicle, or the maintenance vehicle drives away or is destroyed, the current items under repair shall continue to be simulated as failed.

Field Artillery Battalion Tactical Operations Center (FABTOC)

The FABTOC shall provide direct support and general support level simulation of fire support and fire support coordination. The FABTOC shall net with the FIST-V with automated data transmission encompassing digital message device (DMD) message traffic. This message traffic shall allow the FIST-V to call for fire, adjust fire, register the guns, and provide intelligence and other free text information as transmitted by the FABTOC personnel. The FABTOC consoles shall allow fire support personnel to accomplish the following:

Coordinate fire support. This function includes the application of the commander's guidance, the priority given to targets, and includes the development of the fire support plan in coordination with the maneuver unit commander.

- Acquire targets through DMD message links with the FIST-V
- Deliver field artillery fires
- Move field artillery fires
- Resupply field artillery units
- Command and control of field artillery battalion direct support and field artillery battery general support operations
- Mass field artillery fires

The artillery available shall consist of three batteries of eight 155-mm self-propelled howitzers (M110A2) and one battery of eight 8-inch self-propelled howitzers (M109A3). Both types of howitzers shall be divided into platoons of four. Each platoon of four shall be capable of a different firing mission within the exercise, with all platoons firing simultaneously. These vehicles shall be visible in the CCTT data base to all other personnel and shall be vulnerable to combat and collision damage.

The howitzers shall fire at a maximum sustained rate of three rounds a minute for the first three minutes and one round per minute thereafter. The range of the howitzers shall be from 1000 to 18,100 meters utilizing a high explosive M483 shell with two choices of fuse: point detonating or variable time set to a 20 meter height-of-burst. During initialization the howitzer locations along with ammunition on hand shall be determined.

The FABTOC workstation shall determine the location of the impact point of each round in accordance with the following guidelines:

The target coordinates provided by the FO shall be used as the nominal impact point of the base piece of the battery or platoon. The actual impact point for the base piece shall be determined by applying a random error to the nominal impact point.

The nominal impact points for the remaining pieces in the battery or platoon shall be offset from the base piece in accordance with the type of sheaf fired. For point targets a converging sheaf shall be fired and a standard sheaf shall be fired for area targets. For linear targets, the long axis of the standard sheaf shall be aligned with the long axis of the target. If the axis of the target is not specified then the long axis of the sheaf shall be perpendicular to the observer-target azimuth. Actual impact points shall be determined by applying a random error to the nominal impact points.

The random error for all rounds shall be based on data provided by the government.

The effects of the firing of howitzers shall be displayed in the visual scene as respective flashes relative to their locations of firing, associated flight times, and flashes/explosions at the points of detonation, provided each is within line-of-sight. Associated terrain destruction shall be simulated as a P3I item (e.g., bridge damage/destruction, vehicle damage/destruction, etc.).

Firing shall be setup to be either preplanned for a particular exercise and/or coordinated in real-time with requesting modules for immediate support in a location. Movement of the howitzers shall be provided to the FABTOC consoles taking into account realistic movement times based on the type of terrain and obstacles encountered. This movement, once given a destination location, shall be automatic. The howitzers shall not be capable of firing while in transit. The howitzers shall be capable of sustaining damage from opposing fire and collisions with either partial or total damage the result.

CAS

The CAS console shall provide to the operator the control over two types of close air support missions; preplanned and on-call. The preplanned mission shall be one that exists in the initial conditions of an exercise while the on-call mission shall be one that is initiated in real-time. The on-call mission shall be initiated through radio requests from combat vehicles operating in the exercise. Both missions shall require the allotment of time required for air travel from a designated airfield to the selected strike area.

The CAS console shall provide the following capabilities and displays to the CAS operator.

- Aircraft types available for missions. (e.g., A10, A7, F4, F16)
- Air sorties status for each mission. (Time for arrival, time for return)
- Mission locations with target descriptions
- Capability to select the above functions in real-time

The CAS station shall be tied into the communication network to allow for combat vehicle requests for air support. The aircraft shall carry typical ordinance used on the selected aircraft. The CAS sorties shall produce the weapon effects and damage caused by the ordinances used. The effects and damages shall be displayed visibly to all simulator modules that are within the line-of-sight range and the results shall be displayed on the PVD of the CAS console when selected.

The CAS console shall be capable of being located within the tactical operation center (TOC) or within an M2/M3 simulator module if so desired. In either case, the CAS console design and required interfaces shall be such that the movement of the console shall not require any modifications to either the TOC or the selected M2/M3 module.

The CAS console shall determine the impact point of the aircraft ordnance in accordance with the guidelines given below:

The aircraft shall "check-in" with the TACP upon arrival in the target area for an update on the current target location. If communication cannot be established with the TACP, the aircraft will use the latest reported target location.

The aircraft will search around the designated coordinates for the target specified by the TACP. For example, if the target is specified as "armor" the aircraft shall search for tanks. The search area shall expand outward from the designated coordinates for a radius of 500 meters. The aircraft shall attack the first appropriate target found. If an appropriate target is not found before the search limit is reached, the aircraft shall abort the mission.

The coordinates of the selected target shall become the nominal impact point for the aircraft ordnance. The distribution of actual impact points around the nominal impact point shall be determined stochastically based on data provided by the government.

The aircraft shall be capable of follow-on attacks if fuel and ordnance permit. Selection of subsequent targets shall use the same methodology as the selection of the initial target.

Friendly vehicles within the aircraft search radius shall be subject to attack based on a random number draw against the probability of an incorrect identification of a friendly vehicle. The contractor shall derive an appropriate set of probabilities for this event for approval by the government.

SAFOR (General)

The semi-automated forces are integral to CCTT's ability to train and sustain collective (crew through battalion task force) tasks and skills in command and control, communications, and maneuver, and to integrate the functions of combat support and combat service support units. The friendly SAFOR capabilities must be extensive enough to support the training of maneuver battalions in all aspects of the combat, combat support, and combat service support tasks contained in the appropriate ARTEP. The threat SAFOR capabilities must be extensive enough to provide a challenging opposing force. This opposing force should place the stresses of combat on all training participants and require them to execute realistic individual, crew, and unit actions as they would in combat.

Specifics of the representation of the threat SAFOR are contained in section 3.7.7.1. Specifics of the representation of the friendly SAFOR are contained in section 3.7.7.2.

SAFOR (Threat)

CCTT must provide a capability to use semi-automated forces to represent threat forces up to the battalion level. The forces must be capable of executing offensive and defensive missions within the context of an overall regimental level operation as described in FM 100-2-1, The Soviet Army Operations and Tactics. The forces will be positioned, tailored, tasked, controlled, and fought by a SAFOR commander using a workstation or combination of workstations.

Organizationally, the threat maneuver battalions (armor/motorized rifle) will be structured and equipped with the number and types of weapon systems as described in FM 100-2-3, The Soviet Army Troops, Organization and Equipment. Dismounted infantry and their associated weapon systems, to include RPGs and shoulder-fired SAMs, will be represented. Threat forces will also include a capability to represent those elements of regimental-level organizations and weapon systems that could accompany maneuver battalions, such as when the battalion is acting as a regimental advance guard. These regimental-level organizations include the self-propelled howitzer battalion, the air defense missile and artillery battery, the reconnaissance company, the engineer company, the antitank missile battery, and the chemical protection platoon. Other organizations and weapon systems also could doctrinally be used in support of maneuver battalions and should therefore be represented. These organizations and systems include a regimental artillery group (RAG) and supporting elements of the division artillery group (DAG) and their associated tube artillery and multiple rocket launcher systems; fixed and rotary wing aircraft capable of conducting attack, close air support, and lift/airmobile operations; and division-level surface-to-air missile systems.

The threat forces (maneuver, air defense, fire support, aviation, and others) shall be capable of employment in offensive and defensive operations in accordance with the tactics and doctrine described in FM 100-2-1. In particular, the maneuver battalions and subordinate elements (platoons and companies) shall be capable of using the prescribed tactical formations of march, prebattle, and attack when executing the three forms of offense (attack, meeting engagement, and pursuit). They shall use a "strongpoint" configuration when executing the two forms of defense (hasty and prepared defense).

Threat forces will be deployed and employed by a SAFOR commander using a workstation or combination of workstations. The SAFOR commander will exercise his operational experience to position, tailor, control, and fight all the different types of available forces.

Positioning includes the capability to establish the initial location of individual vehicles or the center of mass of units. It also includes the capability to determine the initial orientation/direction of vehicles and units and the initial formation of any unit.

Tailoring encompasses the capability to initially select the type and size of the threat force. The workstation shall have the capability to use predetermined TOE for platoon-, company-, or battalion-sized ground units to "create" any number of threat forces. For example, there should be a capability to create an air defense gun platoon, a battery of self-propelled surface-to-air missile systems, a reinforced motorized rifle company, a pure tank battalion, or a regimental artillery group. There should also be a capability to create threat aviation systems in various sized flights, e.g., a flight of two CAS aircraft, or a flight of four attack helicopters.

Tailoring also includes the capability to establish initial performance parameters of the vehicles/weapon systems within the force. The workstation shall have the capability to establish or subsequently change the performance parameters of individual threat vehicles/weapon systems. Parameters would include such considerations as fuel load, type and amount of ammunition, movement speed, crew proficiency (target acquisition/gunnery), or target engagement ranges.

Controlling threat forces will be accomplished primarily by means of automated instructions for flights of aircraft or for platoon- through battalion-size ground units. The automated instructions shall support deployment of individual threat systems/units into doctrinally correct formations and shall support tactical control of these units as they execute their missions. By selecting from a menu of automated instructions, the SAFOR commander can preplan how the forces will fight through the sequencing of various automated instructions. Implied in this capability are three considerations. First, there must be a capability for the SAFOR commander to establish control measures so that the initiation or cessation of instruction sets can be controlled in time and space. Secondly, there must be a capability for the commander to intervene to modify or interrupt the preplanned sequencing of the automated instructions should there be a significant change in either the friendly or enemy situation. Finally, "situational" instruction sets must provide for an immediate tactical response (without intervention by the commander) to certain situations, such as when a SAFOR unit unexpectedly comes under air attack.

Threat SAFOR shall be indistinguishable from live forces by those personnel participating in the training. The outward behavior of SAFOR vehicles, dismounted infantry, and/or weapon systems must be realistic to the extent that soldiers in manned simulators will not recognize the SAFOR units as computer controlled. For example, an individual SAFOR vehicle should seek to avoid obstacles (terrain or manmade) as it moves within a unit formation. SAFOR units that come under intense, effective, and unexpected fire should have a capability to take immediate action in response to the fire.

SAFOR vehicles/systems must be vulnerable to the effects of enemy, terrain and weather, stochastic failures, and battle damage in the performance of their functions.

Threat SAFOR must allow for the conduct of up to five separate unit operations simultaneously at a site.

The P3I for threat SAFOR is the development of SAFOR to the regimental level. Organizationally, the threat maneuver regiments (armor/motorized rifle) shall be structured and equipped with the number and types of weapon systems as described in FM 100-2-3. Threat forces shall also include a capability to represent elements of division-level organizations and weapon systems that could be in support of the regiment. Division-level organizations include the artillery regiment, the surface-to-air missile regiment, the reconnaissance battalion, the engineer battalion, and the helicopter squadron.

The regimental-level threat forces (maneuver, air defense, fire support, aviation, and others) shall be capable of employment in offensive and defensive operations in accordance with the tactics and doctrine as described in FM 100-2-1.

SAFOR (Friendly)

CCTT must provide a capability to use semi-automated forces to represent friendly units up to the battalion level. The forces must be capable of executing offensive and defensive missions within the context of a battalion task force as described in FM 71-2, The Tank and Mechanized Infantry Battalion Task Force, or as a maneuver battalion as described in FM 71-3, Armored and Mechanized Infantry Brigade. As stated in paragraph 3.7.7, the friendly SAFOR must be able to train and sustain collective (crew through battalion task force) tasks and skills in command and control, maneuver, and the integration of the functions of combat support and combat service support units.

The SAFOR commander could be either an active or reserve component platoon leader, company commander, or battalion commander, depending on the organizational level of training being supported by the SAFOR. The SAFOR must be able to be fought as a pure, semi-automated force, or as an integrated force (SAFOR vehicles/manned simulators). For example, a pure SAFOR battalion could be used to represent an adjacent battalion to an actual battalion undergoing training. An example of an integrated force would be the use of SAFOR platoons and/or companies to "flesh-out" a battalion when the battalion staff and subordinate commanders are training without troops. In this regard, SAFOR units down to platoon level must be able to interact under the control of manned simulators, and to move as simulated adjacent, forward, and rear elements.

Organizationally, the friendly maneuver battalions (tank or mechanized infantry) shall be structured and equipped with the number and types of major items of combat, combat support, and combat service support equipment as described in FMs 71-2 and 101-10-1/1, Staff Officer Field Manual, Organizational, Technical, and Logistical Data, Volume I. Dismounted infantry and their associated weapon systems (squad assault weapons and light/medium antitank weapons), Fire Support Team - Vehicles, and Tactical Air Control Party - Vehicles shall also be represented. Friendly forces shall also include a capability to represent those elements of brigade- and division-level combat and combat support organizations and equipment that could be attached to or in support of a tank or mechanized infantry task force. These organizations and equipment include artillery units (tube artillery and multiple launch rocket systems), engineer units (armored combat earthmovers and armored vehicle launched bridges), air defense units (vehicle and shoulder fired surface-to-air missiles and gun systems), and aviation units (attack, close air support, and lift/airmobile aircraft).

With the exception of air defense organizations and equipment, many of the brigade- and division-level organizations and weapon systems that would support the maneuver battalions are already described within the CCTT specifications as indicated below:

Functional Area/Element	Paragraph
CSS	3.7.1.1
Engineer	3.7.1.2
Fire Support Element	3.7.1.3
UMCP	3.7.1.4
Fire Direction Center	3.7.1.5
Field Artillery Battalion TOC	3.7.1.6
CAS	3.7.1.7
HMMWV	3.7.1.8
Dismounted Infantry	3.7.1.10

The workstations/consoles controlling these assets/functional areas could be incorporated into an overall friendly SAFOR capability, or a special SAFOR workstation could be developed to represent the functions, organization, and equipment of these brigade- and division-level elements.

The friendly forces (maneuver, air defense, fire support, aviation, and others) shall be capable of employment in offensive and defensive operations in accordance with the tactics and doctrine described in FM 71-2. In offensive operations (movement to contact, hasty attack, deliberate attack, exploitation, and pursuit), the maneuver battalions and subordinate elements shall be capable of using, as a minimum, the prescribed tactical movement formations of column, line, wedge, vee, and echelon. (Basic movement techniques include traveling, traveling overwatch, and bounding overwatch.) In the defense, units shall be capable of defending in sector, defending a battle position, and defending a strongpoint.

The SAFOR commander, using his operational experience, will fight the different forces by positioning, tailoring, and controlling them. Positioning includes the capability to establish the initial location of individual vehicles or the center of mass of units. It also includes the capability to determine the initial orientation/direction of vehicles and units and the initial formation of any unit. There shall be a capability to position pure SAFOR units or SAFOR units that are attached to or under the control of a manned simulator. SAFOR units attached to or under the control of manned simulators shall have bumper markings that are clearly identifiable by the personnel within the parent simulator.

Tailoring encompasses the capability to initially select the type and size of the friendly force. The workstation shall have the capability to use predetermined TOEs for platoon-, company-, or battalion-sized ground units to "create" any number of friendly forces. For example, there should be a capability to create a tank platoon, a tank heavy company team, or mechanized infantry heavy battalion task force. There shall also be a capability to create friendly aviation systems in various sized flights, e.g., a flight of two close air support aircraft or a flight of four attack helicopters.

Tailoring also includes the capability to establish initial performance parameters of the vehicles/weapon systems within the force. The workstation shall also have the capability to establish or subsequently change the performance parameters of individual friendly vehicles/weapon systems. Parameters would include fuel load, type and amount of ammunition, movement speed, vehicle age (for failure rate determination), crew proficiency (target acquisition/gunnery), or target engagement ranges.

Friendly forces shall be controlled primarily through automated instructions for platoon- through battalion-size ground units or for flights of aircraft. The automated instructions shall support deployment of individual systems/units into doctrinally correct formations and tactical control of these units as they execute their missions. By selecting from a menu of these automated instructions, the SAFOR commander can preplan how the forces will fight by sequencing various automated instructions. (Control of a pure SAFOR unit shall be exercised through the SAFOR commander's workstation. Ideally, control of a SAFOR unit attached to a manned simulator should be exercised directly by the manned simulator without going through the SAFOR commander's workstation.)

Implied within the control capability are three considerations. First, there must be a capability for the SAFOR commander to establish control measures so that the initiation or cessation of instruction sets can be controlled in time and space. Second, there must be a capability for the commander to intervene to modify or interrupt the preplanned sequencing of the automated instructions should there be a significant change in either the friendly or enemy situation. Finally, "situational" instruction sets must provide for an immediate tactical response (without intervention by the commander) to certain situations, such as when a SAFOR unit unexpectedly comes under air attack.

Friendly SAFOR shall be indistinguishable from live forces by those personnel participating in the training. The outward behavior of SAFOR vehicles, dismounted infantry, and/or weapon systems must be realistic to the extent that soldiers in manned simulators shall not recognize the SAFOR units as computer controlled. For example, an individual SAFOR vehicle should seek to avoid obstacles (terrain or manmade) as it moves within a unit formation. SAFOR units that come under intense, effective, and unexpected fire should have a capability to take immediate action in response to the fire.

SAFOR vehicles/systems must be vulnerable to the effects of enemy, terrain and weather, stochastic failures, and battle damage in the performance of their functions to the same extent as manned simulators. SAFOR vehicles must also be recoverable and repairable in the same manner as manned simulators.

SAFOR must allow for the conduct of up to five separate unit operations simultaneously at a site.

The P3I for friendly SAFOR is the development of SAFOR to the brigade level. Organizationally, the friendly maneuver brigades (tank/mechanized infantry) shall be structured and equipped with the number and types of weapon systems as described in FM 71-3, Armored and Mechanized Infantry Brigade, and FM 101-10-1. Friendly forces shall also include a capability to represent elements of division-level organizations and weapon systems that could support the brigade. Division-level organizations include division artillery, the air defense battalion, the engineer battalion, and the cavalry squadron.

The brigade-level forces shall be capable of employment in offensive and defensive operations in accordance with the tactics and doctrine described in FM 71-3.

Hull

The CCTT shall simulate the hull dynamics of the M1, M1A1, and M1A2. The hull simulation shall provide the interface with the CCTT terrain representation to provide realistic movement of the vehicle across the terrain. CCTT shall simulate the effects on vehicle speed and mobility of the driver's throttle and brake inputs, the vehicle's automatic transmission, engine and drive train capabilities, soil type, terrain roughness, slope and obstacles. Simulated vehicles shall have mobility performance which closely represents actual vehicle mobility data which will be specified by the government. The hull simulation shall interface with the CCTT graphics system to provide appropriate visual indications to the crew of the ride roughness, hull movement and cant of their vehicle.

Turret

The CCTT shall simulate the M1, M1A1, and M1A2 turret. The turret simulation shall interface with the hull simulation and the graphics system to provide realistic graphics indications of turret movement. Turret movement shall be in response to gunner and/or commander control inputs, motion transmitted from the hull simulation, turret stabilization system inputs and turret and gun elevation drive system capabilities. The commander's cupola and loader's hatch shall be capable of independent rotation as in the actual vehicle. Turret rotation rates, gun elevations rates and turret stabilization shall simulate actual vehicle performance data which will be provided by the government.

(Ballistics Specifications for Paragraphs 3.7.8.2.4, 3.7.11.2.3, 3.7.12.2.3, and 3.7.13.2.3).

CCTT shall simulate the trajectory of each round of a ballistic weapon in sufficient detail to determine; if the round impacts its intended target, the point of impact on the target, and if the round impacts the ground or an object other than the intended target. The hit detection computations shall take into account round-to-round performance variations along with how close the selected target, or other object, is to the trajectory of the fired ammunition. Trajectory modeling shall be based on firing table data which will be provided by the government.

The ballistics simulation of the different weapons and ammunition shall replicate the visual characteristics of the firing signature, trajectory flyout, and the impact signature. During flyout, a tracer shall be visible to the firing vehicle, when appropriate.

The firing of the Smoke Grenade SALVO's on the different weapon systems shall be simulated. The Smoke Grenade SALVO's shall be simulated along an arc 30 meters from the particular vehicle/weapon, 55 degrees to the left and 55 degrees to the right of the gun line (the gun line is an imaginary line drawn from the base of the gun barrel along the center of the barrel out to the desired range). The height and depth of the smoke shall be based on data provided by the government. The persistence of the smoke cloud shall be modeled stochastically based on data provided by the government.

Hull

The hull simulation of the M2/M3 shall provide the interface with the CCTT terrain representation to provide realistic movement of the vehicle across the terrain. CCTT shall simulate the effects on vehicle speed and mobility of the driver's throttle and brake inputs, the vehicle's automatic transmission, engine and drive train capabilities, soil type, terrain roughness, slope and obstacles. Simulated vehicles shall have mobility performance which closely represents actual vehicle mobility data which will be specified by the government. The hull simulation shall interface with the CCTT graphics system to provide appropriate visual indications to the crew of the ride roughness, hull movement and cant of their vehicle.

Turret

The turret simulation of the M2/M3 shall interface with the hull simulation and the graphics system to provide realistic graphics indications of turret movement. Turret movement shall be in response to gunner and/or commander control inputs, motion transmitted from the hull simulation, turret stabilization system inputs and turret and gun elevation drive system capabilities. The commander's cupola shall be capable of independent rotation as in the actual vehicle. Turret rotation rates, and gun elevations rates shall simulate actual vehicle performance data which will be provided by the government.

Weapon Systems

The M2/M3 weapon system simulation shall include the modeling of the following systems:

- M242 25-mm Automatic Gun
- M791, Armor-Piercing Discarding Sabot with Tracer (APDS-T)
- M792, High-Explosive Incendiary with Tracer (HEI-T)
- M240C 7.62-mm Coaxial Machine Gun
- A131, four-ball-and-one-tracer mix
- The TOW 2 Missile (BGM-71D)
- M257 Smoke Grenade Launcher
- The L8A1/A3 red phosphorus smoke grenades

CCTT shall simulate the trajectory of each round of a ballistic weapon in sufficient detail to determine; if the round impacts its intended target, the point of impact on the target, and if the round impacts the ground or an object other than the intended target.

The hit detection computations shall take into account round-to-round performance variations along with how close the selected target, or other object, is to the trajectory of the fired ammunition. Trajectory modeling shall be based on firing table data which will be provided by the government.

The ballistics simulation of the different weapons and ammunition shall replicate the visual characteristics of the firing signature, trajectory flyout, and the impact signature. During flyout, a tracer shall be visible to the firing vehicle, when appropriate.

The firing of the smoke grenade SALVO's on the different weapon systems shall be simulated. The smoke grenade SALVO's shall be simulated along an arc 30 meters from the particular vehicle/weapon, 55 degrees to the left and 55 degrees to the right of the gun line (the gun line is an imaginary line drawn from the base of the gun barrel along the center of the barrel out to the desired range). The height and depth of the smoke shall be based on data provided by the government. The persistence of the smoke cloud shall be modeled stochastically based on data provided by the government.

The TOW 2 missile flyout shall be simulated in three phases; launch, burn and coast. During each phase, the missile's current velocity and turning performance (lateral and vertical acceleration) at each simulation update shall be based upon actual missile performance data to be provided by the government. The missile shall respond to control inputs from the gunner to the extent allowed by the missile's acceleration capability. The missile control system shall be modeled as an underdamped control system as described in the systems characteristics document TOW T-24, Volume 1, Revision C which shall be provided by the government. A missile icon shall be provided which shall be visible as an object on the battlefield as it flies down range. A realistic representation of the missile launch signature and gunner's sight obscuration after launch shall be provided. The flare in the rear of the missile shall be visible to the gunner as long as the missile is within the gunner's field of view.

Surface Contact and Soil Trafficability Types

A minimum of three support points and the associated soil trafficability type shall be reported to the host for each vehicle. Vehicle attitude shall reflect the surface orientation. Vehicle dynamics shall reflect the soil trafficability type. CCTT shall be capable of modeling approximately nineteen different soil trafficability types. The contractor shall be responsible for selecting the most appropriate soil types to be used to represent the trafficability of each portion of a terrain data base. The hull simulations shall utilize the trafficability data, along with other data, such as slope and throttle setting, to determine vehicle speed on a given piece of terrain.

Appendix D. CCTT Training Device Requirement

Part A. TDR for the CCTT

CCTT

CCTT is a system of computer-driven combat vehicle simulators such as the M1 Abrams Tank, the M2 BFV, the M3 Cavalry Fighting Vehicle (CFV), the FIST-V, and emulators that control other vehicle models and functions which work interactively similar to the vehicles and functions they simulate. These simulators and emulators are connected via LAN. The system's computers create a simulated battlefield which, when viewed by soldiers who are using the system, creates the illusion of moving and fighting over actual terrain while operating or riding inside the actual vehicles, and employing the actual weapons systems mounted in or on the vehicles.

Need

The active and reserve components of the US Army need the capability to train the total combined arms force on a simulated, fully interactive, real time battlefield. A system is required to train and sustain collective (crew through battalion task force) tasks and skills in command and control, communications, and maneuver, and to integrate the functions of combat support and combat service support units. The trainer must replicate cues and responses of the operational system, with fidelity sufficient to provide for realistic performance of individual tasks within the context of crew operations. This requires the capability to simulate, in real time, the conduct of combat operations in a realistic environment with an appropriate and challenging opposing force that will require realistic individual, crew, and staff actions, and place the stresses of combat on all participants. This need is expressed by deficiencies revealed in the mission area analysis (MAA) for the close combat force and detailed in the mission area development plan (MADP) and battlefield development plan.

Additionally, there is a need for the conduct of joint operations, involving other US services and members of the allied forces with whom we routinely operate outside CONUS.

This type of simulation will provide a cost effective means of conducting a variety of combined arms and joint operations. The system will allow individuals, crews, and units to operate in a simulated combat environment, reducing the impact of restrictions of weapons effects safety, terrain limitations, and time, and will assist in overcoming the effects of crew turbulence and scarce resources. This must allow units to raise their levels of training, and ensure more efficient use of their training assets when they train in the field. The first unit equipped will be in 2nd Qtr FY 97. IOC is 1st QTR, FY 98.

Operational/Organizational Plan

The CCTT will be used by active duty and reserve units for the conduct of training in command and control, tactical training, ARTEP mission training, and combined arms exercises. The CCTT will be used for selected training events for unit training and institutional instruction (see appendix 4) of selected collective tasks in a fully interactive, real time environment. Wartime factors, such as varying terrain, obstacles, a cluttered battlefield (i.e., smoke, fog, burning equipment), logistics, and indirect fires, will be integral parts of the simulation as will casualty assessment and maintenance failures. Complete exercising of command and control skills in a 360 degree battlefield will be possible on this system.

This system will be constructed in modules that will support the fielding of battalion task force, company team, and platoon sets. These configurations will include combat support and combat service support functions fielded in sufficient quantities, by location, to accommodate the training of close combat BN/TF, CO/TM, or platoon sized elements in CONUS and OCONUS.

The system will be fielded initially in platoon and company team sites. Certain of these sites will be expanded to battalion task force size, and additional sites of battalion task force size will be procured.

Essential Characteristics

System Requirements

The system must provide the interactive networking of vehicle simulators and command, control, communications and support work stations that represent the vehicles, operations centers, support functions, and weapons systems of a BN/TF, a CO/TM or troop, a platoon, and the combat support and combat service support elements.

The vehicle simulators and work stations must be operable by military personnel in the military occupational specialty (MOS) normally found in the unit that is being trained.

The system must allow the initialization, reinitialization, reconstitution, and activation of vehicles into the simulation either individually or in units. It must provide the capability to emplace sections, squads, platoons, company teams, and supporting units at specific coordinates on the simulated terrain in a configuration that is consistent with acceptable patterns of distribution and orientation. The system set up parameters (i.e., unit displacement, weapons systems, controlled supply rates, etc.) will be provided by unit or instructor personnel.

The system must be designed so that military personnel who are intended as the training audience--not those with computer specialties-- can initialize, reinitialize, or reconstitute the system or elements of the system within three attempts after training.

The system must allow for the conduct of up to five separate unit operations simultaneously at a site.

Army aviation simulators will be developed as separate requirements. These modules will interface and interact with the CCTT.

The system must contain built in test equipment (BITE) and self-test diagnostics.

The CCTT (in a degraded mode) must be interoperable with SIMNET.

The system must be modular in design and allow for product improvements and technology upgrades.

The following essential system characteristics will be developed as preplanned product improvements:

- The system must be interoperable with other simulation systems
- The system must provide the capability to network simulations at widely separated site locations
- The system must provide for the expansion of certain company team sites to battalion task force size, and the configuration of modules and associated equipment in tank heavy, mechanized infantry heavy, and balanced battalion task force sets

Vehicle Simulator Modules

There must be simulators to represent the M1, M1A1 and M1A2 family of tanks, M2, M2A1, M2A2 and M3, M3A1, M3A2 family of fighting vehicles, the M113A3 Armored Personnel Carrier, the M901 ITV, and the M981 FIST-V. Soldiers must be able to identify individual simulated vehicles by vehicle bumper number or the combat vehicle marking system.

The vehicle simulators must represent the physical appearance and functional aspects of the crew compartments and functional controls, and replicate the performance characteristics of the vehicles and weapons systems they simulate. During operation, the crews must be able to perform the individual tasks that support the collective tasks they would normally perform to shoot, move, and communicate.

The simulators must replicate the aural, visual, and tactile sensations and cues normally associated with these activities in the actual vehicles. The simulated vehicle speed and maneuverability must be consistent with the trafficability and profile of the simulated terrain. Those controls that are necessary for the performance of collective tasks must be functional. Those that are not required for the functioning of the vehicle during the performance of collective tasks will be mock-ups. The training developer will provide the materiel developer with a list of specific controls which must be functional.

The simulated weapons systems must exhibit the external and terminal ballistics characteristics of the actual weapons. Ammunition, supplies, and fuel basic loads must be selectable as initialization parameters. Primary fire controls and sighting systems must be represented in sufficient detail to allow the use of precision gunnery techniques from the primary sight using normal gunnery mode from a stationary or moving vehicle. These systems must also replicate secondary fire control systems, night vision devices, and thermal capabilities associated with each weapons system.

The system must represent correct vehicle and weapon system operation, movement, and orientation characteristics. The system must represent weapon system primary and secondary armament systems of 120mm and 105mm cannon, 25mm automatic gun, .50cal and 7.62mm machine guns, and TOW II missiles.

The system must be fitted with vision blocks, sighting systems, and sensors that replicate those on the actual vehicles. The visual resolution of the simulated terrain must be such that true perspective is maintained as distance to an object increases or decreases. The system must be capable of displaying both friendly and threat personnel, vehicles, and weapons effects. All objects must appear to be the proper size with distinguishing characteristics for the indicated range as viewed through the optical systems or sensors employed by the weapons systems. Terrain feature clarity must be sufficient to provide authentic depth perception and distant vision. Visual distortion caused by the operation of the simulators must not interfere with visual task performance.

The system must replicate the system's SINCGARS communications capabilities. It must allow the unit that is undergoing training to integrate its organic tactical operations center communications and wire communications schemes. The system must allow crewmen to use the combat vehicle crewman's helmet for communications, and must replicate the effects of interference, jamming, terrain obstructions, and distance on communications.

The simulators must exhibit the effects of deterministic failures consistent with the operating characteristics and capabilities of the actual weapons and equipment; stochastic failures that could occur within the reliability, availability, and maintainability envelope of the actual weapons and equipment; and battle damage caused by enemy and friendly weapons effects on the actual weapons and equipment. The simulators must also replicate fuel and ammunition consumption rates consistent with the systems they simulate, and must respond to emulator stations that simulate resupply, rearm, and refuel functions.

The simulator inside dimensions and arrangement must mimic the weapons system layout in sufficient detail to allow all crew members to operate at any level of mission oriented protective posture (MOPP).

The simulators must provide a compass capability, presented in degrees, depicting the orientation of the long axis of the vehicle on the simulated terrain to grid north. This capability will be available inside the simulator after the vehicle has been stationary for 60 seconds.

The simulation must provide a vehicle which will operate on the terrain and represent the operational characteristics of the HMMWV, provide a horizontal visual, provide multiple channel; voice communications and have the capability to be augmented by a selection of weapons systems including machine guns, M249 SAW, and MK 19 40 mm grenade launcher.

The system must provide a panoramic field of view (FOV) which represents an open or popped hatch for selected vehicle simulators for the vehicle commander position. The view shall be a 360 degree horizontal FOV around the center of the vehicle commanders position that will accommodate a vertical FOV of -15degree to +40 degree at 1-power

(1x). The panoramic field of view must provide a minimal simultaneous peripheral vision of the 90-degree either side of the center of view or 180 degree horizontal. The center of view will be selectable throughout the 360 degree horizontal FOV of the commanders position. The popped hatch FOV will provide a selectable binoculer vision which replicates use of standard military binoculars and night vision goggles.

The following essential vehicle simulator characteristics will be developed as pre-planned product improvements:

The system must simulate the following vehicles:

- 1 M163 Self Propelled Vulcan
- 2 M730 with M48A2 CHAPARRAL
- 3 Pedestal Mounted Stinger
- 4 M728 Combat Engineer Vehicle
- 5 M9 Armored Combat Earthmover
- 6 M88A2 Recovery Vehicle
- 7 Armored Vehicle Launched Bridge (AVLB)
- 8 Air Defense/Anti Tank System (ADATS)
- 9 Non Line of Sight Forward (NLOS-F)
- 10 Multiple Launch Rocket System (MLRS)

The system must accommodate the following equipment modifications and upgrades:

- 1 Block III Tank
- 2 M2/M3 Block III
- 3 Line of Sight Anti-Tank (LOSAT)
- 4 Armored Systems Modernization (ASM)
- 5 Forward Area Air Defense Systems
- 6 Advanced Field Artillery System (AFAS)
- 7 Jaguar and Stingray
- 8 Advanced Tactical Missile System (ATACMS)

The system must provide automation of selected simulator crew positions.

The simulators must provide visual simulation of infra-red, FLIR capabilities, and enhanced thermal capability.

The system must simulate the use of digital message devices.

The system must simulate other small and medium caliber automatic weapons systems such as the MK19 40mm automatic grenade launcher.

Simulated Terrain and Environment

The system must accommodate terrain data bases of 50 by 75 kilometers, with an active terrain radius of 3500 meters around each simulated vehicle.

Terrain databases must simulate terrain that represents Central Europe and the Middle East, and must display topographic features such as hilltops, valleys, saddles, ridges, depressions, gullies, streams, trails, hillocks, mountains, rivers, fords, forests, roads, man-made structures, and vegetation features representative of these areas. These databases must be selectable. These features must be displayed with sufficient fidelity to allow 95 percent of the users to recognize them by shape, size, relationship to other objects, and texture.

The system must provide the capability to selectively represent terrain in detail that will allow the traverse of terrain and the selection of routes that will cover and conceal a vehicles movement. This must be consistent with a contour interval of a maximum of 100 meters and a minimum of 10 meters.

The system must provide Universal Transverse Mercator Projection map representations of the simulated terrain at 1:50,000, 1:100,000, and 1:250,000 scales.

The system must provide a means by which existing terrain databases can be modified, and additional databases can be programed to represent additional areas of terrain as needed.

The system must provide normal day and night visibility, and exhibit the effects of smoke, fog, haze, vehicle exhaust, dust, weapons flash, terminal ballistic effects of simulated ammunition and explosive ordnance, and precipitation.

The following essential simulated terrain characteristics will be developed as preplanned product improvements:

The system must accommodate terrain databases of 75 by 125 kilometers, with an active terrain area of 6000 meters around each simulated vehicle.

The system must be capable of rapidly processing Defense Mapping Agency digital terrain data, and interoperating with present SIMNET terrain databases.

The system must represent mixed agricultural and jungle terrain.

The system must provide the capability to maneuver dismounted units to within one meter of objects, obstacles, and vegetation.

The system must simulate the obscuration and trafficability effects of precipitation and nuclear, chemical and smoke weapons.

The simulated terrain must be dynamic in that it must display the tracks made by moving vehicles, craters and other damage caused by exploding artillery rounds, degraded camouflage, the effects of engineer activities, the construction efforts of dismounted infantry and surface effects caused by precipitation.

The system must simulate the delivery of specific chemical munitions, and must provide audible chemical alarms to warn of their delivery. Following the delivery of a chemical munition, the system must simulate areas of contamination that are consistent with the persistence of the agent and the method by which it was delivered.

The system must simulate the delivery of specific nuclear weapons, and must provide visual/audible cues to warn of their delivery. Following the delivery of a nuclear weapon, the system must simulate areas of nuclear contamination that are consistent with the type of weapon and the method by which it was delivered, and exhibit the effects of the weapon on terrain, communications, and equipment.

Dismounted Personnel (Infantry and Scouts)

The system must simulate dismounted soldiers in scout sections, infantry squads, and platoon headquarters, who can be made to dismount their vehicles/aircraft to perform reconnaissance, scan 360 degrees, engage point and area targets with small arms and anti-armor weapons, move in selected formations at appropriate rates, interact with mounted crews and with one another, communicate as they would under combat conditions that require them to dismount, and remount their vehicles/aircraft.

The system must provide the capability to select and control the dismount element's position, rate of movement, the weapons with which they are armed, their rates of fire, and the threat targets they engage. The view as seen by the dismounted personnel must be the same as if they were in the position of the dismounted element. The dismounted personnel must have the capability to change from normal FOV to binocular FOV or night vision goggle FOV and back.

The mounted crews must be able to identify their dismounted elements, and the dismounted elements must be able to identify their vehicles.

The system must portray the dismounted elements as teams of individuals, armed with appropriate weapons, and supplied with selectable basic loads. The dismounted elements must be able to engage the enemy with the following weapons:

- M16A2 rifle
- M60 machine gun
- M249 squad automatic weapon
- M47 Dragon or the Anti-Armor Weapon System - Medium (AAWS-M)
- AT4 Antitank Weapon or the Multi-Purpose Individual Munition (MPIM)
- M203 Grenade Launcher

The system must provide the capability to replenish and augment ammunition resources from an infantry vehicle, a scout vehicle or a supply vehicle.

The following essential dismounted personnel characteristics will be developed as pre-planned product improvements:

The system must portray dismounted elements in increments of one, two, three, four, or six individuals as selected by the dismounted personnel work station operator.

The system must simulate one soldier depicting the anti-armor specialist with the capability to engage threat targets with the AAWS-M.

The system must simulate two personnel depicting the forward observer and his radiotelephone operator, with the capability to communicate using normal communications and the digital message device.

The system must simulate three personnel depicting the dismounted fire support team element with the capability to communicate using normal communications and the digital message device.

The system must simulate four personnel depicting the platoon leader, his radiotelephone operator, and the forward observer and his radiotelephone operator.

The system must simulate six personnel depicting the dismounted infantry leader and soldiers.

Command and Control, Combat Support, and Combat Service Support

The system must simulate the TOC and the command, control, communications, and intelligence functions normally performed there. The physical configuration of the TOC will be represented by a mock-up of two M577A2 command vehicles arranged in a standard configuration.

The TOC must be authentic in shape and size, and must provide an operational environment that resembles that found in a fully operational TOC in a combat situation.

The system must simulate the Combat Trains Command Post (CTCP) (also known as the Administration and Logistics Center), and the administrative and logistical functions normally performed there. The physical configuration of the CTCP will be represented by a mock-up of a M577A2 command vehicle arranged in a standard configuration. The CTCP must be authentic in shape and size, and must provide an operational environment that resembles that found in a fully operational CTCP in a combat situation.

The system must provide the capability to emplace the following vehicles on the battlefield so that they are visible, operational and vulnerable at all times to actions by both enemy and friendly soldiers and equipment, and provide their normal functions (fire support, engineer, resupply, refuel, transport, etc.).

- The Heavy Expanded Mobility Tactical Truck (HEMTT) family of vehicles (Cargo, fuel service, and wrecker)
- M577A2 Command Post Vehicle
- M113A2 Armored Personnel Carrier
- M106A1 Mortar Carrier
- M109A3 Self Propelled Howitzer
- M728 Combat Engineer Vehicle
- M9 Armored Combat Earthmover
- AVLB
- HMMWV
- M88A1 Armored Recovery Vehicle
- M110A2 Self Propelled Howitzer
- M35 and M900 series of trucks
- M270 MLRS

The simulated vehicles and their functions must be controllable from work stations, and must be vulnerable to the effects of enemy, terrain and weather, time, and stochastic failures, deterministic failures, and battle damage in the performance of their functions. The system must provide for their emplacement as initialization parameters, and their movement and functions on the battlefield must be controllable by work station or by slaving to a manned simulator.

The system must allow pre-positioning and dispensing selected supplies and equipment at designated locations or simulated facilities on the simulated terrain.

The system must simulate the operation of the UMCP and represent it as a HMMWV.

The operation of the UMCP must be controllable by a work station that is capable of moving the UMCP HMMWV and the battalion maintenance platoon vehicles, replicating communications, and moving, maintaining, repairing, recovering, and evacuating other vehicles in the system.

The system must provide for the representation of the personnel support section operations and the execution of personnel service support functions collocated with the S-4 in the CTCP. It must have the capability to assess personnel casualties on both mounted and dismounted soldiers based on probable weapons effects.

The system must represent the command and control, communications, and support functions of a higher headquarters to the extent that the command group of the unit that is using the system can interact with the higher headquarters as they would under combat conditions.

The system must provide for indirect fire support to the ground maneuver forces.

A task force fire support element must be represented as an M577A2 command vehicle with the capability to move about the battlefield and collocate with the TOC, and to perform selected functions of the Advanced Field Artillery Tactical Data System through the use of a simulated Fire Support Command and Control (FSC2) terminal.

The system must provide an indirect fire control center that replicates a FABTOC with communications and control of supporting artillery fire. These capabilities must be selectable to allow for the substitution of fire support element simulators or the use of weapons effects only. The system must have the capability to displace on the battlefield, and to control indirect fire support units in the execution of all types of missions. The fire support work station must be capable of controlling a battalion of 155 millimeter howitzers and a battery of M270 MLRS. It must have the capability to assign fire missions by indirect fire platoon.

The system must provide a mortar fire support work station that will compute firing data, control the fires of the mortar platoon, and provide for the movement of the platoon's vehicles on the battlefield. The system must portray the fire direction center and the vehicles of the battalion mortar platoon as two mortar sections of one M577A2 and three M106A1 mortar carriers each.

Indirect fire weapons effects must be audible and visible to vehicle crews and dismounted elements on the terrain. Impact sounds must be of appropriate volume relative to the distance from each individual vehicle simulator or dismounted element. The system must replicate the audible and visible effects and target damage effects of all 4.2-inch mortar high explosive munitions, 155 millimeter and eight-inch howitzer munitions, Area Denial Artillery Munitions, Remote Anti-Armor Munitions, Copperhead, High Explosive, Anti-Personnel Improved Conventional Munitions, and Dual Purpose Improved Conventional Munitions. M26 Tactical Rocket with M77 basic warhead, Sense and Destroy Armor (SADARM) warhead, Terminal Guidance Warhead (TGW) and ATACMS.

The system must simulate an M2/M3 or M113A3 vehicle that replicates the TACP vehicle. The TACP vehicle must be capable of moving about the simulated battlefield and collocating with the TOC. The rear compartment of this simulator must provide space for normal TACP operations, and must contain a work station for requesting close air support and controlling air sorties allocated to the unit.

The system must replicate air sorties of A10, A7, F4, and F16 aircraft and typical ordnance loads of these aircraft.

The system must provide an engineer work station collocated with the TOC, with the capability to simulate engineer mobility and countermobility operations.

The system must simulate the construction of selected armored vehicle defilade positions and infantry fighting positions, emplacement of mines and obstacles, breaching and destroying obstacles with demolitions, engineer equipment and dismounted personnel, mine rollers, mine plows, Cleared Lane Marking System (CLAMS), and Mine Clearing Line Charge (MCLIC) systems.

The work station must portray and control the movement and operations of the M728 Combat Engineer Vehicle, Armored Combat Earthmover and the AVLB.

Engineer activities must be governed by appropriate time constraints and affect operations on the battlefield appropriately.

The following essential work station characteristics will be developed as pre-planned product improvements:

The system must simulate the emplacement of mines with the FASCAM system, and must cause the mines to be visible on the simulated terrain.

The system must provide an air defense artillery work station with the capability to portray and control the operational capabilities and movement of SHORAD/FAADS systems to acquire, engage, and report aviation targets operating on or above the simulated terrain.

The system must simulate the Army Tactical Command and Control System (ATACCS) as it is integrated in the army system.

The system must provide for the evacuation of personnel casualties.

The system must simulate the following vehicles and weapons systems:

- 1 The M163 Self Propelled Vulcan
- 2 M730 with M48A2 Chaparral
- 3 Stinger
- 4 ADATS
- 5 MLRS

The system must simulate illumination, improved smoke, white phosphorus (WP), nuclear and chemical munitions.

The system must replicate the TACP communications system.

The system must provide a remote Army aviation support work station that will allow scout, airlift, and attack helicopters to be utilized in conjunction with ground maneuver elements in operational missions. This work station must allow the operator to acquire, report, and engage targets in a manner that is doctrinally correct. The operator must be able to represent and control aircraft in the conduct of airlift, reconnaissance, medical evacuation, command and control, and fire observation missions.

The system must represent the Ribbon Bridge.

Operations Monitor and AAR

The system will provide a means to monitor, record, and play back the events that take place during a unit training session. The system must record unit movement, weapons engagements, hits, kills, ammunition expended, communications conversations, combat support, and combat service support operations in video and data printout forms during the conduct of training.

The recorded data must be time-stamped so that the commander can stop at significant points during the playback to highlight and illustrate important principles.

The system must provide video playback of a UTMP view of the entire operation on a high resolution video screen, and project the play back onto a standard 60-inch by 80-inch video projection screen with icons and menu controls for scale. The system must also allow the trainer to flag events as they occur to facilitate locating specific events during playback. The system must be capable of superimposing the operations overlay onto the viewing display at the same scale as was used in its creation, and must provide the capability to increase or decrease the scale of the composite view thereafter. The system must provide the capability to play back an exercise at a selectable ratio of 4:1 or greater over real time.

The system must provide for the conduct of up to five independent/simultaneous after action reviews.

The system must provide a horizontal view of the simulated terrain from any selectable perspective and elevation (up to 300 meters above the terrain database elevation).

The system must provide the capability to freeze or stop an exercise for a during action review and restart the exercise at that point.

The simulation must provide SAFOR with the capabilities to perform all the battlefield tasks and supporting functions that live forces can perform in the simulation with a minimum of human involvement.

SAFOR must replicate both enemy and friendly forces in battalion size units or a distribution of the subordinate elements thereof including tanks, personnel carriers, command and control vehicles, reconnaissance vehicles, forward area air defense weapons, and dismounted infantry and their weapons. These forces will be controlled down to platoon level by personnel who have been trained in their control and employment, and will be indistinguishable from live forces by those participating in training.

The system must provide SAFOR elements capable of assuming offensive or defensive roles in the simulation consistent with selected allied or Threat doctrine and tactics.

The system must provide SAFOR elements to interact under the control of manned command simulators and to move as simulated adjacent, forward, and rear elements.

The system must provide a SAFOR work station that will allow the operator to control vehicle movement, formations, weapons employment, and orientation of friendly semi-automated platoon vehicles in support of command field exercises; and to control fire support assets consistent with the deployment of a Threat Regimental Artillery Group (RAG) and supporting elements of the DAG. Employment of these assets must be consistent with weapons systems capabilities and doctrine.

The system must provide for the conduct of fixed and rotary wing aviation operations to include attack, CAS, and lift/airmobile.

The system must provide the capability to emplace vehicles (OPFOR and/or BLUEFOR) in selected positions and execute movement sequences on the terrain for the conduct of preplanned exercises.

P3I for SAFOR must include; development of SAFOR to regimental or brigade level.

This simulation system will be fielded in fixed site installations of battalion task force size (1 to 150 simulators with support stations), CO/TM size (1 to 50 simulators with support stations), platoon size elements (4 or 7 simulators with collocated support stations) and mobile platoon versions (4 or 7 simulators with collocated support stations). Environmental protection for the system is required in accordance with the operational parameters detailed in the operational mode summary and mission profile.

Mobile and fixed platoon sites do not require the operational environments for the work stations required in the company and battalion size sites. Platoon sites require collocated work stations.

The PSS, logistics, and maintenance terminals must be collocated so that all three functional areas can be operated by one individual.

The fire support, close air support, air defense artillery, aviation, and mortar work stations must be collocated so that all five functional areas can be operated by one individual.

The AAR work station and next higher headquarters voice communications must be collocated and must be capable of operation by one individual.

The engineer work station must be capable of operation by one person.

The SAFOR work station must be designed to be operated by one person.

The system will meet RAM requirements for peacetime and wartime (See Appendix 3).

CCTT MTBOMF Values

Subsystem	User Reqmt.	MDP
MCC	681	681
Op Ctr	681	681
SAFOR	1486	1486
AAR	681	681
Simulators		
M1	200	308
M1A1/M1A2	200	308
M2/3	200	294
M2/3A1	200	294
M2/3A2	200	294
DIM	200	678
FIST-V	200	294
HMMWV	200	244
M901	200	294
M113A3	200	294

Technical Assessment

Fielded applications have demonstrated that the local area networking technology required to perform this type of simulation is a low risk. Basic microprocessor technology is considered a low risk. Improved graphics systems that meet imagery requirements is a high risk. Long haul networking is considered a high risk. Technology requirements of pre-planned product improvements have not been evaluated and should be considered a medium or high risk.

System Support Assessment

The system will require a government owned, contractor operated, CLS operation. CLS will include site management, operations, semi-automated forces operators, simulation system instruction, and simulation systems maintenance and logistics

Mobile version transportation requirements will be part of CLS.

MANPRINT Assessment

Manpower/Force Structure Assessment

Institutional systems may require dedicated military/civilian managers/instructors for proper incorporation of tactical instruction into institutional training exercises.

SAFOR operators which are knowledgeable in tactics and non-US tactical doctrine(s) will be required and will be considered a potential contractor fill. It is anticipated that these personnel will be civilian contractors.

Personnel Assessment

The system will not affect accessions into user MOS's. The system must not require a change in the skills and knowledge of effected MOS's. The system will be maintained and repaired by some form of CLS.

Training Assessment

System orientation training that encompasses system capabilities and the development exercise initialization parameters development must be conducted by the contractor using contractor developed, user validated and approved lesson materials. These materials will be left behind as the training package for instructor and trainers to use in training the units in the development of exercises and use of the system.

The CCTT must minimize the expenditure of training resources.

The CCTT must not cause degradation of individual skill proficiency.

Human Factors Engineering (HFE)

The operation of the software must be user friendly to the extent that the target audience, with no more training than listed above, can use it.

The CCTT will ensure accurate representation of work space and operators positions in each of the vehicle variants and work area environments.

System Safety

The system must not give off any harmful radiation. All electrical connections must be constructed so as to prevent the possibility of electrical shock to users/operators. Soldiers must be able to enter and exit the simulators and work station areas safely.

Health Hazards Assessment (HHA)

The vehicle simulator modules or system components will not present any health hazards to users, trainers or operators.

Standardization and Interoperability

It is desired that the system accommodate a standardized network design to allow simulators of various services, countries, and types to be integrated onto one simulated battlefield.

Life Cycle Cost Assessment

Annex A

Milestone Schedule

Event	Date
TDNS Approved	8 October 1987
TDR Approval	2nd Qtr FY 91
MDR I/II ASARC	3rd Qtr FY 91
SIPR (Contract Award)	2nd Qtr FY 92
TT/IOTE	3rd Qtr FY 94
MDR III ASARC	1st Qtr FY 96
FUE	2nd Qtr FY 97
IOC	1st Qtr FY 98

NOTE: Appendices not included

Part B. Consolidated Task list for CCTT

CCTT CONSOLIDATED TASK LIST TASK

TASK ARTEP	TASK AREA	TASK NUMBER	TASK DESCRIPTION
** Branch Type ------> ARMOR			
* Level -----> Tank Platoon			
17-237-10-MPT	ADA	44-3-C001	Take passive air defense measures
17-237-10-MPT	ADA	44-3-C002	Take actiive air defense measures aganst hostile aircraft
17-237-10-MPT	C3	17-3-0100	Perform tactical planning
17-237-10-MPT	C3	17-3-0101	Prepare for tactical operations
17-237-10-MPT	C3	17-3-0102	Perform precombat checks
17-237-10-MPT	C3	17-3-0104	Produce a platoon fire plan
17-237-10-MPT	C3	17-3-0105	Employ command and control measures
17-237-10-MPT	CSS	17-3-0601	Perform resupply operations
17-237-10-MPT	INTEL	17-3-0302	Establish an observation postition
17-237-10-MPT	MANEUVER	17-3-0201	Execute a coil formation
17-237-10-MPT	MANEUVER	17-3-0202	Execute a herringbone formation
17-237-10-MPT	MANEUVER	17-3-0203	Execute a column formation
17-237-10-MPT	MANEUVER	17-3-0204	Execute a staggered column formation
17-237-10-MPT	MANEUVER	17-3-0205	Execute a wedge formation
17-237-10-MPT	MANEUVER	17-3-0206	Execute a vee formation
17-237-10-MPT	MANEUVER	17-3-0207	Execute a line formation
17-237-10-MPT	MANEUVER	17-3-0208	Execute an echelon formation
17-237-10-MPT	MANEUVER	17-3-0209	Execute traveling
17-237-10-MPT	MANEUVER	17-3-0210	Execute a traveling overwatch
17-237-10-MPT	MANEUVER	17-3-0211	Execute a bounding overwatch
17-237-10-MPT	MANEUVER	17-3-0212	Conduct a tactical road march
17-237-10-MPT	MANEUVER	17-3-0213	Move in a built up area
17-237-10-MPT	MANEUVER	17-3-0215	Perform a passage of lines
17-237-10-MPT	MANEUVER	17-3-0217	Perform a platoon fire and movement
17-237-10-MPT	MANEUVER	17-3-0218	Perform reconnaissance by fire
17-237-10-MPT	MANEUVER	17-3-0219	Perform attack by fire
17-237-10-MPT	MANEUVER	17-3-0220	Assault an enemy position
17-237-10-MPT	MANEUVER	17-3-0221	Execute actions on contact
17-237-10-MPT	MANEUVER	17-3-0222	Occupy a platoon battle position

CCTT CONSOLIDATED TASK LIST

TASK ARTEP	TASK AREA	TASK NUMBER	TASK DESCRIPTION
17-237-10-MPT	MANEUVER	17-3-0223	React to an enemy dismounted attack
17-237-10-MPT	MCS	17-3-0401	Take actions at an obstacle
17-237-10-MPT	MCS	17-3-0412	Conduct chemical reconnaissance
17-237-10-MPT	MCS	03-3-C034	Cross a chemically contaminated area
** Branch Type ------> CAVALRY			
* Level -----> Reg Cav Troop			
17-97-1-MPT	ADA	17-2-6-1	Defend against air attack
17-97-1-MPT	C3	17-2-1-1	Perform precombat checks
17-97-1-MPT	C3	17-2-1-2	Perform precombat inspectons
17-97-1-MPT	C3	17-2-2-1	Perform troop-leading procedures
17-97-1-MPT	C3	17-2-2-2	Develop a fire support plan
17-97-1-MPT	C3	17-2-2-3	Develop a direct fire plan
17-97-1-MPT	C3	17-2-2-4	Develop an obstacle plan
17-97-1-MPT	C3	17-2-2-5	Develop an air defense plan
17-97-1-MPT	C3	17-2-2-6	Develop a combat service support plan
17-97-1-MPT	CSS	17-2-7-1	Operate troop trains
17-97-1-MPT	CSS	17-2-7-2	Report logistical informaton
17-97-1-MPT	CSS	17-2-7-3	Perform resupply operations
17-97-1-MPT	CSS	17-2-7-3	Perform resupply operations
17-97-1-MPT	MANEUVER	17-2-4-1	Perform route reconnaissance
17-97-1-MPT	MANEUVER	17-2-4-2	Perform zone reconnaissance
17-97-1-MPT	MANEUVER	17-2-4-3	Perform screen operations
17-97-1-MPT	MANEUVER	17-2-4-4	Perform movement to contact
17-97-1-MPT	MANEUVER	17-2-4-5	Perform ·asty attack
17-97-1-MPT	MANEUVER	17-2-5-1	Perform tactial movement
17-97-1-MPT	MANEUVER	17-2-5-2	Occupy an assembly area
17-97-1-MPT	MANEUVER	17-2-5-3	Perform a relief in place
17-97-1-MPT	MANEUVER	17-2-5-4	Perform battle handover and passage of lines
17-97-1-MPT	MANEUVER	17-2-5-7	Perform actions on contact
17-97-1-MPT	MANEUVER	17-2-5-8	Perform hasty obstacle breaching

CCTT CONSOLIDATED TASK LIST

TASK ARTEP	TASK AREA	TASK NUMBER	TASK DESCRIPTION
* Level ----> Scout Platoon			
17-57-10-MPT	ADA	44-3-C001	Use passve air defense measures
17-57-10-MPT	ADA	44-3-C002	Take active air defense measures against hostile aircraft
17-57-10-MPT	C3	17-3-1032	Produce a platoon fire plan
17-57-10-MPT	C3	17-3-1033	Perform precombat checks
17-57-10-MPT	C3	17-3-1034	Perform rehearsals
17-57-10-MPT	C3	17-3-1035	Perform tactical planning
17-57-10-MPT	C3	17-3-1036	Employ command and control measures
17-57-10-MPT	C3	17-3-1040	Prepare for tactical operations
17-57-10-MPT	CSS	17-3-1030	Perform resupply operatons
17-57-10-M	INTEL	17-3-1039	Establish an observation post
17-57-1	MANEUVER	17-3-1012	Perform a tactical road march
17-57-	MANEUVER	17-3-1014	Perform a passage of lines
17-57-10	MANEUVER	17-3-1016	Conduct tactical movement
17-57-10-MPT	MANEUVER	17-3-1017	Perform a route reconnaissance
17-57-10-MPT	MANEUVER	17-3-1018	Perform a zone reconnaissance
17-57-10-MPT	MANEUVER	17-3-1019	Prepare an area reconnaissance
17-57-10-MPT	MANEUVER	17-3-1020	Reconnoiter an obstacle and a bypass
17-57-10-MPT	MANEUVER	17-3-1021	Execute actions on contact
17-57-10-MPT	MANEUVER	17-3-1023	Conduct a Screen
17-57-10-MPT	MCS	17-3-1026	Emplace and retrieve an hasty protective minefield
17-57-10-MPT	MCS	17-3-C011	Prepare for chemical attack
17-57-10-MPT	MCS	17-3-C034	Cross a chemically contaminated area
17-57-10-MPT	MCS	17-3-C013	Cross a radiologcally contaminated area
** Branch Type ------> INFANTRY			
* Level -----> Infantry Platoon			
7-8-MPT	C3	7-3/4-1046	Prepare for combat
7-8-MPT	CSS	7-3/4-1048	Perform aeral resupply
7-8-MPT	FIRE SPT	7-3-1046	Employ Fire support
7-8-MPT	INTEL	7-3-1043	Reconnoiter zone

CCTT CONSOLIDATED TASK LIST TASK

TASK ARTEP	TASK AREA	TASK NUMBER	TASK DESCRIPTION
7-8-MPT	INTEL	7-3/4-1042	Reconnoiter area
7-8-MPT	INTEL	7-3-1059	Reconnoiter route
7-8-MPT	INTEL	7-3/4-1069	Occupy observation post/Perform survellance
7-8-MPT	MANEUVER	7-3/4-1011	Assualt
7-8-MPT	MANEUVER	7-3/4-1007	Overwatch/support by fire
7-8-MPT	MANEUVER	7-3/4-1021	Defend
7-8-MPT	MANEUVER	7-3/4-1022	Occupy assembly area
7-8-MPT	MANEUVER	7-3/4-1025	Move tactically
7-8-MPT	MANEUVER	7-3-1035	Perform a roadmarch
7-8-MPT	MANEUVER	7-3/4-1040	Perform a passage of lines
7-8-MPT	MANEUVER	7-3/4-1013	Assault mounted
7-8-MPT	MCS	7-3/4-1014	Breach Obstacles
7-8-MPT	MCS	7-3-1068	Construct obstacles

** Branch Type -----> TANK_MECH
* Level -----> Battalon TF

71-2-MPT	ADA	7-1-3911	Perform air defense operations
71-2-MPT	ADA	7-1-3037	Defend against air attack
71-2-MPT	C3	7-1-3901	Command and control the battalon task force
71-2-MPT	C3	7-1-3903	Command group operations
71-2-MPT	C3	7-1-3904	Operate main command post
71-2-MPT	C3	7-1-3036	Establish command post
71-2-MPT	C3	7-1-3401	Maintain Comunications
71-2-MPT	CSS	7-1-3912	Perform combat servce support operations
71-2-MPT	CSS	7-1-3913	Operate combat trains CP
71-2-MPT	CSS	7-1-3913	Operate field trains CP
71-2-MPT	FIRE SPT	7-1-3907	Employ fire support
71-2-MPT	FIRE SPT	7-1-3908	Operate fire support section
71-2-MPT	INTEL	7-1-3905	Perform intelligence operations
71-2-MPT	MANEUVER	7-1-3001	Occupy assembly area
71-2-MPT	MANEUVER	7-1-3002	Perform tactcal road march
71-2-MPT	MANEUVER	7-1-3003	Perform passage of linec
71-2-MPT	MANEUVER	7-1-3004	Move tactically
71-2-MPT	MANEUVER	7-1-3006	Fight a meeting engagement
71-2-MPT	MANEUVER	7-1-3007	Assault
71-2-MPT	MANEUVER	7-1-3008	Attack/Counterattack by fire
71-2-MPT	MANEUVER	7-1-3009	Defend
71-2-MPT	MANEUVER	7-1-3013	Delay
71-2-MPT	MANEUVER	7-1-3014	Perform relief in place
71-2-MPT	MANEUVER	7-1-3021	Bypass ememy forces
71-2-MPT	MANEUVER	7-1-3027	Breach defended obstacles
71-2-MPT	MCS	7-1-3034	React to indirect fire
71-2-MPT	MCS	7-1-3909	Perform mobility & survivability operations

* Level ----> Company Team

71-1-MPT	ADA	44-2-C002	Defend against air attack active
71-1-MPT	ADA	44-2-C001	Defend against air attack
71-1-MPT	C3	17-2-0101	Prepare for combat
71-1-MPT	CSS	17-2-0702	Perform tailgate
71-1-MPT	CSS	17-2-0703	Perform servce-station resupply
71-1-MPT	FIRE SPT	17-2-0401	Employ indirect fire in
71-1-MPT	FIRE SPT	17-2-0402	Employ indirect fire in the defense
71-1-MPT	INTEL	17-2-0201	Maintain operation security
71-1-MPT	MANEUVER	17-2-0325	Occupy assembly area
71-1-MPT	MANEUVER	17-2-0301	Perform tactcal movement
71-1-MPT	MANEUVER	17-2-0302	Perform tactical road
71-1-MPT	MANEUVER	17-2-0202	Perform reconnanissance
71-1-MPT	MANEUVER	17-2-0303	Perform passage of lines
71-1-MPT	MANEUVER	17-2-0304	Perform actions on contact
71-1-MPT	MANEUVER	17-2-0306	Support by fire
71-1-MPT	MANEUVER	17-2-0307	Occupy objectve rally point
71-1-MPT	MANEUVER	17-2-0326	Assault an enemy position
71-1-MPT	MANEUVER	17-2-0328	Perform and attack by fire
71-1-MPT	MANEUVER	17-2-0309	Perform ambush
71-1-MPT	MANEUVER	17-2-1021	Defend
71-1-MPT	MANEUVER	17-2-0321	Delay
71-1-MTP	MANEUVER	17-2-0311	Perform Attack by fire
71-1-MPT	MCS	17-2-0501	Breach an obstacle.

Acronyms

A	
AAR	after action report
AAWS-M	anti-armor weapon system-medium
AC	Active component
ACP	Army cost position
ADATS	air defense/anti tank system
AFAS	advanced field artillery system
AMC	Army Materiel Command
AMSAA	Army Materiel Systems Analysis Activity
AOB	Armor Officer Basic
APC	armored personnel carrier
ARI	Army Research Institute
ARTEP	Army Training Evaluation Program
ASARC	Army System Acquisition Review Council
ASM	armored systems modernization
ATACMS	advanced tactical missile system
AVLB	armored vehicle launched bridge
B	
BCC	Bradley Commander Course
BCE	baseline cost estimate
BEP	break-even points
BFV	Bradley Fighting Vehicle
BITE	built in test equipment
BLTM	battalion level training model
BN/TF	battalion/task force
BOIP	basis of issue plan
C	
C2	command and control
CAS	close air support
CAT	Canadian Army Throphy
CATS	combined arms training strategies
CCTT	Close Combat Tactical Trainer
CEAC	Cost and Economic Analysis Center
CEP	concept evaluation program
CFV	Cavalry Fighting Vehicle
CLS	contractor logistic supported
CO/TM	company/team
CTCP	combat trains command post
CTEA	Cost and Training Effectiveness Analysis
D	
DAG	division artillery group
DARPA	Defense Advanced Research Project Agency
DEPEX	deployment exercise
DMD	digital message devise
E	
EEA	essential elements of analysis
EOL	end of life
F	
FABTOC	Field Artillery Battalion Tactical Operations Center
FCX	fire coordination exercise
FDTE	force development testing and experimentation
FIST-V	fire support team-vehicles
FLIR	forward looking infra-red
FO	forward observer
FOV	field of view
FTX	field training exercise
H	
HEMTT	heavy expanded mobility tactical truck
HFE	human factors engineering
HHA	health hazards assessment
HMMWV	high mobility multipurpose wheeled vehicle
I	
IOAC	Infantry Officer Advance Course
IOTE	initial operational test and evaluation
ITV	improved TOW vehicle
IV&V	independent verification and validation
L	
LAN	local area network
LCC	life cycle costs
LCCE	life cycle cost estimate
LOSAT	line of sight anti-tank

M	
MAA	mission area analysis
MADP	mission area development plan
MLRS	multiple launch rocket system
MOPP	mission oriented protective posture
MOS	military occupational speciality
MPIM	multi-purpose individual munition
MTBF	
MTP	mission training plans
N	
NG	National Guard
O	
OMA	operations and maintenance Army
OMS/MP	operational mode summary/mission profile
OPSEC	operations security
OPTEMPO	operating tempo
P	
P3I	preplanned product improvement
PDTS	preliminary training development study
PIP	product improvement program
POL	petroleum, oil and lubricants
PSE	Potomic Systems Engineering
PVD	plan view display
R	
RAM	reliability, availability, and maintainability
RC	reserve component
ROM	rough order of magnitude
RPG	Radio Frequency

S	
SAFOR	semi-automated forces
SAM	surface to air missile
SIM2	Simulator/Simulation-Based Training
SIMNET	simulation networking
SINCGARS	single channel, ground/air radio system
SOW	statement of work
SSR	system specification review
T	
TACP	tactical air control party
TADSS	training aids, devices, simulators, and simulations
TDR	training device requirement
TEMP	test and evaluation master plan
TEWT	tactical exercises without troops
TEXCOM	Test and Experimentation Command
TOC	tactical operations center
TRAC-WSMR	TRADOC Analysis Command-White Sands Missile Range
TRADOC	Training and Doctrine Command
TRM	training resource model
U	
UMCP	unit maintenance collection point
USAR	United States Army Reserve
W	
WP	white phosphorus

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1. Memorandum, HQ TRADOC, ATIC-DMS, 1 Oct 90, subject: Study Directive - Assessment of Cost, Training Effectiveness, Training Application, and Operating Tempo (OPTEMPO) Offset for Close Combat Tactical Trainer (CCTT) Simulation.

2. TRADOC REG 11-8, Army Programs, Studies Under AR 5-5, 29 Mar 1985.

3. TRADOC Pam 11-8, Army Programs, Studies and Analysis Handbook, 19 July 1985.

4. Field Manual 22-100, "*Military Leadership*," Headquarters Department of Army, Washington, DC, 31 October 1983.

5. Chase, Clinton I., *Measurement for Educational Evaluation*, Addison-Wesley Publishing Company, Reading, Mass., 1974.

6. Asher, William J., *Educational Research and Evaluations Methods*, Little, Brown and Company, Boston, Mass., 1976.

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REPLY TO
ATTENTION OF

SGRD-RMI-S (70-1y)   ERRATA -AD-B173567   1 Dec 94

MEMORANDUM FOR Administrator, Defense Technical Information Center, ATTN: DTIC-HDS/William Bush, Cameron Station, Bldg. 5, Alexandria, VA 22304-6145

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1. The U.S. Army Medical Research and Materiel Command (USAMRMC) has reexamined the need for the limited distribution statement on technical reports in the Defense Technical Information Center database. Request the limited distribution statement for [redacted] ADB173567, be changed to "Approved for public release; distribution unlimited," and that copies of these reports be released to the National Technical Information Service.

2. The point of contact for this request is Ms. Virginia Miller, DSN 343-7328.

CAREY O. LEVERETT
LTC, MS
Deputy Chief of Staff for
Information Management

ERRATA