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Requirements for a Device-Based Training and Testing Program for M1 Gunnery: Volume 2. Detailed Analyses and Results

ARI Field Unit at Fort Knox, Kentucky
Training Research Laboratory

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U. S. Army Research Institute for the Behavioral and Social Sciences

U. S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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EDGAR M. JOHNSON
Technical Director

WM. DARRYL HENDERSON
COL, IN
Commanding

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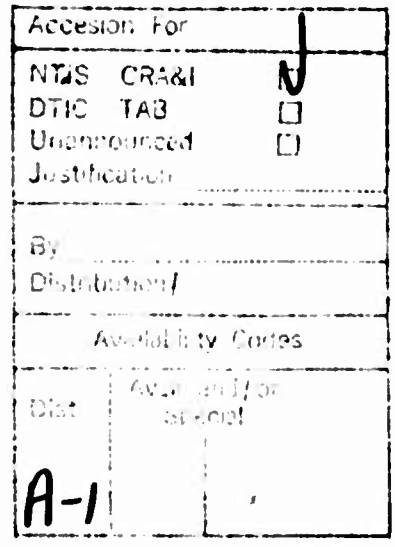
Technical review by

David W. Bessemer
Ronald E. Kraemer



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The first volume of this report (ARI Technical Report 783) presented the analytic rationale for determining the requirements of a device-based program for training and testing armor skills. The resulting concept indicated that it was feasible to use existing devices to train and test much of the domain of tank gunnery in an integrated fashion. However, there were gaps in the program where devices did not support substantial portions of the domain. Also, there were cases where training on basic skills and knowledges was not integrated into training on higher level skills. It was concluded that on-tank experience at both the beginning and advanced stages of training is necessary to train and test the entire domain of gunnery.

This second volume of the report details the results that support the research activities described above. These detailed results are presented as a series of

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appendixes that support the following research activities: (a) definition of the domain of gunnery in terms of individual conditions and actions; (b) identification of gunnery performance deficiencies through an analysis of Directorate of Evaluation and Standardization (DOES) performance data, a review of the research literature, and an analysis of Table VIII performance at Grafenwöhr; (c) identification of training and testing objectives through a hierarchical analysis of the gunnery domain; (d) evaluation of gunnery devices with respect to their fidelity features, instructional features, and testing features; and (e) specification of the training and testing program by a detailed listing of objectives within instructional units.

Keywords: Gunnery trainers, Tank crews, Training devices, Army training. (SDW)

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John E. Morrison and R. Gene Hoffman
Human Resources Research Organization

for

Contracting Officer's Representative
John A. Boldovici

ARI Field Unit at Fort Knox, Kentucky
Donald F. Haggard, Chief

Training Research Laboratory
Jack H. Hiller, Director

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600

Office, Deputy Chief of Staff for Personnel
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Education and Training

FOREWORD

This report is the second of two volumes describing four related activities related to M1 tank crew gunnery performance: (1) analysis of the domain of tactical gunnery, (2) specification of training and testing objectives, (3) content evaluations of four training devices, and (4) development of a training and testing strategy using those training devices.

This research is a part of the task entitled "Application of Technology to Meet Armor Skills Training Needs." That task is performed under the auspices of the Army Research Institute's Armor Research and Development Activity at Fort Knox, whose mission includes optimizing the use of armor training devices for readiness in gunnery and tactics.

The proponent for this research is Training and Doctrine Command (TRADOC), and the user is U.S. Army Armor Center (USAARMC) (letter of agreement with ARI entitled "Establishment of Training Technology Field Activity, Fort Knox, Kentucky," dated 4 November 1983).

Plans for, and progress on, this project have been disseminated through briefings to the Assistant Commandant, Technical Director, and Department Heads of the U.S. Army Armor School at Fort Knox. Project scientists also made informal presentations to the Director of the Armor School Directorate of Training Developments (DOTD), and to ORSA (Operations Research and Systems Analysis) personnel. Additional presentations are being planned for DOTD personnel and the American Psychological Association.

The research provides information complementary to current emphases and proposals regarding armor device training strategies. The gunnery training objectives, summaries of device capabilities and limitations, and procedures for developing device-based training will be useful at all levels of training and testing development for armor crews.

EDGAR M. JOHNSON
Technical Director

REQUIREMENTS FOR A DEVICE-BASED TRAINING AND TESTING PROGRAM FOR M1 GUNNERY: VOLUME 2. DETAILED ANALYSES AND RESULTS

CONTENTS

REQUIREMENTS FOR A DEVICE-BASED TRAINING AND TESTING PROGRAM FOR M1 GUNNERY: VOLUME 2. DETAILED ANALYSES AND RESULTS

Introduction

The advanced technology incorporated in the M1 tank has changed the way gunnery tasks are performed. For instance, the lead sensor system detects the angular velocity of the turret and automatically adjusts the sight/target relationship to apply the appropriate lead to moving targets. Similarly, once activated, the laser range finder determines the target range and automatically inputs the result into the ballistic solution. As a result of these innovations, the gunner is no longer required to lead moving targets or to estimate target ranges, both of which are difficult skills. On the other hand, this new technology creates new responsibilities for the armor crewman. For instance, he must now know how to detect failures in any of these systems and what to do in case of such failures.

Technology has also changed the way gunnery is trained. Older tank-appended training devices provide practice and feedback on limited aspects of the domain, namely tracking and aiming the main gun with the power control handles. Recent advances in computer technology has permitted the development of new stand-alone devices that attempt to represent larger segments of the gunnery domain. In the present report, we examine four such computer-based devices that can be used to train M1 gunnery skills: (a) the Videodisc Integrated Gunnery Simulator (VIGS), (b) the arcade-type TopGun device, (c) the Unit Conduct-of-Fire Trainer (U-COFT), and (d) the Simulated Networking (SIMNET) battle simulation system. These devices have the ability to measure performance as well as train skills within the domain of M1 gunnery.

The purpose of the present research was to determine the performance and simulation requirements of an M1 gunnery training program and to design an integrated program for training and testing M1 gunnery skills using the four designated computer-based devices.

Summary of Volume 1

The first volume of this report (Hoffman & Morrison, 1987) presents the analytic rationale for determining the requirements of the device-base training/testing program plus a summary of the results from the analyses. The research was divided into four major activities: (a) analysis of stimulus conditions and actions related to gunnery, (b) derivation of training and testing objectives, (c) evaluation of device capabilities and limitations, and (d) design of a draft training and testing strategy. In addition, research was performed to identify specific areas of gunnery that may be particularly difficult to learn and may require special training attention. The resulting training and testing strategy indicated the feasibility of the program to train and test much of the domain of tank gunnery in a integrated fashion. However, there were "gaps" in the training program where devices did not support substantial portions of the domain. Also, there were cases where training on basic skills and knowledges was not integrated into training on

higher level skills. It was concluded that on-tank experience at both the beginning and advanced stages of training is necessary to train and/or test the entire domain of gunnery.

Contents of Present Volume

This (the second) volume of the report provides a detailing of the analyses and results that support the research activities described above. These detailed analyses and results are presented as a series of appendixes, each of which is described below in the context of the research activities that they were intended to support.

Domain of Gunnery Behaviors

An initial problem in the research project was to determine the M1 gunnery performance requirements that were subsequently used to derive training and testing objectives as well as to provide criteria for evaluating training devices. The M1 gunnery performance domain was defined in terms of two dimensions: stimulus conditions and behaviors. With regard to the former, 22 different environmental parameters were identified along with the conditions defining each parameter. These conditions and parameters are summarized in Table 2-3 of Volume 1. The analysis of stimulus conditions revealed basic simulation requirements for the devices. The stimulus conditions also aided in our partitioning of the domain of gunnery behaviors, which are detailed in Appendix A of this volume. Individual behaviors (or performance elements) were organized into eleven "activities." For the most part, activities were derived from accepted armor doctrine. For instance, Activities 3 through 10 correspond to chapters and sections within chapters of the gunnery manual (FM 17-12-1). Activities 1 and 2 (related to preparing the tank for operation and for firing, respectively) were taken from the M1 Operator's Manual (TM 2325-255-10-2). Activity 11 (Assess Results of Engagement) were derived from tactical considerations discussed in Division 86 tank platoon (FC 17-15). Many of the activities were further subdivided into "parts" and "options." Parts were used in Target Acquisition to divide the activity into phases (sequentially related groups of elements). Options were used in several activities to indicate alternative courses of actions that are dependent on various mission and equipment status conditions. The basic format of presenting the simultaneous behaviors associated with each of the four crewman in four columns followed the convention of Kraemer (1983) and FM 17-12-1. However, the analysis is more inclusive than either source in both depth and breadth: (a) in depth because greater detail is provided in describing behavior, and (b) in breadth because elements associated with activities beyond pure gunnery are included.

Identification of Gunnery Performance Deficiencies

We originally planned to focus device training on specific deficiencies in gunnery performance. However, as discussed below, identification of specific armor performance deficiencies was more difficult than we expected. After rejecting the idea to survey subject matter experts on the basis of some pilot results, we subsequently sought to identify performance deficiencies using three other information sources that were thought to yield more objective data. These three sources are described below.

Analysis of DOES Survey Data. We examined survey data collected by the Directorate of Evaluation and Standardization (DOES) of the Armor School. Supervisors (n = 23) rated recent OSUT graduates in terms of Skill Level One Soldiers' Manual tasks. These tasks were rated on level of performance (cannot perform, less than adequate, adequate, more than adequate, and exception) and frequency of performance (never performed, seldom performed, performed monthly, performed weekly, performed daily). Correlational analyses indicated a significant correlation between these two ratings ($r = .69$, $p < .01$) suggesting that, at least from the observations of the raters, task proficiency is dependent on frequency. Furthermore, examination of the frequency-by-performance plot suggested a curvilinear trend. That is, the incremental effects of task frequency on performance are greatest at the low end of frequency and plateau as frequency increases. This was tested by added a curvilinear component (frequency squared) to a multiple regression model. The curvilinear component was significant ($p < .05$), increasing the prediction of performance to $R = .72$ ($p < .01$). In order to obtain an index of task difficulty independent of frequency, residual performance was calculated as the difference between performance level that would be expected based on the curvilinear function of frequency minus actual performance. Results from the analyses, presented in Appendix B, indicate three gunnery related tasks were performed less well than would be predicted by the amount of practice they received: (a) identify threat aircraft, (b) identify friendly and threat armored vehicles, and (c) drive an M1 tank. Gunnery engagement skills, on the other hand, were not singled out as deficient by the residual performance method. Rather they were described as on par with frequency. In other words, there were no deficiencies in gunnery performance that were not also associated with deficiencies in practice.

Review of Research Literature. Unlike most other job domains, there is considerable empirical research on armor gunnery performance. To review this extensive literature, the domain of gunnery was broken down into a number of broad, generally recognized categories of armor skills and knowledges. In that regard, the literature on armor job samples was examined particularly closely since many armor job samples are addressed specifically to these gunnery skills and knowledges components. Unfortunately, the literature has not directly addressed the issue of identifying performance deficiencies. Nevertheless, some findings have addressed two related questions: (a) Is there a relationship between the skill or knowledge and gunnery performance? (b) Does performance on the skill or knowledge improve with experience? Affirmative answers to these questions would identify a gunnery skill or knowledge that is both important and trainable. The results of the review were disappointing in that, with the possible exception of observation skill,

the literature (detailed in Appendix C) failed to identify any skill or knowledge component as unequivocally related to gunnery performance. On the other hand, there was somewhat stronger evidence that at least some of the skill/knowledge components were trainable.

Analysis of Grafenwöhr Gunnery Data Base. Tank Combat Table VIII is a live-fire gunnery test designed to determine whether or not individual crews are qualified. The Office, Chief of Armor (OCOA) maintains a detailed data base on Table VIII performance at Grafenwöhr, one of several sites at which Table VIII is administered. The data base provides information for the Chief of the Armor Branch and serves as a research data for other Army organizations. The data base is a rich and complex source on information on gunnery performance, including information about the crewmembers, the targets, and the test conditions. In many ways, this data base provides an ideal source on information about gunnery performance deficiencies. The data base was manipulated to answer a list of specific questions about gunnery performance. Details of the analysis and the findings are presented in Appendix D. The analysis did provide some findings that may be of interest to the Armor training community. However, as in the previous two analyses, these results failed to reveal specific performance deficiencies that could be addressed by the proposed device-based program.

Hierarchical Skills Analysis of Gunnery Domain

Training and testing objectives for the gunnery domain were derived through a hierarchical skills analysis technique that was modified from one used to identify objectives for a early mathematics education curriculum (Resnick, Wang, & Kaplan, 1973). A skill hierarchy is an analysis of a terminal learning objective its constituent behavioral and enabling objectives. The result is an inverted tree structure with related objectives connected by lines. Analyses of the entire gunnery domain are presented in Appendix E. Each analysis consists of three distinct levels as described below.

The topmost level defines a terminal objective. A terminal objective represents the objective for a unit or subunit of instruction, and corresponds to a major activity or option identified in the task analysis. The terminal objective (as well as all other objectives in the hierarchy) is divided vertically by a line with the stimulus conditions portion of the objective listed above and the actions summarized below the line. The logical operators "&" and "OR" are used to combine the multiple conditions or actions within an objective.

The next level of analysis consists of behavioral objectives. According to our technique, the overall task (activity) is partitioned into meaningful chunks of behavior. Behavioral objectives are outlined by noticeably thicker lines to distinguish them from either terminal or enabling objectives. Arrows are used to indicate sequential dependencies between overt behaviors. Loops are used to indicate that performers must recycle through certain series of

steps. Decision points are represented by splitting the box vertically to indicate different stimulus-response contingencies. Crewman duty title is sometimes provided at this level to clarify who performs a particular action.

The objectives at the lowest level of analysis correspond to enabling skills. These enabling skills are not actually performed in the course of the terminal behavior but are assumed to either be necessary (prerequisite) or helpful (propadeutic) in learning the superordinate objective. Subordinate behaviors may be further analyzed into lower order behaviors until the lowest level of skill not possessed by the training population is reached. Note that even the prerequisite skills are behaviorally defined by specific sets of conditions and actions.

Evaluation of Devices with Respect to Training Requirements

To determine the capabilities of the four designated training devices to train gunnery skills, the devices were evaluated with respect to two general classes of training device features: fidelity features and instructional features. Fidelity features are defined as those simulator components that enable the simulator to mimic the operational equipment. In contrast, instructional features are those simulator capabilities that facilitate the instructional process. The evaluation of each class of features is discussed below.

Fidelity Features. The fidelity of devices was defined in terms of the two dimensions of the performance domain: conditions and actions. For the former dimension, the evaluation consisted of determining whether or not devices could simulate each condition within the parameters described in Chapter 2. The detailed results (presented in Appendix F) consist of a table of "YES" and "NO" entries corresponding to instances where the device either could or could not simulate a particular condition. Summaries of these ratings may be found in Figure 5-1 of Volume 1. Similarly, the extent to which every action identified in the domain could be performed on the devices was determined by answering some "YES/NO" questions. The questions were all phrased so that "NO" responses required comments whereas "YES" responses do not. The questions were addressed in the following order: (a) can the action be performed or practiced on device (if not, do not answer any more questions); (b) can every subcomponent (step) of the action be performed or practiced; (c) are stimuli/responses equivalent to those on operational equipment; and (d) should performance on the device be positively related to performance on the operational equipment? The responses to these questions and the detailed comments are found in Appendix G. Summaries of these ratings may be found in Figures 5-2 to 5-4 of Volume 1. Also, instances of potential negative transfer were singled out for discussion in the text (see Volume 1, Chapter 5).

Instructional Features. To determine the instructional features on the designated devices, we first composed a comprehensive list of these features that have been identified in the research literature. Appendix H summarizes this literature by describing each feature in terms of its function, its training purpose, and references to it in the research literature. The

appendix indicates the relative consensus in the citations to the features by listing them in order of the number of associated references. The features with more references are more general in function (i.e., less dependent on the nature of training), whereas features with fewer references were more idiosyncratic in nature (i.e., relevant to a particular training application). Using this inventory as a guide, 17 separate instructional features were identified over all 4 devices. Of that total, 12 instructional features were found implemented on U-COFT in comparison with 9 on TopGun, 7 on VIGS, and 4 on SIMNET. A summary of instructional features that are found on each device is provided in Table 5-1 of Volume 1 and the effectiveness of each is discussed in the text (see Volume 1, Chapter 5).

Evaluation of Devices with Respect to Testing Requirements

Ratings of device capabilities for testing performance in the tactical gunnery domain were made at two levels. First, a number of questions were directed at the individual elements of the gunnery domain. These included representation of the element, type of automatic recording that might be available for the element, and the possibility of scoring being done by an observer. An assumption underlying our testing concept is that performance and therefore tests of performance are organized around chunks of connected elements. Thus, a second set of evaluation questions were directed at the activities and options as organized in the tactical gunnery domain analysis. These included questions about the coverage and composite scoring for the domain segment being reviewed. Ratings for each device along with coding keys for the ratings are presented in Appendix I. These ratings are summarized in Figures 6-1 to 6-3 of Volume 1.

List of Training and Testing Objectives Within Instructional Units

The final product of the research was the assignment of devices and objectives to units of instruction. The hierarchical analysis of gunnery skills revealed 235 training and testing objectives, 144 of which were not duplicates of objectives presented elsewhere in the domain. Those 144 objectives were then assigned to 19 units of instruction. The prerequisite relationships between units of instruction are shown in Figure 7-1 of Volume 1. Appendix J provides a listing of the objectives within each of the units of instruction. As shown in the appendix, the instructional units are numbered from 1 to 19 to identify units as well as to provide a suggested order of presentation. The sequence was primarily determined by the prerequisite relationships in the diagram and a progressive elaboration strategy as described in chapter 4. However, practical constraints were also considered in sequencing instructional units. Finally, the appendix indicates where objectives were assigned to more than one unit of instruction. The intent of this iterative training strategy was to provide the student with multiple experiences on gunnery training objectives in an increasingly realistic context.

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APPENDIX A

DOMAIN OF ARMOR GUNNERY CREW BEHAVIORS

APPENDIX A DOMAIN OF ARMOR GUNNERY CREW BEHAVIORS

CONTENTS

ACTIVITY 1. PREPARE STATIONS FOR OPERATION (PREOPS)[1]

TC	GNR	LDR	DVR
Enter TC station	Enter GNR's station	Erect crosswind sensor	Enter DVR's station
Power up CWS/turret	Operate domelight	Install LDR's machinegun	Power up hull systems
Operate domelight	Operate intercom	Enter LDR's station	Operate domelight
Operate intercom	Install coax	Operate domelight	Check turret seal
Adjust seat	Adjust seats/browpads	Power up LDR's station	Operate intercom
Adjust hatch	Adjust chestrest	Operate intercom	Adjust seat/periscopes
Adjust platform	Power up GNR station	Adjust LDR's seat/platform	Adjust hatch
Install TC's weapon	Perform GPS function check	Adjust LDR's hatch	Adjust steer/throttle control
Adjust kneeguard	Adjust GPS	Install/check LDR's night vision viewer	Operate drain valves
Adjust GPSE headrest/lens	Perform computer self-test	Position LDR's guards for firing	Start engine
Operate manual range controls	Perform computer data check	Operate LDR's panel	Make after-start checks
Operate power control handle	Perform TIS check	Operate turret traverse lock	
Operate CWS in power/manual modes	Perform GAS adjust	Operate ready ammunition door in auto/manual modes	
	Operate power control handles	Operate semi-ready ammunition door	
	Operate manual elevation/traverse cranks	Operate hull ammunition door	
	Perform lead system check	Stow 105MM ammunition	
	Perform firing circuits check	Operate main gun breechblock	
	Perform crosswind sensor check	Check replenisher	
	Perform hydraulic pressure check		

[1]Prepare for Operations (PREOPS) checks are performed with the aid of the Operator's Manual (TM 9-2350-10-2). These procedures are not necessarily performed in the stated order.

ACTIVITY 2. PERFORM PREPARE-TO-FIRE (PRE-FIRE)[2] CHECKS

TC	GNR	LDR	DVR
Supervise/assist main gun boresight	Boresight main gun	Clear/load coaxial machinegun	Check fuel tanks
		Fill ready rack	Report fuel status
Boresight TC's weapon	Zero coaxial machinegun		
		Report ammo status	
Zero TC's weapon	Report weapon status		
Select/announce battlecarry AMMO, RANGE	Index battlecarry ammo using AMMO SELECT switch	Load battlecarry ammo	
	Introduce battlesight range into CCP		
Option 2.1. Prepare for Offense			
Receive offensive mission/ formation/movement/commo			
Analyze terrain			
Check map overlay			
Brief crew	Receive TC briefing	Receive TC briefing	Receive TC briefing
Control DVR, if necessary, to maintain position in PLT formation and to exploit cover and concealment			Select routes in accordance with mission and formation

[2]Boresighting is performed in accordance with procedures outlined in the Tank Gunnery Tables (FM 17-12-1).

Option 2.2. Prepare for Defense

TC	GNR	LDR	DVR
Issue driver commands to move with platoon to occupy battle position			Drive to battle position
Receive defensive mission/position commo			
Prepare primary/alternate/ supplementary positions			Rehearse movement between primary and alternate firing positions
Analyze terrain	Inspect terrain through GPS/TIS	Inspect terrain to flank/rear	
	Check GAS clearance		Take primary firing position
Prepare tank sketch card indicating . TRPs . key terrain features . sector boundaries . indirect fire locations	Learn TRP locations/ranges		Monitor displays

ACTIVITY 3. ACQUIRE TARGET(S)

Part 3.1. Search for Target(s)

Option 3.1.1. Search Open Hatch--Day

TC	GNR	LDR	DVR
Receive instruction for sector air guard/ATGM guard	Select 3X GPS/TIS magnification		If moving, follow wingman concept/react to formation changes
Assign responsibility to loader	Search on gun axis using GPS		
Orient gun tube	Alternate using GPS with TIS (see Option 4.4: "Engage targets using TIS")	Perform air guard search (if assigned)	
Search left front clockwise to left rear		Search right front center clockwise to right rear	Search fender to fender
Execute search techniques: . rapid scan . slow scan . detailed search . flat terrain air search . hilly terrain air search	Execute search techniques: . rapid scan . slow scan . detailed scan	Execute search techniques: . rapid scan . slow scan . detailed search . flat terrain air search . hill terrain air search	Execute search techniques: . rapid scan . slow scan . detailed search

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Option 3.1.2. Search Closed Hatch--Day

Search 360°	Select 3X GPS/TIS magnification		If moving, follow wingman concept/react to formation changes
Perform air guard duties	Search on gun axis using GPS		
	Alternate using GPS with TIS (see Option 4.4: "Engage targets using TIS")	Search right front counter-clockwise to right rear	Search fender to fender
Execute search techniques: . Rapid scan . Slow scan . Detailed search . Flat terrain air search . Hilly terrain air search	Execute search techniques: . Rapid scan . Slow scan . Detailed scan . Near scan [Check with Dave B. on this]	Execute search techniques: . Rapid scan . Slow scan . Detailed search . Flat terrain air search . Hill terrain air search	Execute search techniques: . Rapid scan . Slow scan . Detailed search

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Option 3.1.3. Search at Night

Search 360°	Search on gun axis using TIS	Search right front counter-clockwise to right rear using VVS-2 (night vision device)	Search fender to fender using VVS-2 (night vision device)
Use off-center vision			

Part 3.2. Detect/Locate/Identify Target(s)

TC	GNR	LDR	DVR
Detect target(s)/signature(s)/ obstacle(s)	Detect target(s)/signature(s)/ obstacles	Detect target(s)/signature(s)/ obstacles	Detect target(s)/signature(s)/ obstacles
Locate target(s) using one of the following methods: . traverse . optics . reference point	Locate target(s) using one of the following methods: . optics . reference point	Locate target(s) using one of the following methods: . clock . sector	Locate target(s) using one of the following methods: . clock . sector
Identify target(s) making the following determinations: . IFFN . nomenclature	Identify target(s) making the following determinations: . IFFN . nomenclature	Identify target(s) making the following determinations: . IFFN . nomenclature	Identify target(s) making the following determinations: . IFFN . nomenclature
Note number of targets Classify multiple targets as most dangerous, dangerous, or least dangerous	If target detected, announce GUNNER REPORT, <TARGET>, <LOCATION>	If target detected, announce LOADER REPORT, <TARGET>, <LOCATION>	If target detected, announce LOADER REPORT, <TARGET>, <LOCATION>
Confirm acquisition report	Confirm acquisition report		Evaluate cover and concealment
Estimate range to select weapon(s) and to evaluate LRF return	Estimate range to evaluate LRF return		

Part 3.3. Evaluate Situation

TC	GNR	LDR	DVR
Decide whether or not to engage contingent on the following factors: • platoon mission . platoon fire plan (fire pattern/firing technique) . platoon leader command			
Select the appropriate weapon/ ammunition and the firing mode (precision/degraded) contingent on the following factors: . Target range . Target type (hard/soft, point/area) . Tank status (ammo, malfunctions)			
Determine crewman (GNR, TC, LDR) and type of fire command (single, multiple, or simultaneous) contingent on the following factors: . Number of targets . Target classification			

ACTIVITY 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN

Option 4.1. Engage single target from the offense using precision gunnery

TC	GNR	LDR	DVR
Issue contact report: CONTACT <DIRECTION> <TARGET>		Drop down into turret	Monitor TC and platoon leader commands
Decide whether to engage target while moving or from a short halt		Check turret ring	
If engaging from a short halt, issue driver command: DRIVER STOP		Set GUN/TURRET DRIVE switch in EL UNCPL position	If TC announces HALT, stop smoothly
Relay any action drill command		Case 4.1.A. Announced Round is Not Loaded	If TC does not announce HALT, maintain steady platform
Issue fire command: GUNNER <AMMO> <TARGET>	Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT as announced	Move ejection guard to SAFE	If antitank fire is encountered, seek cover and concealment or execute action drill
Lay gun (simultaneous with fire command)		Ensure SAFE light is lit	Alert crew of obstacles
	Sight through GPS	Open breech	
Release override	Grasp palm switches	Remove incorrect round from chamber, if necessary	
Sight through GPSE	Announce IDENTIFIED	Open ammo doors	
	Switch GPS to 10X	Stow unwanted round, if necessary	
	Lay on center mass of target	Remove correct round from stowage	
	Begin to track moving target	Load desired round	
	Listen for driver alerts	[Continue with Case B:]	
	Depress lase button(s) with reticle on target	Case 4.1.B. Announced Round is Loaded	
Evaluate range display	Evaluate range display	Move ejection guard to FIRE	
	Check ready-to-fire and fault symbols	Clear recoil path	
	Make control lay		

Option 4.1. Engage single target from the offense using precision gunnery (cont.)

TC	GNR	LDR	DVR
Listen for UP	Listen for UP	Announce UP	
Announce FIRE or FIRE, FIRE <ALTERNATE AMMO>	Listen for FIRE		
	Announce ON THE WAY		
	Squeeze trigger(s) with reticle on target		
	Continue tracking	Open ammo doors	

Option 4.2. Engage single target from the defense using precision gunnery

TC	GNR	LDR	DVR
Issue contact report: CONTACT <DIRECTION> <TARGET>		Drop down in turret	Set TACTICAL IDLE switch to ON
		Check turret ring	Set transmission control to D
Issue fire command: GUNNER <AMMO> <TARGET>	Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: 3X	Ensure GUN/TURRET DRIVE switch in POWERED	Release parking brake
			Depress/hold service brake
Announce DRIVER MOVE OUT, GUNNER TAKE OVER	• GUN SELECT: MAIN • AMMO SELECT as announced	Case 4.2.A. Announced Round is Not Loaded	
			Move to hull defilade position
Lay gun (simultaneous with fire command)	Sight through GPS	Move ejection guard to SAFE	Set transmission control to R
Release override	Grasp palm switches	Ensure MAIN GUN STATUS light is lit	Depress/hold service brake
	Look through GAS to determine when gun clears defilade	Open breech	
	Announce DRIVER STOP	Remove incorrect round from chamber, if necessary	
	Look through GPS	Open ammo doors	
Sight through GPSE	Announce IDENTIFIED	Stow unwanted round, if necessary	
	Switch GPS to 10X	Remove correct round from stowage	
	Lay on center mass of target	Load desired round	
	Track moving target	[Continue with Case B:]	
	Depress lase button(s) with reticle on target	Case 4.2.B. Announced Round is Loaded	
Evaluate range display	Evaluate range display	Move ejection guard to FIRE	
	Check ready-to-fire and fault symbols	Clear recoil path	
	Make control lay		

Option 4.2. Engage single target from the defense using precision gunnery (cont.)

TC	GNR	LDR	TC
Listen for UP	Listen for UP	Announce UP	
Announce FIRE or FIRE, FIRE <ALTERNATE AMMO>	Listen for FIRE		
	Announce ON THE WAY		
	Squeeze trigger(s)		
	Continue tracking	Open ammo doors	

Option 4.3. GNR cannot identify announced target

TC	GNR	LDR			DVR
	Case 4.3.A. GNR fails to identify target(s) Announces CANNOT IDENTIFY or does not respond				
Direct GNR onto target using one of the following techniques: . use verbal commands: - TRAVERSE <LEFT/RIGHT>, - STEADY, - ON . use TRP . announce WATCH MY TRACERS and use CAL .50 to point to target					
OR					
Announce FROM MY POSITION and proceed as a TC engagement (see Activity 10)					
	Case 4.3.B. GNR identifies incorrect target(s) Announces IDENTIFY <DIFFERENT TARGET>				
If GNR is correct, issue a correction to the fire command					
If GNR identifies wrong target, treat as Case 4.3.A and proceed					

Option 4.4. Engage target using TIS

TC	GNR	LDR	DVR
Engage targets using precision gunnery (Option 4.1 or 4.2)	Engage targets using precision gunnery (Option 4.1 or 4.2) with the following alternate switch settings: * THERMAL MODE: ON . FLTR/CLEAR/SHTR: SHTR . THERMAL MAGNIFICATION: 3 TO 10X . POLARITY SWITCH: WHITE or BLACK HOT, as desired . SENSITIVITY/CONTRAST/FOCUS for best image	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform OVR's actions as described in precision gunnery (Option 4.1 or 4.2)

ACTIVITY 5. ADJUST FIRE

TC	GNR	LDR	DVR
Recover sight picture	Recover sight picture	Set GUN/TURRET drive switch on EL UNCPL	
Observe strike of round	Observe/announce strike of every round using one of the following terms:	Load announced round (Case A Option 4.1)	
If TARGET was observed, determine whether or not target was destroyed	. TARGET . LOST . OVER . SHORT . DOUBTFUL	Move ejection guard to FIRE	
		Clear recoil path	
		Announce UP	
Option 5.1. Use reengage technique			
	Announce REENGAGING		
	Release/reengage palm switches		
	Lay center of mass		
	Track moving target		
	Depress lase button(s) with reticle on target		
Evaluate range	Evaluate range		
Announce FIRE	Check ready-to-fire and fault symbols		
	Announce ON THE WAY		
	Squeeze trigger(s) with reticle on target		
	Continue tracking		

Option 5.2. Use standard adjustment

TC	GNR	LDR	DVR
	Observe/announce deflection and range error		
	Release/reengage palm switches		
	Adjust 1 mil in deflection		
	Adjust 200 meters in range		
	Begin to track moving target		
	Announce ON THE WAY		
	Squeeze trigger(s) with aiming point on target		
	Continue tracking		

Option 5.3. Use TC adjustment

Issue subsequent fire command to adjust fire .5-3 mils in deflection and .5-2 mils in range (100-450m)			
	Release/reengage palm switches		
	Apply TC correction		
	Announce ON THE WAY		
	Squeeze trigger(s) with aiming point on target		
	Continue tracking		
If target is destroyed or exposure is too long, command CEASE FIRE			Return to defilade, or alternate position or seek alternate position
If in defensive posture, command DRIVER, BACK UP			

ACTIVITY 6. ENGAGE A SINGLE TARGET WITH THE COAX

TC	GNR	LDR	DVR
Issue fire command: GUNNER COAX <TARGET>	Set/check switches: * FIRE CONTROL MODE: NORMAL * LRF ARM: ARM LST RTN * GPS: 3X . GUN SELECT: COAX	Set GUN/TURRET drive switch on POWERED	Maintain steady platform
Lay gun (simultaneous with fire command)			
Release override	Grasp palm switches		
	Announce IDENTIFIED		
	Switch GPS to 10X		
	Lay center of target		
	Depress lase button(s)		
Evaluate range display	Evaluate range display		
	Listen for FIRE		
Announce FIRE			
	Announce ON THE WAY		
Monitor/evaluate engagement	Fire 20-30 rounds (5-6 tracers) to destroy/suppress point/area targets	Monitor and correct ammo feed	
	Adjust fire as needed		
Command CEASE FIRE			

ACTIVITY 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN

TC	GNR	LDR	DVR
Issue fire command: GUNNER <AMMO> <NUMBER> <TARGETS>,<RIGHT/LEFT> <TARGET> FIRST	Engage first target using precision gunnery (Option 4.1 or 4.2)	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Engage first target using precision gunnery (Option 4.1 or 4.2)			
If first target is not destroyed, adjust fire (Activity 5)	If first target is not destroyed, adjust fire (Activity 5)	If first target is not destroyed, perform LDR's actions as described in Activity 5	If first target is not destroyed, perform DVR's actions as described in Activity 5
If first target is destroyed, announce <NEXT> TARGET	Engage second target using precision gunnery (Option 4.1 or 4.2)	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
[Continue until all targets are destroyed]			
Announce CEASE FIRE			

ACTIVITY 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS AND MAIN GUN ENGAGEMENTS)

TC	GNR	LDR	DVR
Option 8.1. Simultaneous targets			
Issue fire command: GUNNER <AMMO> <TARGET>, FIRE AND ADJUST	Engage main gun target using precision gunnery (Option 4.1 or 4.2)	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Continue with Option 8.2	Adjust fire using standard adjustment as described in Option 5.2		
	If target is destroyed, announce TARGET--CEASE FIRE		
Option 8.2. Cal .50 targets			
Announce: CALIBER .50			
Charge TC's weapon			
Lay weapon for deflection			
Estimate range to target			
Lay CWS sight range line on target			
Adjust fire if needed	Aid in adjusting TC's weapon		
If target is destroyed, announce TC COMPLETE			

ACTIVITY 9. ENGAGE TARGET(S) USING DEGRADED GUNNERY TECHNIQUES

Option 9.1. Engage target(s) using battlesight gunnery

TC	GNR	LDR	DVR
Issue fire command: GUNNER BATTLESIGHT <TARGET>	Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: SAFE • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT: battlecarry ammo	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Depress MANUAL RANGE BATTLE SGT button			
Estimate range to target			
If target is outside of ± 200m of battlesight range, enter range change using MAN RNG B/S ADD/DROP toggle switch			
Check range readout in GPSE			
Engage target using precision gunnery (Option 4.1 or 4.2) but <u>without</u> evaluating LRF display	Engage target using precision gunnery (Option 4.1 or 4.2) but <u>without</u> lasing to target		

Option 9.2. Engage target given ineffective LRF

TC	GNR	LDR	DVR
If LRF fails to function or is rendered ineffective due to environmental conditions or battlefield obscurants, TC chooses of using one of the following techniques:		Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Case 9.2.A. Use battlesight gunnery			
Engage target using battlesight gunnery (Option 9.1)	Engage target using battlesight gunnery (Option 9.1)		
Case 9.2.B. TC indexes range			
Issue fire command: GUNNER <AMMO> <TARGET>	Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target		
Estimate range to target	Announce IDENTIFIED		
Index range using MAN RNG B/S ADD/DROP toggle switch			
Case 9.2.C. GNR indexes range			
Estimate range to target			
Issue fire command: GUNNER <AMMO> INDEX <RANGE>	Open CCP door		
	Press RANGE button		
	Enter <RANGE>		
	Press ENTER button		
	Close CCP door		
	Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target		
Case 9.2.D. GNR manually applies range			
Engage target using GAS (Option 9.10)	Engage target using GAS (Option 9.10)		

Option 9.3. Engage target given multiple returns from LRF

TC	GNR	LDR	DVR
Estimate range to target	Depress lase button(s)	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Evaluate range display	If multiple return symbol appears in GPS, announce RANGE <IN METERS>		
If range appears incorrect, may instruct GNR to switch LRF setting from ARM 1ST RTN to ARM LAST RTN or v.v.	Switch LRF setting in accordance with TC instructions		
If multiple return symbol appears in GPSE and displayed range is outside ± 200m, take either one of the following actions:			
Case 9.3.A. Gunner releases			
Announce RELASE	Relay on target		
	Depress lase button(s)		
Case 9.3.B. TC corrects range			
Correct range using MAN RNG B/S ADD/DROP toggle switch			
If displayed range is within ± 200m of estimated range, announce FIRE	Squeeze trigger(s) with reticle on target		

Option 9.4. Engage target given no range display (loss of symbology)

TC	GNR	LDR	DVR
Case 9.4.A. Little or no time			
Engage target using precision gunnery (Option 4.1 or 4.2) but without evaluating range	Engage target using precision gunnery (Option 4.1 or 4.2)	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Case 9.4.B. Time permitting			
Have gunner report range from CCP	Open CCP door		
	Press RANGE button		
Evaluate range	Announce range		

Option 9.5. Engage target given crosswind sensor failure

If computer self-test indicates crosswind sensor failure, have the gunner cancel crosswind input	Open CCP door	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
	Press CROSSWIND button		
	Press "0" key		
	Press ENTER button		
	Close CCP door		
Engage target using precision gunnery (Option 4.1 or 4.2)	Engage target using precision gunnery (Option 4.1 or 4.2)		

Option 9.6. Engage target given cant sensor failure

TC	GNR	LDR	DVR
If computer self-test indicates cant sensor failure, have the GNR cancel cant input	Open CCP door	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
	Press CANT button		
	Press "0"		
	Press ENTER button		
	Close CCP door		
Announce DRIVER STOP			Move tank to level ground and stop tank
Engage target using precision gunnery--stationary (Option 4.2 while monitoring GNR's cant correc'ion	Engage target using precision gunnery--stationary (Option 4.2)		
	If tank is not on level ground, compensate by aiming 1 mil high/1 mil opposite direction of cant per 1000 meters in range to target		

Option 9.7. Engage target given lead angle sensor failure

If computer self-test indicates lead angle sensor failure, have the GNR cancel lead angle input	Open CCP door	Perform LDR's actions as described in precision gunnery (Option 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.2)
	Press LEAD button		
	Press "0" key		
	Press ENTER button		
	Close CCP door		
Announce DRIVER STOP			Stop smoothly
Engage target using precision gunnery--stationary (Option 4.2) while monitoring lead	Engage target using precision gunnery (Option 4.2) but apply lead to moving target as follows: . 2.5 mils for sabot . 5 mils for HEAT		

Option 9.8. Engage target given GPS failure (day channel)

TC	GNR	LDR	DVR
If no GPS image, have GNR switch to thermal channel and engage targets using TIS (Option 4.4)	Engage targets using TIS (Option 4.4)	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)

Option 9.9. Engage target given GPS/TIS failure

If both GPS and TIS fail, the TC has the choice of using one of the following engagement techniques:		Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Case 9.9.A. Use GAS with precision techniques			
Engage target using GAS gunnery (Option 9.10)	Engage targets using GAS gunnery (Option 9.10)		
Case 9.9.B. Use GAS with battlesight techniques			
Engage target using battlesight gunnery (Option 9.1)	Engage target using battlesight gunnery (Option 9.1) but with the GAS instead of the GPS		

Option 9.10. Engage target using GAS

TC	GNR	LDR	OVR
Estimate range to target		Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)
Issue fire command: GUNNER <AMMO> <TARGET> <RANGE>	Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: SAFE • GUN SELECT: MAIN • AMMO SELECT: as announced		
Lay gun (simultaneous with fire command)			
	Sight through GAS		
Release override	Grasp palm switches		
	Announce IDENTIFIED		
	Lay announced range line on target		
	Begin tracking moving target		
	Apply lead to moving target		
Announce FIRE	Listen for FIRE		
	Announce ON THE WAY		
	Squeeze trigger(s) with reticle aiming point on target		
	Continue tracking		

Option 9.11. Engage target given stabilization system failure (in emergency mode)

TC	GNR	LDR	DVR
Issue fire command: GUNNER <AMMO> <TARGET>	Set/check switches: • FIRE CONTROL MODE: EMERGENCY • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT: as announced	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Announce DRIVER STOP	Sight through GPS		Stop smoothly
Lay gun (simultaneous with fire command)			
Release override	Grasp palm switches		
	Announce IDENTIFIED		
	Begin tracking moving target		
	Apply lead to moving target		
Announce FIRE	Listen for FIRE		
	Announce ON THE WAY		
	Squeeze trigger(s) with reticle aiming point on target		
Announce DRIVER, MOVE OUT	Continue tracking		Resume driving

Option 9.12. Engage target given turret power failure (in manual mode)

TC	GNR	LDR	DVR
Announce DRIVER STOP	Set/check switches. • FIRE CONTROL MODE: MANUAL • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT: as announced	Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Stop smoothly
Issue fire command: GUNNER <AMMO> <TARGET> <DIRECTION> <RANGE>	Sight through GAS		Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
	Traverse/elevate gun with manual controls		
	Announce IDENTIFIED		
	Lay announced range line on target		
	Begin tracking moving target		
	Apply lead to moving target		
Announce FIRE	Listen for FIRE		
	Announce ON THE WAY		
	Press elevation knob firing trigger with reticle aiming point on target		
	If gun fails to fire, vigorously turn blasting machine handle 3-4 times		
Announce DRIVER MOVE OUT			Resume driving

ACTIVITY 10. ENGAGE TARGET FROM THE TC POSITION[3]

TC	GNR	LDR	DVR
Issue one of the following fire commands:		Performs LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	Performs DVR's actions as described in precision gunnery (Option 4.1 or 4.2)
Case 10.A. Gunner cannot identify target: FROM MY POSITION	Set/check switches: • FIRE CONTROL MODE: NORMAL • TIS: STBY/ON • LRF: ARM LAST RTN • GPS: 10X • GUN SELECT: MAIN • AMMO SELECT: as announced		
Case 10.B. Three-man crew (no GNR)			
Announce LOAD <AMMO>			
Estimate range to target			
Sight through GPSE			
Lay on center mass of target			
Depress lase button			
Evaluate range display			
Take control lay			
Announce ON THE WAY			
Squeeze trigger			
Announce CEASE FIRE			

[3]In three-man crew arrangement, TC performs GNR actions as well as his own.

ACTIVITY 11. ASSESS RESULTS OF ENGAGEMENT

TC	GNR	LDR	DVR
Assess battle damage/casualties	Check/adjust MRS	Check replenisher reservoir	
Determine if and how crew should be reorganized to fight in a three-man configuration		Remove spent casings	
Issue SPOTREP			
Case 11.A. Stationary Determine whether to move to primary, alternate, or supplementary firing positions			
Issue driver command			Respond to TC driving commands
Case 11.B. Moving Determine changes to route			
Issue driver command			Respond to TC driving commands
Determine appropriate ammo for anticipated targets			
Announce PREPARE BATTLECARRY <AMMO> or RELOAD <AMMO>	Index battlecarry ammo		
Enter battlecarry range using the MANUAL BATTLE SGT ADD/DROP toggle switch	Announce <AMMO> INDEXED	Load announced round as described in precision gunnery (Option 4.1 or 4.2) Announce loading status	

APPENDIX B

RESULTS FROM DOES 19K SURVEY

APPENDIX B RESULTS FROM DOES 19K SURVEY

CONTENTS

Table B-1

Frequency, Performance, and Predicted Performance of M1 Tasks Listed in Rank Order for each Variable

Rank Order	Frequency		Performance		Predicted Performance[a]		
	Task	Mean Frequency[b]	Task	Mean Performance[c]	Task	Estimate	Residual[d]
1	48	1.545	48	2.444	18	3.403	-0.546
2	68	1.652	3	2.450	3	2.880	-0.430
3	*25*	1.739	68	2.556	2	3.113	-0.385
4	10	1.773	8	2.714	17	3.447	-0.356
5	3	1.783	2	2.727	1	3.214	-0.351
6	4	1.783	4	2.762	66	3.154	-0.336
7	*23*	1.913	66	2.818	8	3.047	-0.333
8	33	2.000	10	2.842	54	3.489	-0.298
9	*51*	2.045	18	2.857	19	3.556	-0.295
10	8	2.087	1	2.864	48	2.737	-0.293
11	37	2.174	33	2.905	53	3.433	-0.283
12	*57*	2.190	56	2.944	*65*	3.363	-0.252
13	*22*	2.217	*64*	2.955	68	2.803	-0.248
14	2	2.217	17	3.091	*64*	3.195	-0.240
15	66	2.304	*57*	3.111	56	3.161	-0.216
16	62	2.304	*65*	3.111	15	3.372	-0.191
17	56	2.318	53	3.150	9	3.335	-0.145
18	*47*	2.318	*25*	3.158	38	3.556	-0.121
19	*64*	2.391	15	3.182	*31*	3.640	-0.119
20	61	2.391	9	3.190	4	2.880	-0.118
21	6	2.391	54	3.190	16	3.340	-0.113
22	*27*	2.409	36	3.227	33	3.001	-0.097
23	1	2.435	16	3.227	*42*	3.447	-0.083
24	59	2.455	67	3.227	46	3.366	-0.081
25	*24*	2.478	19	3.261	67	3.306	-0.079
26	36	2.591	46	3.286	41	3.680	-0.071
27	13	2.609	12	3.364	7	3.474	-0.065
29	67	2.652	*24*	3.364	36	3.281	-0.054
30	32	2.696	*42*	3.364	50	3.462	-0.041
31	9	2.727	*51*	3.368	10	2.875	-0.033
32	16	2.739	7	3.409	40	3.676	-0.024

(table continues)

Rank Order	Frequency		Performance		Predicted Performance[a]		
	Task	Mean Frequency[b]	Task	Mean Performance[c]	Task	Estimate	Residual[d]
33	*65*	2.800	50	3.421	*43*	3.447	-0.018
34	46	2.810	*23*	3.421	12	3.370	-0.006
35	12	2.818	*22*	3.429	28	3.447	0.008
36	15	2.826	*43*	3.429	*57*	3.099	0.012
37	18	2.913	38	3.435	11	3.418	0.017
38	14	2.913	11	3.435	60	3.462	0.038
39	*49*	2.952	59	3.444	*30*	3.694	0.045
28	*52*	2.619	13	3.364	29	3.585	-0.064
40	11	2.957	14	3.455	45	3.619	0.048
41	*26*	2.957	28	3.455	14	3.403	0.051
42	53	3.000	*52*	3.474	39	3.683	0.056
43	55	3.000	37	3.476	13	3.288	0.075
44	28	3.043	61	3.478	21	3.523	0.086
45	*42*	3.043	60	3.500	35	3.683	0.090
46	63	3.043	*31*	3.522	55	3.433	0.091
47	17	3.043	29	3.522	*44*	3.511	0.108
48	*43*	3.043	55	3.524	20	3.534	0.118
49	60	3.091	32	3.524	*24*	3.233	0.130
50	50	3.091	6	3.545	*49*	3.417	0.139
51	7	3.130	62	3.550	63	3.447	0.153
52	54	3.182	*49*	3.556	34	3.672	0.154
53	58	3.227	*47*	3.600	*52*	3.293	0.181
54	*44*	3.261	63	3.600	32	3.323	0.201
55	21	3.304	41	3.609	5	3.581	0.202
56	20	3.348	21	3.609	59	3.223	0.222
57	19	3.435	*27*	3.619	58	3.502	0.225
58	38	3.435	*44*	3.619	*26*	3.418	0.234
59	5	3.545	40	3.652	61	3.195	0.284
60	29	3.565	*26*	3.652	*25*	2.855	0.303
61	45	3.739	20	3.652	*22*	3.113	0.316
62	*31*	3.870	45	3.667	*51*	3.025	0.343
63	34	4.130	58	3.727	6	3.195	0.351
64	40	4.174	*30*	3.739	37	3.091	0.385

(table continues)

Rank Order	Frequency		Performance		Predicted Performance[a]		
	Task	Mean Frequency[b]	Task	Mean Performance[c]	Task	Estimate	Residual[d]
65	41	4.217	39	3.739	62	3.154	0.396
66	39	4.261	35	3.773	*27*	3.203	0.416
67	35	4.261	5	3.783	*47*	3.161	0.439
68	*30*	4.522	34	3.826	*23*	2.954	0.467

Notes. Task means are based on 23 supervisor's ratings of 11 drivers, 8 loaders, 2 gunners and 2 "others," all "recent" OSUT graduates. Task titles are identified in the following table. Asterisks surround tasks which are contained in the gunnery analysis.

[a]Task mean performance estimated with a curvilinear function of task frequency. Multiple R is .72, with curve component significant at $p < .05$.

[b]Ordered from low to high frequency.

[c]Ordered from low to high performance.

[d]Ordered from performance below that expected based on frequency to performance above that expected based on frequency.

Table B-2

List of 19K OSUT Tasks

Task Number	Task Title
1.	PERFORM OPERATOR'S MAINT ON AN M16A1 RIFLE, MAGAZINE, AND AMMO
2.	LOAD, REDUCE A STOPPAGE AND CLEAR AN M16A1 RIFLE
3.	BATTLESIGHT ZERO AN M16A1 RIFLE
4.	ENGAGE TARGETS WITH AN M16A1 RIFLE
5.	PERFORM OPERATOR MAINT ON A CAL 45 PISTOL
6.	ENGAGE TARGETS WITH A CAL 45 PISTOL
7.	SET HEADSPACE AND TIMING ON A CAL .50 MG
8.	ESTIMATE RANGE
9.	COMMUNICATE USING VISUAL SIGNALLING TECHNIQUES
10.	CONSTRUCT INDIVIDUAL FIGHTING POSITIONS
11.	IDENTIFY TERRAIN FEATURES ON A MAP
12.	DETERMINE THE GRID COORDINATES ON A MILITARY MAP
13.	MEASURE DISTANCE ON A MAP
14.	USE CHALLENGE AND PASSWORD
15.	SEND A RADIO MESSAGE
16.	MOUNT RADIO SET AN/VRC-64 OR 53 OR AN/GRC-160 OR 125
17.	PREPARE/OPERATE FM RADIO SETS
18.	PERFORM PMCS ON AN/VRC-64 OR 53 OR AN/GRC-160 OR 125
19.	OPERATE INTERCOMMUNICATION SET AN/VIC-1 IN AN M1 TANK
20.	INSTALL/REMOVE THE M240 COAX MG ON AN M1 TANK
21.	PERFORM OPERATOR MAINT ON AN M240/240C MACHINEGUN
22.	ZERO THE M240 COAX MG ON AN M1/M1A1 TANK
23.	ENGAGE TARGETS WITH THE M240 COAX MG FROM THE GUNNER'S STATION ON AN M1/M1A1 TANK
24.	CLEAR AN M240 COAX TO PREVENT ACCIDENTAL DISCHARGE ON AN M1/M1A1 TANK
25.	ENGAGE TARGETS WITH THE M240 MG FROM THE LOADER'S STATION ON AN M1/M1A1 TANK
26.	INSTALL/REMOVE THE M240 LOADER'S MG ON AN M1/M1A1 TANK
27.	INSPECT AMMO AND PREP FOR STOWING
28.	MAINTAIN OPERATOR'S PART OF EQUIPMENT RECORD HOLDER
29.	PERFORM PREVENTIVE MAINT ON BASIC ISSUE ITEMS
30.	START/STOP THE ENGINE ON AN M1/M1A1 TANK
31.	DRIVE AN M1/M1A1 TANK
32.	SLAVE START AN M1/M1A1 TANK
33.	PERFORM FUEL TRANSFER PROCEDURES ON AN M1/M1A1 TANK
34.	PREPARE DRIVER STATION FOR OPERATION ON AN M1/M1A1 TANK
35.	SECURE DRIVER STATION ON AN M1/M1A1 TANK
36.	OPERATE THE AV/VVS-2 NIGHT VISION VIEWER IN DRIVER'S HATCH ON AN M1/M1A1 TANK

(table continues)

Task Number	Task Title
37.	REMOVE/INSTALL TRACK BLOCKS ON AN M1/M1A1 TANK
38.	TROUBLESHOOT THE M1/M1A1 TANK USING DRIVER'S CONTROL PANEL WARNING/CAUTION LIGHTS
39.	PERFORM BEFORE OPERATION CHECKS AND SERVICES ON AN M1/M1A1 TANK
40.	PERFORM DURING OPERATION CHECKS AND SERVICES ON AN M1/M1A1 TANK
41.	PERFORM AFTER OPERATION CHECKS AND SERVICES ON AN M1/M1A1 TANK
42.	PERFORM GUNNER'S/LOADER'S PREVENTIVE MAINT PREPARE-TO-FIRE CHECKS/ SERVICES ON AN M1/M1A1 TANK
43.	PERFORM GUNNER'S/LOADER'S PREVENTIVE MAINT AFTER FIRING CHECKS/SERVICES ON AN M1/M1A1 TANK
44.	PREPARE LOADER'S STATION FOR OPERATION ON AN M1/M1A1 TANK
45.	SECURE LOADER'S STATION ON AN M1/M1A1 TANK
46.	PERFORM OPERATOR MAINT ON THE 105-MM BREECHBLOCK ASSEMBLY ON AN M1 TANK
47.	LOAD/UNLOAD THE 105-MM MAIN GUN ON AN M1 TANK
48.	LOAD/UNLOAD AN M250 GRENADE LAUNCHER ON AN M1/M1A1 TANK
49.	PREPARE GUNNER'S STATION FOR OPERATION ON AN M1/M1A1 TANK
50.	SECURE GUNNER'S STATION ON AN M1/M1A1 TANK
51.	ENGAGE TARGETS WITH THE MAIN GUN FROM THE GUNNER'S STATION ON AN M1/M1A1 TANK
52.	STOW AMMUNITION ON AN M1/M1A1 TANK
53.	PREPARE GUNNER'S/LOADER'S WEAPONS FOR TRAVEL ON AN M1/M1A1 TANK
54.	SERVICE THE PRECLEANER ON AN M1/M1A1 TANK
55.	CLEAN/SERVICE THE 105-MM MAIN GUN ON AN M1 TANK
56.	OPERATE THE GPFU ON AN M1 TANK
57.	BORESIGHT/SYSTEM CALIBRATE AN M1/M1A1 TANK
58.	REFUEL AN M1/M1A1 TANK
59.	UNLOCK STUCK PARKING BRAKE ON AN M1 TANK
60.	SERVICE THE AIR INDUCTION SYSTEM ON AN M1 TANK
61.	PREPARE AN M1 TANK FOR POWERPACK REMOVAL
62.	CLEAR A CAL .50 M2 HB MG TO PREVENT ACCIDENTAL DISCHARGE
63.	MAINTAIN A CAL .50 M2 HB MG ON AN M1/M1A1 TANK
64.	VISUALLY IDENTIFY THREAT AIRCRAFT
65.	RECOGNIZE/IDENTIFY FRIENDLY AND THREAT ARMORED VEHICLES
66.	CAMOUFLAGE EQUIPMENT
67.	CAMOUFLAGE YOUR DEFENSIVE POSITION
68.	LOAD/UNLOAD AND CLEAR AN M203 GRENADE LAUNCHER

Table B-3

Descriptive Statistics for 68 19K OSUT Tasks

	Mean	S.D.	Minimum	Maximum
Frequency	2.82	0.69	1.54	4.52
Importance	3.83	0.33	2.68	4.39
Performance	3.32	0.33	2.44	3.83

APPENDIX C

REVIEW OF RESEARCH RELATED TO GUNNERY SKILL AND KNOWLEDGE COMPONENTS

APPENDIX C REVIEW OF RESEARCH RELATED TO GUNNERY SKILL AND KNOWLEDGE COMPONENTS

CONTENTS

REVIEW OF RESEARCH RELATED TO GUNNERY SKILL AND KNOWLEDGE COMPONENTS

As stated in the text of the report, we examined the literature on generally acknowledge skill and knowledge components of armor gunnery. For each component, we attempted to answer the following questions: (a) Is there evidence for any relatioship between the skill/knowledge and gunnery performance, and (b) is the skill/knowledge trainable? The literature on each component is discussed separately below.

Target Acquisition

According to FM 17-12-1, target acquisition can be broken down into six steps: crew search, detection, location, identification, classification, and confirmation. However, the middle three steps (detection, location, and identification), which define the three phases of target acquisition, are the core concepts in target acquisition. In fact, FM 17-12-1 defines target acquisition as "...the timely detection, location, and identification of targets in sufficient detail to permit accurate attack by either direct fire or supporting weapons" (p. 2-2).

Crew Search

Crew search refers to the collective efforts of a tank crew to systematically search the assigned areas of observation in order to acquire targets. In addition to perceptual skill required by this component, crewmembers must also know the sectors of observation along with specific ground and air search techniques. There is no research that relates these search skills and knowledges to gunnery performance; nor is there research on the trainability of these hypothesized components of gunnery proficiency.

Detection

Detection is the first of the three phases of target acquisition and is defined as "...the discovery, by any means available (sight, sound, smell), of any phenomena (personnel, equipment, objects) of potential military significance" (FM 17-12-1, p. 2-2). Detection occurs as a direct result of observing a target signature, which is an observable indicator of the presence of a potential target. Examples of target signatures include soldier footprints and the loud dull report indicating artillery.

Campbell and Black (1982) investigated the relationship between job sample performance and performance in training for a sample of soldiers in Basic Armor Training (BAT). Job sample testing was accomplished during the days prior to the start of training. Among the five job sample tests was one in which the soldiers were required to search a slide presentation using simulated gunner controls and sights in order to locate a partially hidden

target. Job sample performance was measured in terms time to locate the target and whether or not the subject located the target (laid reticle "at or near" target). Thus, the emphasis on this job sample was on correct detection of the target rather than the precision of the lay. The target location times were significantly correlated with student rankings as provided by instructors. The correlation was negative, as expected, indicating that higher ranks were associated with lower target detection times. However, target detection was not related to the other proficiency criteria: performance on mid- and end-of-cycle tests and main gun firing on Table VII.

Biers and Sauer (1982) similarly tested experienced tank commanders and gunners on a microcomputer-based job sample that measured some aspects of the target detection skill. As in the previously described job sample, potential targets were presented on photographic slides. Subjects began their search under simulated 3X magnification. They indicated target location by manipulating a joystick under microcomputer control to lay a simulated reticle on the target. The job sample procedure then called for subjects to switch to 10X magnification and relay the reticle. Once the reticle was centered on the target, the subject pressed a button labeled LASER. If invalid range data appeared as a result, the procedure called for the subject to press the laser a second time. If, however, valid range data were obtained, the subjects were to press another button labeled FIRE. Performance measures included distance from reticle to target (accuracy) and time to press 10X, LASER, and/or FIRE buttons (speed). The accuracy of procedures was also scored, but these measures are not relevant to target detection. These measures were correlated with self-reports of success at annual gunnery qualifications. Although the relationships were generally in the expected direction (i.e., good job sample performance associated with good gunnery scores), none of the relationships was statistically significant.

Black and Mitchell (1986) extended the work of Biers and Sauer by testing gunners on two job samples related to target detection. One job sample was the microcomputer-based job sample described above. The other was an analogous detection-like hands-on task using the M1 tank and an M55 laser boresighted with the main gun. Target scenes were presented by projector on a screen and viewed through the M1 sights. As above, speed and accuracy measures were recorded although the speed measures are the more relevant to target detection. Their results indicated that the hands-on and the computerized task were correlated with one another indicating that they tapped similar skills. However, there were no correlations between performance on either job sample and supervisor ratings of gunner performance. Black and Mitchell also examined records of actual (not recalled) performance of gunners on on their most recent Table VIII. They found that a positive relationship between speed on the hands-on job sample and percent hits in the night portion of Table VIII, which approached significance at the .05 level. There were no other significant relationships between gunnery scores and either job sample.

Over a series of eight experiments, Wolff and colleagues studied target detection training. In the first study, Stark, Wolff, and Haggard (1961) examined performance before and after classroom training using slides and movies. Their results showed that a reliable increase in performance between the two testings. Furthermore, comparison of posttraining performance between

a group receiving the pretest and one not receiving a pretest indicated no differences. The lack of differences indicated that the increase in performance could not entirely be due to the effects of repeated testing. A later study (Wolff & Van Loo, 1962) compared performance of subjects who were trained under different response conditions. Their results indicated that active responding by students using a response box to indicate the location of detected targets 25 percent over comparable conditions. Finally, the last study in the series (Wolff, Burnstein, Haggard, & Van Loo, 1962) indicated similar differences using a field test criterion. The field test stimuli consisted of actual stationary military targets at distances of 200 to 1500 yards. Students were instructed to detect and identify targets during the 60 secs allotted for each of the 21 presentations. Three training conditions were compared: classroom training with active participation, classroom without active participation, and a no training condtrol. Results indicated that classroom training with active participation produced superior detection performance.

Kottas and Bessemer (1983) also showed increases in target detection over trials for BAT students viewing targets through simulated optical and thermal sights. Their results indicated that alternating between optical and thermal sights produced better performance than either optical alone and thermal alone. However, the increase in accuracy associated with the alternating strategy occurs at the expense of an increase in time to detect. The fastest time occurred when using the optical sights alone. Performance using the thermal sights was initially poor but improved over time. An obvious question from this research is whether or not good gunners use an alternating optical/thermal strategy to detect targets in more realistic conditions. This question has not been addressed thusfar.

In conclusion, the research on target detection was mixed: One study showed a relationship to subjective ratings of performance in training; another showed some evidence of a relationship to actual gunnery performance. However, other studies failed to find those same relationships. On the other hand, there is rather convincing evidence that target detection is a trainable skill.

Location

Location, the second phase of target acquisition, refers to the determination of where the target is on the battlefield. Location is usually indicated by the tank commander using his controls to orient the gun in the general location of the target. The gunner then makes a final and more precise lay of the reticle on the target. In addition, FM 17-12-1 describes other methods for locating targets: clock, sector, traverse, reference point, and grid methods. No research has been performed to assess the relationship between the skills and knowledges related to locating targets and gunnery performance.

Identification

Identification refers to the to the process of identifying a potential target as a particular object. Target identification is sometimes distinguished from target recognition. Recognition refers to placing the perceived target into some class of objects, e.g., threat vs. friendly vehicles; whereas identification is the more specific process of naming the object, e.g., T72 or M113.

Olson, Goss, and Voiers (1958) examined the detection and identification of either a M48 tank or 2 1/2 ton truck. Among the more interesting findings was that the ranges at which the soldiers detected targets and identified targets were virtually identical. The authors cautioned that this may not be true with a larger sample of vehicles with which the soldiers were less familiar. Subjects were tested in groups of 10. The difference between the range at which the first observer detected/identified test vehicles and the range at which the fifth (median) observer identified the vehicle was about 200 yards. This finding indicates considerable individual differences on this target identification skills.

Graham (1986) examined the relationship between target identification and gunnery proficiency using the Unit Conduct of Fire Trainer (U-COFT). Target identification was defined as the time from when a target first appears to when the gunner announces "identified." Thus, as in the previous study, identification was confounded with the detection process. Three criteria of gunnery proficiency were measured: hit rate, reticle aim score, and opening time. Opening time is a speed measure of gunnery performance and is defined as the time from target appearance to firing the first round. Not surprisingly, target identification time was positively related to opening time, since opening time is contaminated with the time required to identify the target. Reticle aim scores are composite measures computed from opening time, time to kill, and reticle aim error. Identification time was positively related to this composite measure, which again was contaminated with predictor variance. In contrast, the third criterion (hit rate) was not contaminated with identification time. However, the results indicated that identification time and hit rate were not related.

Warnick, Chaistain, and Ton (1979) demonstrated that recognition and identification skills can be trained. Their subjects were Army helicopter pilots who were tested on those skills by viewing model vehicles through COBRA/TOW weapons sights. All subjects were initially pretested on recognition and identification without receiving feedback on their responses. They were then trained on the skills, which essentially consisted of practice on recognizing and identifying the model vehicles with feedback until they reached a performance criterion of two consecutive perfect trials. They were then posttested on the vehicles, again without feedback. The results indicated substantial gains in recognition and identification performance.

To summarize, there is some evidence that the speed of target identification may be related to speed measures of gunnery proficiency;

however, the interpretation of this effect is compromised by problems in criterion contamination. On the other hand, there is rather good evidence that target identification is trainable.

Classification

The tank commander estimates the danger of potential targets by classifying each as either most dangerous, dangerous, or least dangerous. Most dangerous targets are targets with armor-defeating capabilities that appear to be readying to engage the tank. Dangerous targets are also targets with armor-defeating capabilities but do not appear to be presently engaging the tank. Least dangerous targets are those without armor-defeating weapon system but can report the tank to a threat vehicle that has such capabilities. These estimates are then used to determine engagement priorities.

Biers and Sauer (1982) tested tank commanders and gunners on their abilities to classify targets by presenting them slides of three threat vehicles. They were asked to identify the most dangerous vehicle by depressing a button corresponding to the vehicle. Both speed and accuracy measures were obtained from this job sample. These measures were correlated with past success in gunnery qualification. The experimenters obtained the expected positive correlations between speed of decision making and gunnery qualification scores. The results were opposite from expectations: performance on the classification job sample were negatively correlated with gunnery scores. However, neither of these relationships was significant. The experimenters speculated that the negative relationship may be due to the fact that gunnery engagement strategies may run counter to doctrine on threat classification. For instance, the more successful crews may open fire on any reasonable target rather than wasting time on this decision.

To test the trainability of the decision making skills, Biers and Sauer compared the performance of tank commanders and gunners. Presumably tank commanders have had more experience making this judgment and should perform better. The results did not confirm this expectation: tank commander and gunner performances were essentially equal. This finding was used to support the previous contention that tank commanders who are successful on Table VIII do not bother to classify targets. That is, the failure to find differences between groups may not indicate that the skill is untrainable; rather, that it is irrelevant to gunnery performance as defined by Table VIII.

Thus, the research literature failed to indicate a relationship between target classification and gunnery proficiency, nor was there evidence of systematic increases in target classification skill as a function of experience.

Range Determination

The laser range finder in the M1 tank is used to rapidly and accurately determine the range to a target. Consequently, tank gunnery performance on the M1 is not as dependent on the tank commander's range determination skills as it might be for less sophisticated tanks. Nevertheless, there are situations in which range determination skills are important to M1 gunnery. For instance, the tank commander uses his own estimates of range to verify returns from the laser range finder. In addition, range determination becomes crucial if the laser range finder becomes inoperable.

Kress (1981) correlated performance of tank commanders on a range estimation job sample and M60A1 gunnery performance on Table VIII. The range estimation job sample required tank commanders to estimate the range to full scale target panels under both aided with the M60A1 coincidence range finder and unaided with the range finder. Accuracy of job sample performance was within standards of +/- 3% error for aided range estimations and +/- 20% error for unaided estimations. However, neither aided nor unaided range estimation performance was significantly related to Table VIII performance.

It is not even clear whether or not range estimation is a trainable skill. Stark, Wolff, and Haggard (1961) measured the accuracy of range estimations both before and after receiving a range estimation training program. Because the data were skewed by extreme scores, nonparametric tests were used to test the significant between groups. The analyses indicated no differences in median accuracy; however, there was a reliable decrease in the range of scores as a function of training.

In summary, then, the literature did not indicate that skill in ranging is related to gunnery performance. There was also no evidence that range estimation is a trainable skill.

Knowledge of the Fire Control System

This category refers to crucial gunner and tank commander knowledges concerning the operation and capabilities of the fire control system. These knowledges form the basis of gunnery decision making that "...directly impacts on target engagement outcomes--both in terms of target destruction and crew survival" (Kraemer, 1984, p. 4). Because of the complexity of these knowledges and their obvious combat criticality, ARI developed training materials to sustain and enrich these knowledges for the M1 tank (Silbernagel, Vaughan, & Schaefer, 1982) and for the M60A3 (Kraemer, 1984). The training materials for the M1 and M60A3 are similarly organized around the following topics and subtopics:

. Fire Commands
- Overview of Fire Commands
- Classifying Threats
- Ammunition/Weapon Selection
- Fire Command Elements and Sequence
- Single Target Engagements
- Multiple/simultaneous Target Engagements

. Degraded Mode Gunnery
- M1 Gunnery Systems
- Non-immediate Engagements
- Immediate Engagements

. Multiple Returns

Excluding threat classification, which was previously discussed, there is no research that relates tank commander or gunner knowledge of the fire control system and gunnery performance. There is, however, some research on the trainability of these knowledges. Silbernagel et al. (1982) showed significant gains in performance from pre- to posttests on M1 fire control system knowledges as a result of working through each of the knowledge booklets. In contrast, Kraemer (1984) failed to show similar performance gains on the M60A3 knowledge booklets. The crucial difference between the two studies appears to be that Kraemer (1984) permitted soldiers to study the booklets on their own time. As a result, according to post-experimental questionnaire responses, most of the soldiers who were issued booklets failed to complete both knowledge and scenario portions of the booklets.

Firing the Initial Round

Firing an initial round at a target requires two distinct skill/knowledge components. The first component is the knowledge of the appropriate sight picture. "Sight picture" refers to the relationship between reticle and target. The second component is the psychomotor skill involved in operating the gunner or tank commander control handles so that the appropriate sight picture is achieved. This skill is commonly referred to as "tracking." The following discussion is organized according to these two components.

Some of the following research examines the relationship between gunnery proficiency and performance on a job sample that simulates either stationary or moving engagements. Although both knowledge of sight picture and tracking skill are necessary for both moving and stationary engagements, their relative criticality differs between these two types of engagements. For stationary engagements, knowledge of the sight picture predominates with tracking skill being relatively inconsequential. Consequently, stationary job samples that involve simulation of stationary engagements are discussed below under knowledge of sight picture. For moving engagements, tracking skill becomes more important. Thus, moving engagements are discussed under the latter topic.

Sight Picture/Stationary Engagements

Kress (1981) examined the relationship between gunners' knowledge of appropriate sight pictures and their performance on Table VIII. Gunners were tested by having them demonstrate the appropriate reticle/target relation by positioning a the reticle, drawn on a clear plastic overlay, on top of line drawing of a target. The engagement conditions were defined by a fire command that was printed on the target background. The percent correct on this job sample was computed for each subject and correlated with six measures of Table VIII gunnery performance. None of the correlations were significant.

Eaton (1978) tested the ability of the gunner to initially lay on a stationary target using the Willey Burst-on-Target (BOT) trainer. His results indicated that faster BOT times were significantly associated with a greater number of successful Table VIII battlesight engagements. However, BOT performance was not related to the speed of Table VIII battlesight engagements. Further, BOT performance was not related to Table V (subcaliber) performance.

Eaton, Johnson, and Black (1980) measured the relationship between a "center-of-mass" job sample and gunnery performance on a modified Table VI. In the job sample, the reticle of the Willey BOT trainer is placed in the middle of four tank silhouettes. At a signal, the subject was told to manipulate the control handles such that the reticle was laid on the center of mass one of the four targets. Both speed and accuracy measures were taken. Two groups of BAT students received job samples either before the start of training or after eight weeks of training. Comparisons of the two groups showed that BAT students made significantly fewer errors than Reception Station personnel on the center-of-mass job sample, but that the two groups did not differ in speed of performance. Correlational analyses failed to reveal a relationship between the job sample and gunnery performance.

Biers and Sauer (1982) examined the relationship between a stationary engagement job sample and gunnery performance defined by the most recent gunnery qualification score. This job sample was intended to capture the tank commander's skill in providing an initial lay on the target. Their job sample required gunners and tank commanders to use actual M1 tank commander sights and controls to lay the reticle on a slide projection of a black dot. As before, both speed and accuracy measures were obtained from the job sample. As expected, tank commanders were significantly faster and more accurate than gunners at this job sample since they have more experience at using the commanders sights and controls. The only significant relationship between the job sample time and gunnery qualification performance was that for those qualifying at the gunner station; however, the relationship was opposite from the predicted direction: Longer gun lay times were associated with higher qualification scores and vice versa.

Kress (1981) tested the relationship between a stationary engagement job sample and gunnery performance. Skill at stationary engagements was tested by having gunners fire at reflective targets using an M55 laser mounted coaxially with the main gun. The results indicated that job sample performance was significantly correlated with time measures derived from Table VIII. As

expected, gunners taking more time to complete the stationary engagement job sample also took more time to complete Table VIII engagements. A less expected finding was that gunners who were more accurate at the stationary engagement job sample took more time to complete Table VIII engagements.

In summary, the research data failed to show a relationship between sight picture knowledge and gunnery performance. When this knowledge is combined with the minimal tracking skill required in stationary engagements, the predictive relationship to gunnery performance is quite mixed: One study fails to show a relationship, others found significant relationships in the expected direction, while still others found signficant relationships in unexpected directions. Nevertheless, the research findings were relatively unambiguous that stationary tracking skill is trainable.

Tracking/Moving Engagements

Eaton, Johnson, and Black (1980) found that tracking performance on a job sample test (diamond, but not circle, pattern on Willey BOT) was correlated with performance on a modified Table VI. In other words, good gunners evidenced better tracking skill. This relationship cross-validated across all three phases of the research. However, they found conflicting evidence as to whether or not this skill is trainable. They found no differences between gunners and loaders who presumably differ in gunnery training and experience (Phase II). In contrast, a longitudinal comparison (Phase III) showed differences between subjects in the Reception Station and subjects who had completed 8 weeks of BAT.

Campbell and Black (1982) modified the diamond tracking task described by Eaton et al. and used it as a job sample for predicting entry level training performance. The results showed an inconsistent relationship between the tracking job sample and training performance across the two companies of M1 crewmen that were tested. The first company showed a significant positive relationship between tracking accuracy and training performance defined by the instructor rankings and course tests. In contrast, the second company showed a significant positive relationship between tracking speed and training performance defined by the instructor rankings only. Neither company demonstrated a significant correlation between performance on the diamond tracking job sample and gunnery performance.

Two studies (Biers & Sauer, 1982; Black & Mitchell, 1986) examined the relationship between a computerized target tracking task and gunnery performance. The task required armor crewmen to track a randomly moving dot on a computer monitor with a joystick. Correlational analyses in both studies indicated no significant relationships between performance on this job sample and gunnery qualification scores. However, there was evidence that the computerized tracking task was not an appropriate job sample for tracking the in M1: (a) Biers and Sauer demonstrated that less experienced personnel (drivers and loaders) performed significantly better than personnel who should have more experience with the M1 sights and controls (gunners and tank commanders); and (b) Black and Mitchell failed to demonstrate a relationship betwen the computerized tracking sample and the hands-on job sample (described

below) which is more similar to the actual task. Biers and Sauer noted that stimulus-response relationships required by the job sample were not analogous to those required in the actual tank, which may have caused negative transfer from the tank to the job sample.

These same two studies studied the relationship between a hands-on tracking task wherein armor crewmen were required to follow a "snakeboard" track using both the gunner and tank commander sights and controls on an actual M1. Both studies found a relationship between performance on the tracking job sample and gunnery performance, but the relatioships were not consistent. Biers and Sauer (1982) found a relationship between the total number of hits on the job sample and the most recent qualification score while the subject was in the tank commander's seat. However, this relationship is opposite from expectations, i.e., lower numbers of job sample hits was associated with higher qualification scores. In contrast, Black and Mitchell (1986) showed a significant relation between performance on the job sample and performance on the night portion of Table VIII.

Kress (1981) also found some significant and predictable relationships when tracking skill was measured within the context of a moving target engagement job sample. As in the stationary engagement job sample described above, his gunners were tested in their speed and accuracy at using an M55 laser to hit reflective targets. In the present sample, however, the targets were moved either to the left or right. Although speed measures derived from job sample performance did not significantly correlate with Table VIII performance, the job sample accuracy measures evidenced some rather strong relationships with Table VIII performance measures: the percent of hits, the percent of target hits, and the percent of target engagements.

The research described above concerns tracking targets from a stationary tank, i.e., stationary/moving engagements. In contrast, Harris, Melching, Morrison, and Goldberg (1982) addressed the specific issue of training gunnery from a moving platform, i.e., moving/moving engagements. Harris et al. identified two sources of "error" input that operate during tracking to draw the reticle off target. The first source of error is due to the movement of the target relative to the firing tank. This sort of error is common to both stationary/moving and moving/moving engagements. Moving/moving engagements have an additional source of error: that caused by the movement of the firing tank. Their training program consisted of a knowledge component that presented moving platform gunnery principles and a practice component that employed a simple response device for practicing moving/moving skills. However, results from an evaluation of the training program failed to provide evidence that moving platform gunnery skills can be trained: Performance on the practice device did not improve over trials, and moving/moving skills did not transfer to the criterion performance device, the Fire Control Combat Simulator (FCCS), which simulates moving/moving engagements.

In summary, there was some evidence that tracking skill correlates with gunnery performance although this relationship was not found in one study (Biers & Sauer, 1982). It also appears that tracking is a trainable skill. In the context of moving engagements, the findings are again mixed: While one study found a predictable and strong relationship between tracking moving

targets and gunnery performance (good tracking associated with good gunnery), another showed opposite relationships (good tracking associated with poor gunnery). Finally, the timing skills required in moving/moving engagements may not be trainable.

Firing Subsequent Rounds

Although tank fire control systems have become increasingly accurate, tank gunners do not always hit designated targets on the first round fired. There are two identifiable skill/knowledge components that are associated with firing subsequent rounds at the target: (a) observing the initial round, which is primarily perceptual in nature; and (b) adjustment techniques, which is primarily a knowledge-based activity. These two topics are discussed below.

Observation[1]

Observation refers to announcements made by the gunner or tank commander with regard to the relation of the round or its effects to the target. These observations provide the basis for adjustment of fire. One of the following five terms to describe an observation: (a) "target" meaning the target was observed to be hit, (b) "lost" indicating that neither the round nor its effects were observed, (c) "over" where the round is observed above the target, (d) as oppose to "short" where the round is observed to fall short of the target, and (e) "doubtful" indicating that the round was observed to the right or left of the target but at the correct range, i.e., it is doubtful that a range correction will need to be applied.

Eaton, Johnson, and Black (1980) examined the relationship of a "sensing" job sample to gunnery performance. In their job sample, armor personnel viewed a photographic slide presentation of a typical gunnery range target array upon which a tachistoscope superimposed a red blip to simulate a round fired. The subjects indicated their sensing of the round by drawing the location on a hand-drawn replication of the target slide. The distance between the subject's indicated sensing and the actual location was computed. Eaton et al. found that round sensing was positively related to Table VI (modified) performance. In other words, good gunners sense rounds better than poor gunners. The relationship cross-validated for the first two phases of the research but not the third. Their results also provided mixed evidence concerning the trainability of the sensing/observation skill: If the skill were trainable, one would expect differences between recent graduates of entry level training who received either gunner and loader training; no such difference was observed. However, comparison between armor personnel assigned to the Reception Station (i.e., prior to training) and personnel who had

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[1]Techniques of observation were formerly referred to as "sensings" in earlier armor doctrine.

received eight weeks of entry level training indicated a significant advantage in sensing performance for the latter group.

Campbell and Black (1982) modified the Eaton et al. sensing job sample to more accurately reflect job requirements. Instead of binocular viewing in the Eaton et al. job sample, Campbell and Black required monocular viewing as required in the actual tank. Also, subjects indicated their sensing/observation by manipulating a gunner's control handle to place the reticle where the simulated burst was perceived. Their results indicated that performance on the round sensing task was positively related to Table VII performance for one of the two samples of BAT trainees tested. However, round sensing was not related to any of the other criteria in their study.

In conclusion, observation skills do appear to be related to gunnery performance. However, it has not been established whether or not these skills are trainable.

Adjustment of Fire

Doctrine on the preferred fire adjustment techniques has changed with the advent of the advanced fire control systems in the M60A3 and M1 tanks. Currently, the preferred adjustment technique is the reengagement method. This method requires that, after missing the target, the gunner dump the ballistic solution by releasing his palm switches momentarily and reentering a new solution by relaying the reticle and relasing to the target. Previously, the preferred adjustment technique was the burst-on-target (BOT) method. Simply stated, this adjustment required the trainee to note where the round was sensed on the reticle and to adjust the sights so that point on the reticle was placed on the target's center of mass. The research cited below concerns the latter technique of fire adjustment.

Kress (1981) designed two fire adjustment job samples similar to his sight picture job sample described in the previous section. The first job sample (Apply Sight Reticle for Fire Adjustment) tested gunners' ability to make an appropriate adjustment in response to a subsequent fire command. A line drawing provided a depiction of the target and the aiming point of the first round. In addition, the appropriate fire command elements were printed on the drawing. Gunners demonstrated their knowledge for a particular fire adjustment technique by positioning a reticle drawn on a clear plastic overlay with respect to the target. The second job sample (Determine Fire Adjustment) tested the tank commander's ability to announce the appropriate sensing/observation and to issue an appropriate fire command. The subject was provided with a line drawing of the target and a dot representing the perception of a round. Performance on both job samples was measured as a percent of correct responses. Performance on neither was related to measures derived from Table VIII.

The following research concerns not only the knowledge of fire adjustment techniques but also the ability to use that knowledge to correctly adjust fire on training devices. Eaton (1978) measured the number of hits achieved using BOT method on the Willey device. His results indicated a significant

relationship between BOT accuracy and performance on the battlesight engagements of Table VIII such that the greater number of hits was associated with longer engagements times. This correlation is difficult to interpret. However, time measures on the Willey were correlated with accuracy on Table VIII such that faster BOT times were associated with more accurate Table VIII battlesight engagements. No relationship was detected between the number of BOT hits and the number of successful battlesight engagements for Table VIII.

Eaton et al. (1980) used the FCCS device to test armor trainees' ability to adjust fire after missing an initial round. A constant error was programmed into the FCCS so that the subject would miss with the first round, but could adjust fire using the burst-on-target technique. Job sample performance was scored in terms of the total number of second round hits achieved on the FCCS. Correlational analyses failed to indicate a relationship between performance on the round adjustment job sample and gunnery performance on Table VI.

In summary, these findings failed to indicate a relationship between the skills and knowledges related to adjusting fire and gunnery performance. No research has been performed to determine whether or not these skills/knowledges are trainable.

Knowledge of Armor Procedures

The final category of skills and knowledges is that regarding armor procedures. Procedural knowledges cut across all phases of gunnery and are increasingly important as the fire control system have become automated. A crucial gunnery-related procedure is that required to systems calibrate the main gun. Subject matter experts often claim that the knowledge and skill related to systems calibration account for much of the between-subject differences in gunnery performance. As is true of similar complex procedures, this task should be performed with the aid of a technical manual (TM). Other important gunnery related procedures are those related to operating the ballistic computer. These procedures include the computer self-test, computer data check, and fire control system checks.

Campbell and Black (1982) tested armor trainees on their ability to use the TM for the M1 tank (TM 9-2350-255-10). The 13-item test was divided into three parts: (a) use of the index, (b) reading and comprehending information on specified pages of the TM, and (c) location, reading, and comprehending information within a given section of the TM. The measure of performance for this job sample was the percent of items answered correctly. Performance on the job sample failed to correlate with any of the gunnery and training performance criteria measured in their study.

In contrast to the previous study related to using the TM, there are three different demonstrations that job samples designed to simulate operation of the ballistic computer correlate with some aspects of gunnery proficiency. In the first, Campbell and Black (1982) used a programmable calculator to simulate the functions of the ballistic computer. The soldier's task was to

follow instructions that were prepared in TM format to enter fire control data. Two measures of job sample performance were recorded: the number of steps correctly completed and the total time to complete the task. The accuracy measures did not correlate with any of the job performance criteria measured by Campbell and Black. However, the time to complete the task negatively correlated with Gate scores and instructor rankings for the first company of M1 trainees, i.e., low times were associated with high criteria scores. However, this relationship failed to replicate for the second company of M1 trainees tested in the study.

Biers and Sauer (1982) developed a similar job sample designed to measure performance on entering data and self-testing the ballistic computer; this same computerized job sample was later tested by Black and Mitchell (1986). This job sample was simulated by microcomputer that presented a graphic depiction of a computer control panel. Trainees interacted with the computer by means of a light pen. Speed and accuracy of performance were measured on 10 trials in which the subject was required to enter data and 10 simulated computer self-tests. Biers and Sauers found that the number correct on the job sample was significantly and positively related to the most recent Annual Qualification score as recalled by both TC and gunner, i.e., higher job sample scores are associated with high gunnery qualification scores. In contrast, Black and Mitchell (1986) found no relationship between the computerized job sample and actual Table VIII performance.

Thus the results from relating procedural skills and knowledges related to operation of the ballistic computer to gunnery proficiency are mixed. However, whether or not these performance components are trainable has not been tested.

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APPENDIX D

ANALYSIS OF THE GRAFENWÖHR GUNNERY DATABASE

APPENDIX D ANALYSIS OF THE GRAFENWÖHR GUNNERY DATABASE

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ANALYSIS OF THE GRAFENWÖHR GUNNERY DATABASE

There were potentially a great number of questions that could have been addressed by the Grafenwöhr gunnery database. To focus our efforts, we posed a few a priori questions or issues that we considered to have the greatest relevance to the present project. These questions may be stated as follows:

1. What types of engagements are particularly difficult for tank crews? Anecdotes concerning the difficulty of armor engagements abound, e.g., that moving targets are more difficult than stationary ones, that engaging targets on the offense (i.e., while moving) is more difficult than engaging targets from the defense (i.e., while stationary), and that degraded engagements are more difficult than precision. There are comparisons of engagements within Table VIII that would permit empirical tests of these assertions.

2. What sorts of procedural errors are likely to occur during a gunnery engagement, and what is their effect on gunnery performance? Again, anecdotal suggestions indicate that procedural errors are pervasive problems in tank gunnery. With regard to this issue, Table VIII evaluators score not only the outcome of gunnery performance, but they also score crews on predefined procedural errors as well.

3. What is the effect of experience on gunnery performance? Our research mandate was to identify "persistent" performance problems. Therefore, we were more interested in a performance problems that do not change over time than those that lessen with experience.

4. What are the correlations in performance between tasks in Tables VIII? These correlations would provide an index of the psychological similarity between the engagements. In addition, intertask correlations could to estimate the psychometric reliability of Table VIII as test of performance.

Method

Sample

The sample on which the following analyses were based consisted of all M1 crews except those commanded by officers that attempted gunnery qualifications at Grafenwöhr in the period January-July 1986. Because of missing data problems, the *n*s were not consistent across comparisons; nevertheless, most comparisons are based on 600-800 different crews. The exception to this generalization was Task 5. From the data, it was obvious that, more often than not, Task 5 was presented in place of the alternate task, 5A, in Table VIIIA; whereas Task 5A appeared to be chosen more often over Task 5 in Table VIIIB. Consequently, Task 5A of Table VIIIA and Task 5 of VIIIB are based on much smaller *n*s, i.e., usually less than 20.

The Database

The Grafenwöhr Table VIII data is implemented on an IBM mainframe computer program called the Structured Query Language/Data System (SQL/DS).[1] Although a powerful database management system, SQL/DS provides only a few built-in statistical functions, of which the more useful include (a) count records having stated criteria, (b) identify maximum and minimum values of a variable, and (c) calculate the sum and the average value of a variable. One of the most serious shortcomings of SQL/DS is its lack of a built-in function for calculating the variance or the standard deviation of variables.

Statistical Analyses

To the extent possible, descriptive analyses were performed for all engagements. The exceptions were the machinegun engagements--Task 3 in both Tables VIIIA and VIIIB. The criteria for a first-round hit in a machinegun engagement is different than measurement of a first-round hit with main gun round. Because this measure is incommensurate with accuracy measurement in the rest of the table, the first round hit rates were not reported for this task. In contrast, the opening times for machinegun engagements are analogous to opening times for main gun engagements. Therefore, opening times for machinegun engagements were included. Also, data from engagements are Task 5A of Table VIIIA and Task 5 of VIIIB were included in the descriptive analyses in the interest of completeness, despite the fact that they were based on small sample sizes. As a result, however, the sampling error associated with these statistics is unacceptably large due to small sample sizes. Therefore, the results from these engagements are excluded from the inferential tests of significance.

The differences between hit rates were evaluated with the Chi-square test of independence. The appropriate test for the opening times was the One-Way Analysis of Variance (ANOVA). ANOVA computations were complicated by the fact that SQL/DS software did not calculate an estimate of the population variance. However, information from the US Army Armor and Engineer Board provided a technique for estimating the significance of the latter differences.[2] The Armor Board obtained the Grafenwöhr data from OCOA, had it transferred to diskette by DOIM, and analyzed it with the PC version of SPSS. We obtained their SPSS output, which provided standard deviations of opening times for each individual engagement at Grafenwöhr. There were some subtle differences between the database we obtained from OCOA and that analyzed by the Armor Board, however. For one, our database covered crews who underwent qualification from January to July of 1986, whereas the Armor Board's database covers two fewer months (February to June 1986). Second, their data included all crews, whereas ours excluded crews commanded by officers. We speculate that the additional officer data probably increased rather than decreased

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[1]We thank Mr. Robert Cisco of OCOA for providing access to the system and in helping to interpret the results.

[2]We thank Mr. Albert Pomey of the Armor Board for providing these data.

variability. As a result, use of the Armor Board's variability estimates probably resulted in a conservative test of significance. Therefore, the ANOVAs of opening time data should be regarded as only approximate tests of significance.

Results and Discussion

Differences Between Types of Engagements

Tables D-1 and D-2 provide a breakdown of performance on Tables VIIIA and VIIIB respectively by individual engagements (tasks). In addition to hit probabilities and opening times, the table also includes sample sizes (in parentheses) on which the statistics were based. The results are interesting in that they do not confirm conventional wisdom concerning "difficult" engagements. Consistent low hit rates or high opening times were not associated with either moving (offensive) engagements, moving targets, or degraded mode (battlesight) engagements. Despite the failure to find these expected differences, there were some unexpected differences between engagements that were explainable, at least after the fact. These are discussed below.

The most obvious trend from the data was that higher first-round hit rates and faster opening times were associated with shorter target ranges. There was also a similar relationship between gunnery performance and the size of the target, e.g., large tanks were hit more often than smaller armored personnel carriers. These relationships were perfectly reasonable assuming that distant and/or small targets are difficult to acquire and engage. However, it is also reasonable that the M1 fire control system is less accurate for distant and/or smaller targets. Thus the effect of target range and size may not be exclusively due to human performance deficiencies.

Task 4 in Table VIIIA is associated with especially poor performance that cannot be attributed to target range or size. This assertion is supported by a comparison of Tasks 4 and 5 of Table VIIIA. Performance on Task 4 is markedly poorer than performance on Task 5 despite the fact that both are moving engagements using precision techniques and that targets for both tasks are two T72 tanks at 1400-1600 meters. One difference between the two engagements is that the two target tanks are stationary in Task 4 whereas they are moving in Task 5. However, this stationary/moving difference does not explain the difference in performance between the two tasks, because one would expect poorer performance on Task 5 than on Task 4--a difference that is counter to findings.

We speculate that the key difference between Task 4 and 5 is that 4 is performed in an NBC environment whereas Task 5 is not. By NBC environment is meant that the crew is "buttoned up" in the tank (i.e., hatches are closed) and is wearing mission-oriented protective posture (MOPP) gear, which may include (depending on MOPP level) an overgarment, overboots, mask/hood, and gloves. A subject matter expert from OCOA confirmed that the MOPP gear would indeed degrade performance to the extent observed between Task 4 and Task 5

Table D-1

Gunnery Performance on Table VIIIA

Task	Target: First prob. (1st rnd hit)	Target: First opening time	Target: Second prob. (2nd round hit)[a]	Target: Second opening time
1. Engage multiple targets (defense) using GAS/battlesight techniques.	.900 (705)	3.42 (726)	.836 (627)	12.03 (635)
Targets: 1 stationary T72 at 900-1300m 1 moving T72 at 900-1300m				
2. Engage simultaneous targets (defense) using GPS/precision techniques.	.851 (549)	2.57 (723)	---	9.31 (467)
Targets: 1 stationary BMP at 900-1300m 1 RPG team at 400-1100m				
3. Engage multiple targets (offense) using GPS/precision techniques.	---	5.36 (727)	---	---
Targets: 1 set of troops at 400-600m 1 set of troops at 700-900m				
4. Engage multiple targets (offense) using GPS/precision techniques in an NBC environment.	.660 (723)	7.59 (732)	.674 (472)	16.38 (477)
Targets: 2 stationary T72s at 1400-1600m				
5. Engage multiple targets (offense) using GPS/precision techniques.	.841 (694)	6.55 (703)	.854 (584)	14.52 (584)
Targets: 2 moving T72s at 1400-1600m				
5A. Engage multiple targets (offense) using GPS/precision techniques.	.737 (19)	7.48 (23)	.786 (14)	18.86 (14)
Targets: 1 stationary T72 and 1 moving T72 at 1400-1600m				

[a]Conditional upon obtaining first round hit on first target

Table D-2

Gunnery Performance on Table VIIIB

Task	Target: First prob. (1st rnd hit)	Target: First opening time	Target: Second prob. (2nd round hit)[a]	Target: Second opening time
1. Engage a target (defense) using GPSE/precision techniques and a three-man configuration. Target: 1 stationary T72 at 1400-1600m	.808 (719)	4.54 (729)	---	---
2. Engage multiple targets (defense) using GPS/precision techniques. Target: 2 stationary BMPs at 1200-1400m	.789 (697)	3.61 (711)	.821 (541)	11.55 (550)
3. Engage multiple targets (offense) using GPS/precision techniques in an NBC environment. Targets: 1 stationary BMP and 1 RPG team at 400-600m	.918 (692)	6.49 (706)	---	14.14 (635)
4. Engage multiple targets (offense) using GPS/precision techniques. Targets: 1 stationary T72 and 1 moving T72 at 1300-1500m	.762 (686)	7.06 (708)	.814 (522)	15.74 (523)
5. Engage a target (defense) using GAS with illumination from a stationary tank. Target: 1 stationary T72 at 1200-1400m	.684 (19)	8.20 (20)	---	---
5A. Engage a moving target (defense) using GPS/precision techniques. Target: 1 moving T72 at 1700-1900m	.782 (684)	4.17 (688)	---	---

[a]Conditional upon obtaining first round hit on first target

performances. The results of Task 3, Table VIIIB apparently contradict the previous interpretation. Despite the fact that this task also requires MOPP gear, performance is relatively good. In fact, performance is better on this task than any other engagements in Tables VIIIA and VIIIB. When asked to reconcile this apparent contradiction, the subject matter expert pointed out that the 400-600 meter target range for that task is the shortest range on both tables. He further stated that any target in the 500 meter range is generally regarded as a "gimme" in that it does not require a precise target lay. In other words, he thought that the engagement was so easy that MOPP gear was not a factor.

Effects of Time in Position

Tables D-3 and D-4 compare performance of crews differing in time in position for the tank commander and for the gunner, respectively. For the accuracy measure (first-round hits), the data failed to indicate increased performance as a function of time in position for either the tank commander or the gunner. In fact, there is a slight but nonsignificant trend in the opposite direction.

The relationship between time in position and opening time is more complex. One would expect that longer time in position to be associated with shorter opening times. There was a slight trend in that direction over all the tasks, but only two tasks show a significant trend in the expected direction: Task 2, Table VIIIA and Task 1, Table VIIIB--both effects of tank commander experience. Curiously, both of these tasks are stationary/stationary engagements, purportedly the easiest types of engagements. One would have expected tank commander experience to have had its greatest effect on the more difficult tasks. The only significant trend as a function of gunner as well as tank commander experience was the machinegun engagement: Table VIIIA, Task 3. However, the relationship was nonmonotonic in both cases: Crews in the middle category of experience were the slowest, followed by the least experienced crews, and finally the most experienced. In summary, the effects of time in position on gunnery performance are complex and not clear from the present data.

Procedural Errors

Crew cuts are procedural errors that result in points being deducted from a crew's Table VIII qualification score. Evaluators score crews on 22 different errors, 18 of which are applicable to the M1. Table 5 presents the percentage of engagements in which crew cuts were observed. Note that only 10 of the total 18 possible M1 crew cuts were actually observed in the FY 86 data base. The most likely of these infrequent errors were the two crew cuts related to fire commands: (a) incorrect initial or subsequent fire command, and (b) incorrect response to initial or subsequent fire commands. Nevertheless, the most striking result from these data is the relative infrequency of procedural errors. One may reach two possible conclusions: (a) that the procedural errors in fact infrequently occur, or (b) that Table VIII evaluators do not detect the errors as often as they occur. The latter

Table D-3

Performance on First Target for Crews Differing in Tank Commander Time in Position

Table Task	Tank Commander Time in Position 0-5 Months	 6-11 Months	 12 or more Months	Test Statistic[a]
VIIIA				
1. Engage multiple targets (defense).				
p(hit)	.916	.897	.888	1.13
opening time	3.60	3.35	3.28	1.17
2. Engage simultaneous targets (defense).				
p(hit)	.833	.845	.815	3.75
opening time	2.94	2.55	2.18	5.96**
3. Engage multiple targets (offense).				
p(hit)	---	---	---	---
opening time	5.58	5.85	4.71	7.79**
4. Engage multiple targets (offense).				
p(hit)	.654	.676	.652	0.36
opening time	7.96	7.44	7.32	0.75
5. Engage multiple targets (offense).				
p(hit)	.869	.853	.802	4.50
opening time	6.70	6.85	6.13	1.98
VIIIB				
1. Engage a target (defense).				
p(hit)	.828	.806	.788	1.37
opening time	5.45	3.90	4.06	9.42**
2. Engage multiple targets (defense).				
p(hit)	.795	.795	.777	0.30
opening time	3.71	3.24	3.82	1.92
3. Engage multiple targets (offense).				
p(hit)	.912	.948	.899	3.61
opening time	6.31	6.29	6.85	1.81
4. Engage multiple targets (offense).				
p(hit)	.773	.782	.734	1.62
opening time	6.99	7.00	7.19	0.19
5A. Engage a moving target (defense).				
p(hit)	.789	.778	.778	0.11
opening time	4.42	4.04	4.00	0.43

[a]Chi-square for differences between hit rates and F for differences between opening times.

*p <.05; **p <.001

Table D-4

Performance on First Target for Crews Differing in Gunner Time in Position

Table Task		Gunner Time in Position 0-5 Months	 6-11 Months	 12 or more Months	Test Statistic[a]
VIIIA					
1. Engage multiple targets (defense).					
	p(hit)	.889	.916	.908	1.13
	opening time	3.60	3.36	3.06	1.80
2. Engage simultaneous targets (defense).					
	p(hit)	.862	.842	.833	0.60
	opening time	2.65	2.49	2.50	0.17
3. Engage multiple targets (offense).					
	p(hit)	---	---	---	---
	opening time	5.37	5.67	4.80	3.71*
4. Engage multiple targets (offense).					
	p(hit)	.666	.650	.662	0.16
	opening time	7.59	7.92	6.99	1.25
5. Engage multiple targets (offense).					
	p(hit)	.840	.846	.837	0.07
	opening time	6.82	6.28	6.32	1.08
VIIIB					
1. Engage a target (defense).					
	p(hit)	.810	.793	.832	0.87
	opening time	4.80	4.25	4.38	0.93
2. Engage multiple targets (defense).					
	p(hit)	.798	.789	.766	0.59
	opening time	3.66	3.79	3.17	1.88
3. Engage multiple targets (offense).					
	p(hit)	.931	.913	.892	1.88
	opening time	6.65	6.50	6.08	1.36
4. Engage multiple targets (offense).					
	p(hit)	.765	.792	.703	3.62
	opening time	7.24	6.90	6.89	0.53
5A. Engage a moving target (defense).					
	p(hit)	.799	.767	.767	1.02
	opening time	4.47	4.04	3.63	1.51

[a]Chi-square for differences between hit rates and F for differences between opening times.

*p <.05; **p <.01

Table D-5

Percent of Engagements in Which Crew Cuts Were Observed

Crew Cut	Percent Engagements
Failure to adhere to conditions.	0.93
Incorrect engagement techniques.	0.40
Using incorrect weapon or ammunition.	0.21
Firing before reciving FIRE, UP, or announcing ON THE WAY.	0.02
Main gun not in safe position when loading.	0.01
Loader fails to close ammunition door during an engagement.	1.49
Incorrect initial or subsequent fire command.	4.14
Incorrect response to initial or subsequent fire commands.	4.80
Incorrect driving techniques	0.12
Loader not securing spent casings.	0.05

argument is plausible given the fact that evaluators are seated on the top of the tank and score behavior through the TC's hatch.

As previously stated, procedural errors associated with the fire command were, by far, the most frequent observed of all crew cuts. Tables D-6 and D-7 summarize the relationship between fire command procedural errors and performance on each engagement. As expected, correct fire commands are associated with higher hit rates. However, the associations are significant on only 4 of the 20 comparisons. As might be expected, three of the four significant relationships involve "difficult" engagements: Task 4, Table VIIIA (the NBC engagement) and Task 5A, Table VIIIB (target at maximum range) for errors in both issuing and responding to fire commands. In contrast, ther remaining significant relationship between errors in response to the fire command and hit rate is Task 1, Table VIIIB--an "easy" stationary/stationary engagement, but requiring the crew to fire the tank in a three-man

Table D-6

First-Round Performance of Tank Commanders Issuing Either Correct or Incorrect Fire Commands

Table Task	Fire Command		Test Statistic[a]
	Incorrect	Correct	
VIIIA.			
1. Engage multiple targets (defense).			
p(hit)	.833	.906	2.61
opening time	2.96	3.46	-1.45
2. Engage simultaneous targets (defense).			
p(hit)	.875	.850	0.12
opening time	2.25	2.59	-0.80
3. Engage multiple targets (offense).			
p(hit)	---	---	---
opening time	6.12	5.35	0.92
4. Engage multiple targets (offense).			
p(hit)	.400	.673	11.06**
opening time	9.42	7.50	1.84
5. Engage multiple targets (offense).			
p(hit)	.741	.846	2.14
opening time	7.07	7.53	0.68
VIIIB.			
1. Engage a target (defense).			
p(hit)	.818	.808	0.02
opening time	3.98	4.56	-0.78
2. Engage multiple targets (defense).			
p(hit)	.775	.790	0.05
opening time	3.18	3.64	-0.83
3. Engage multiple targets (offense).			
p(hit)	.868	.920	1.29
opening time	5.58	6.55	-1.66
4. Engage multiple targets (offense).			
p(hit)	.750	.763	0.02
opening time	6.90	7.07	-0.24
5A. Engage a moving target (defense).			
p(hit)	.565	.790	6.57**
opening time	5.75	4.11	1.64

[a]Chi-square for difference between hit rates and t for differences between opening times.
*$p < .05$; **$p < .01$

Table D-7

First-Round Performance of Crews Responding Either Correctly or Incorrectly to Fire Commands

Table Task	Fire Command Incorrect	 Correct	Test Statistic[a]
VIIIA.			
1. Engage multiple targets (defense).			
p(hit)	.794	.906	4.54*
opening time	3.38	3.42	-0.10
2. Engage simultaneous targets (defense).			
p(hit)	.879	.849	0.22
opening time	2.33	2.58	-0.66
3. Engage multiple targets (offense).			
p(hit)	---	---	---
opening time	5.05	5.37	-0.44
4. Engage multiple targets (offense).			
p(hit)	.562	.669	2.96
opening time	8.91	7.47	1.80
5. Engage multiple targets (offense).			
p(hit)	.821	.843	0.14
opening time	6.78	6.54	0.36
VIIIB.			
1. Engage a target (defense).			
p(hit)	.750	.810	0.54
opening time	6.50	4.47	2.27*
2. Engage multiple targets (defense).			
p(hit)	.667	.798	3.42
opening time	2.43	3.68	-2.18*
3. Engage multiple targets (offense).			
p(hit)	.908	.919	0.09
opening time	6.75	6.47	0.60
4. Engage multiple targets (offense).			
p(hit)	.732	.764	0.23
opening time	7.39	7.04	0.58
5A. Engage a moving target (defense).			
p(hit)	.500	.789	7.66**
opening time	5.94	4.13	1.49

[a]Chi-square for difference between hit rates and t for differences between opening times.
*p <.05; **p <.01

configuration. Finally, the relationship between procedural errors and opening times is even more puzzling. Of the two significant findings, Task 1, Table VIIIB indicates faster opening times associated with correct responses to fire commands; whereas Task 2, Table VIIIB indicated the reverse.

Intertask Correlations

We had intended to examine the intercorrelations between performance on the engagements in Table VIII. This was not possible due to manner in which the database is organized. Database records correspond to individual engagements rather than to crew performance over all engagements. As a result, the SQL/DS system could not crosstabulate hits and misses on one engagement with hits and misses on another, nor could it calculate the crossproducts of the opening times. Without drastically reorganizing the database, we were not able to extract the information required to calculate intertask correlations.

Generalizability of Grafenwöhr Data

The data previously discussed was collected on a single range at Grafenwöhr. The advantage to having data from only one range is that test site conditions are relatively standard across crews. On the negative side, one could ask whether the results discussed here are limited to peculiar conditions at Grafenwöhr. Some data serendipitously obtained from the US Army Armor and Engineer Board[3] addressed these issues. In addition to Grafenwöhr, the Armor Board maintains data on performance at other Table VIII sites in USAREUR and at Ft. Hood. In theory, Table VIII should be administered in standardized fashion according to the Tank Gunnery Tables (FM 17-12-1). To examine their agreement among Table VIII sites, we rank ordered engagements according to hit probability and opening times. In general, the same relationships discussed in the previous memo were evident at other sites as well, e.g., better performance on large/close targets as well as poor performance on Task 4, Table VIIIA (NBC engagement). To measure the agreement between Table VIII sites, we calculated Kendall's Coefficient of Concordance on the rank orders of the individual engagements. The results of this analysis indicated good agreement on the rank ordering of engagements for both hit probability (W = .71) and opening time (W = .78). Both coefficients are significant (p < .001) suggesting that the differences between Table VIII engagements described in the previous memo are not specific to the one range at Grafenwöhr.

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[3]We again thank Mr. Albert Pomey of the Armor Board for these additional data.

APPENDIX E

HIERARCHICAL SKILLS ANALYSES OF GUNNERY DOMAIN

APPENDIX E HIERARCHICAL SKILLS ANALYSES OF GUNNERY DOMAIN

CONTENTS

CONTENTS (continued)

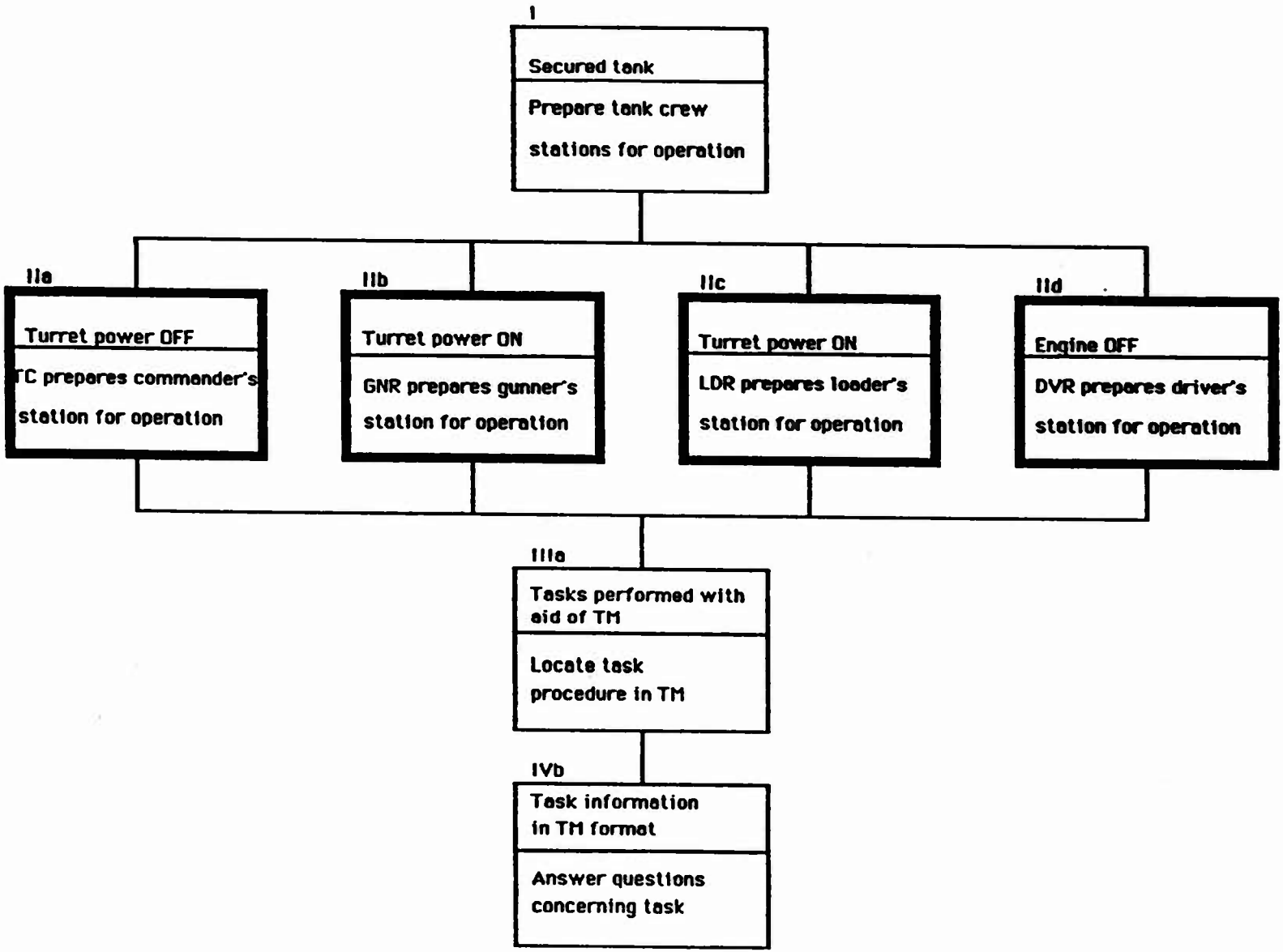

Figure E-1. Hierarchical skills analysis of Activity1: Prepare Stations for Operation (PREOPS).

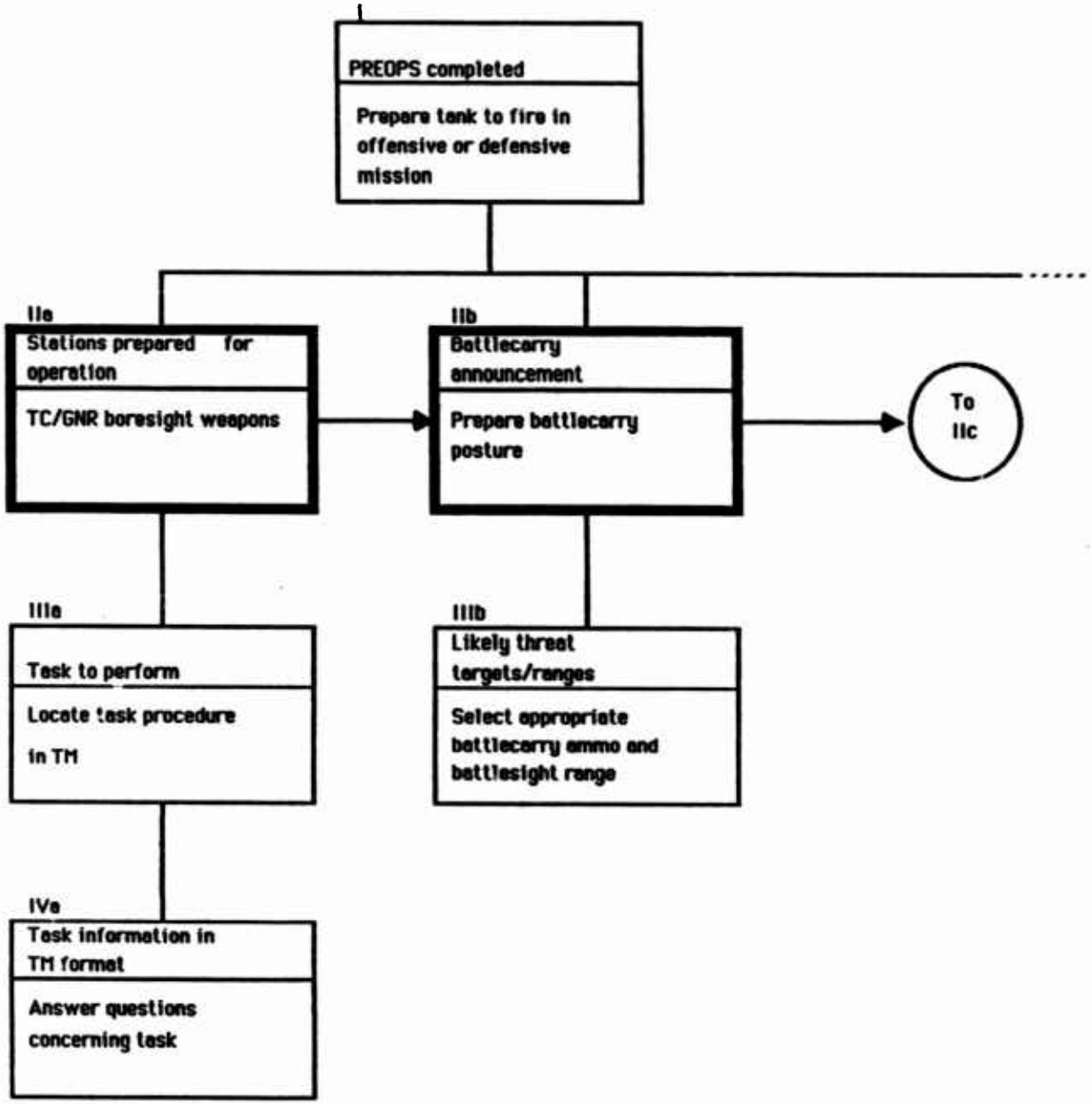

Figure E-2. Hierarchical skills analysis of Activity 2: Prepare Tank to Fire (PREFIRE).

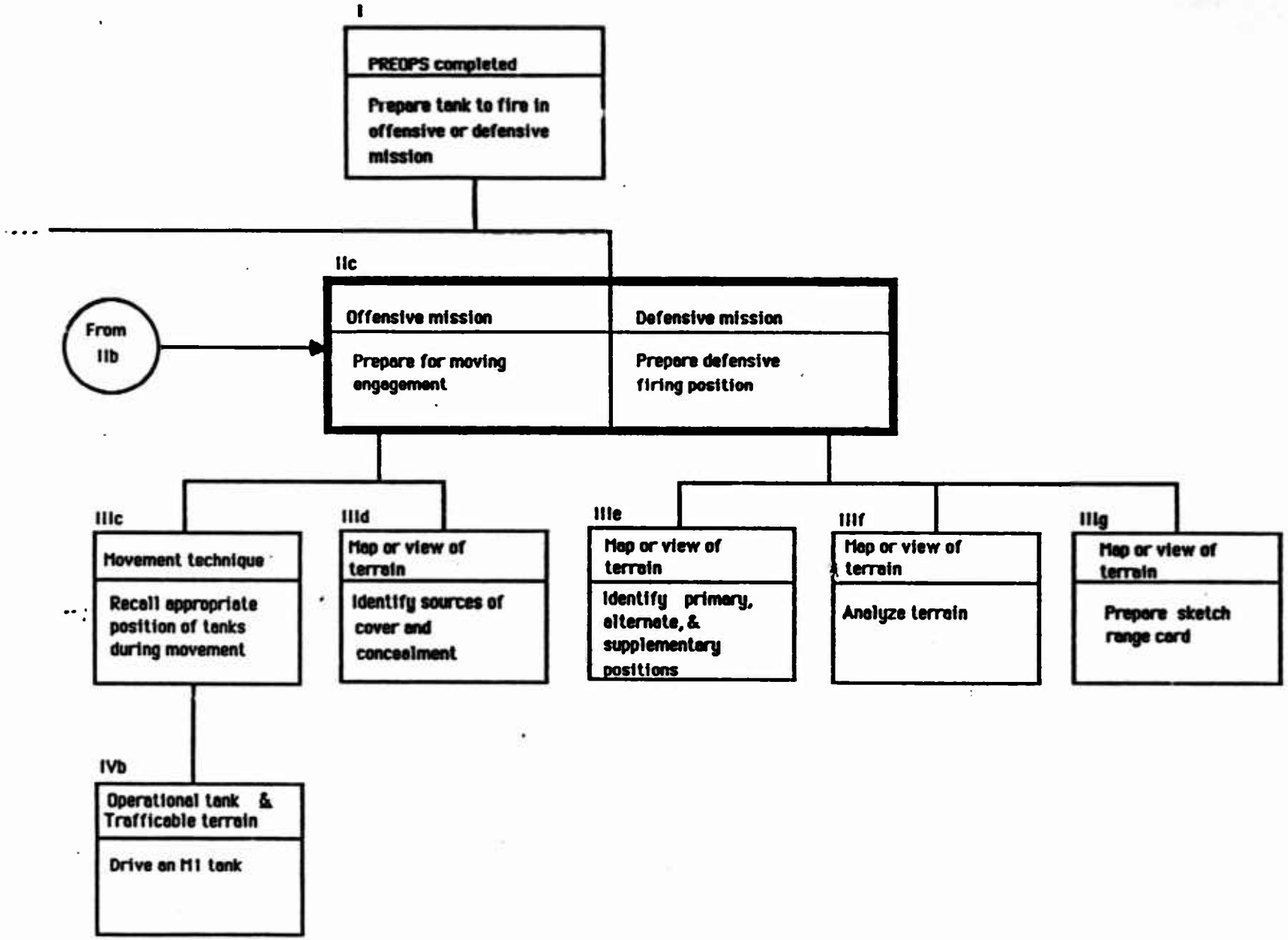

Figure E-2. Hierarchical skills analysis of Activity 2: Prepare Tank to Fire (PREFIRE) (cont'd).

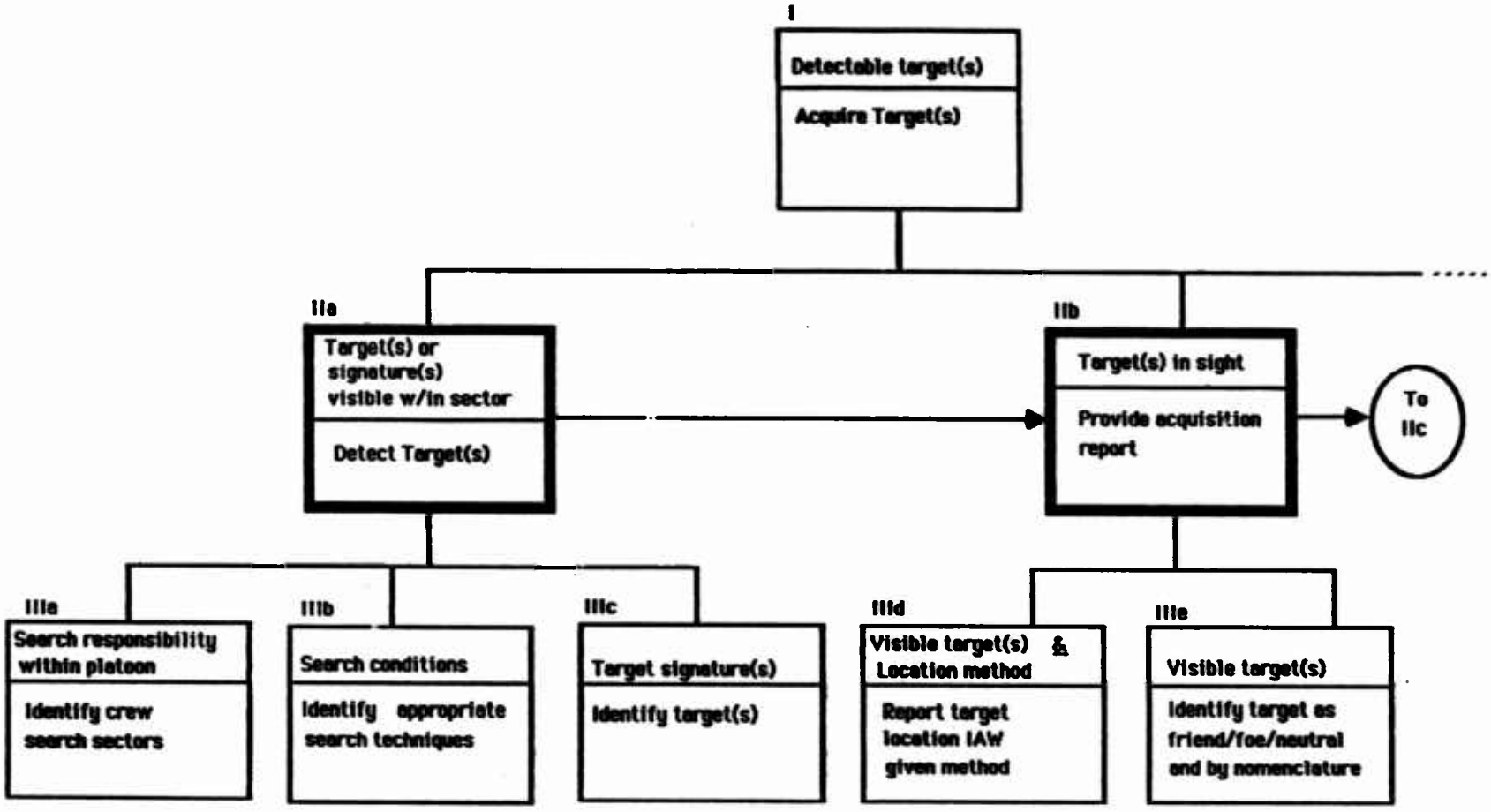

Figure E-3. Hierarchical skills analysis of Activity 3: Acquire Target(s).

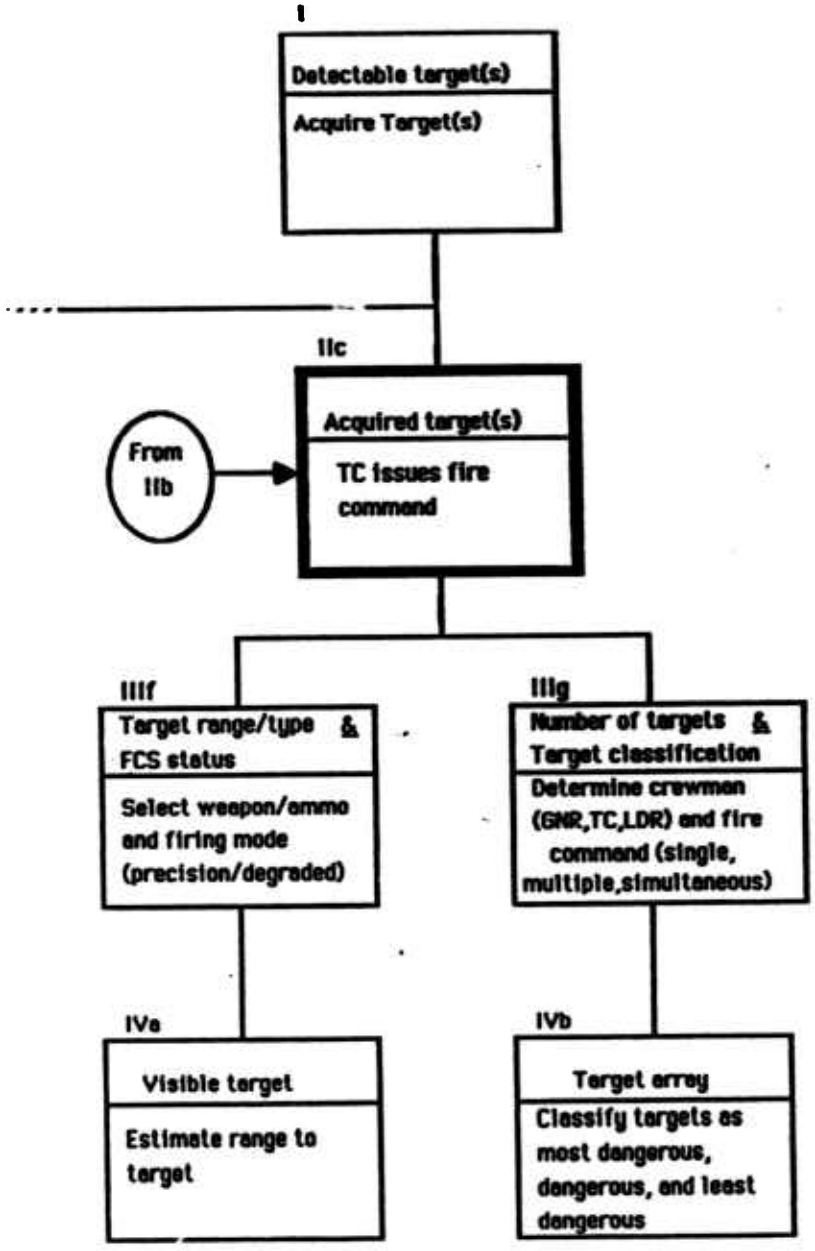

Figure E-3. Hierarchical skills analysis of Activity 3: Acquire Target(s) (cont'd).

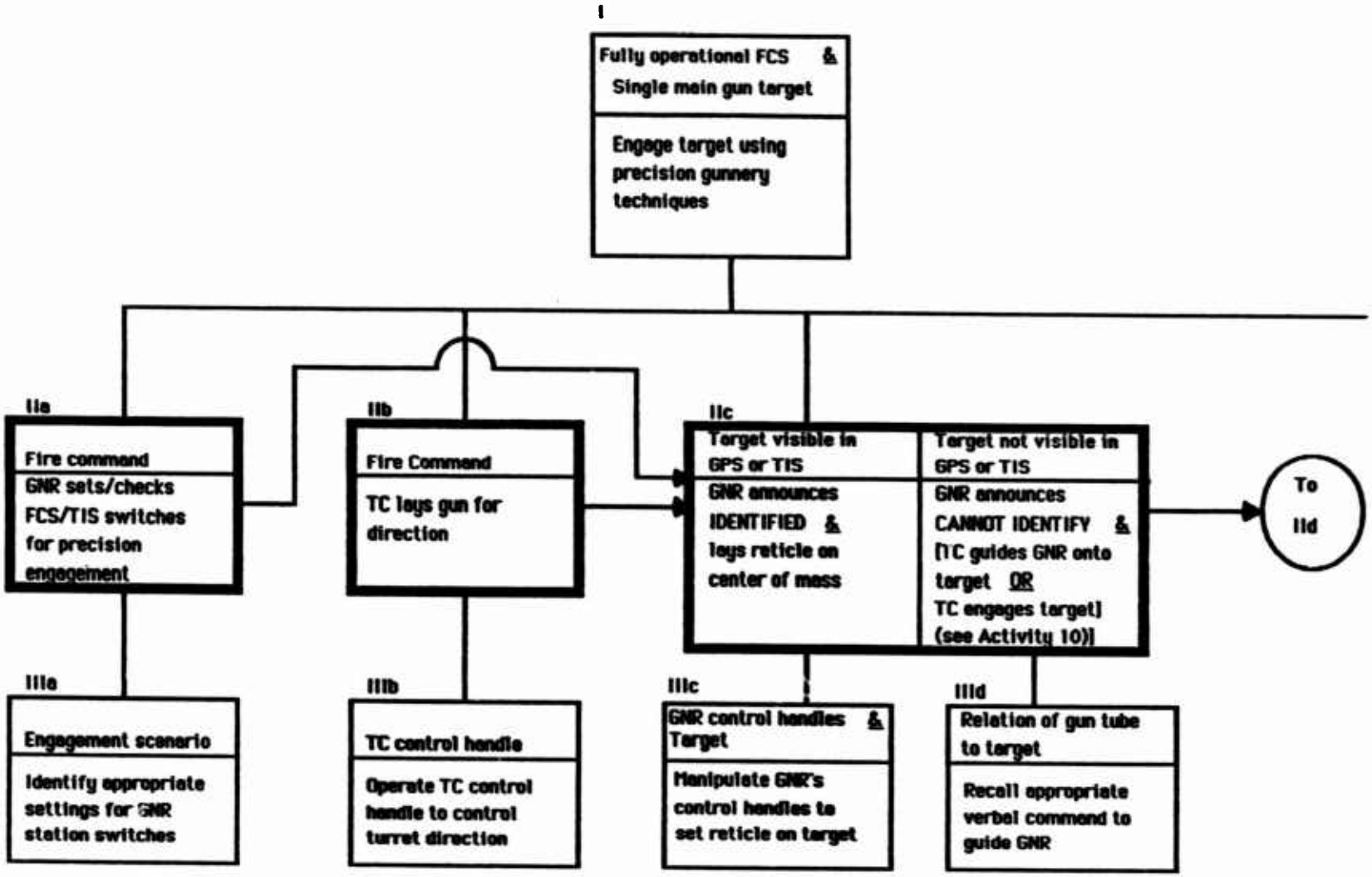

Figure E-4. Hierarchical skills analysis of Activity 4: Engage Single Target Using Precision Gunnery.

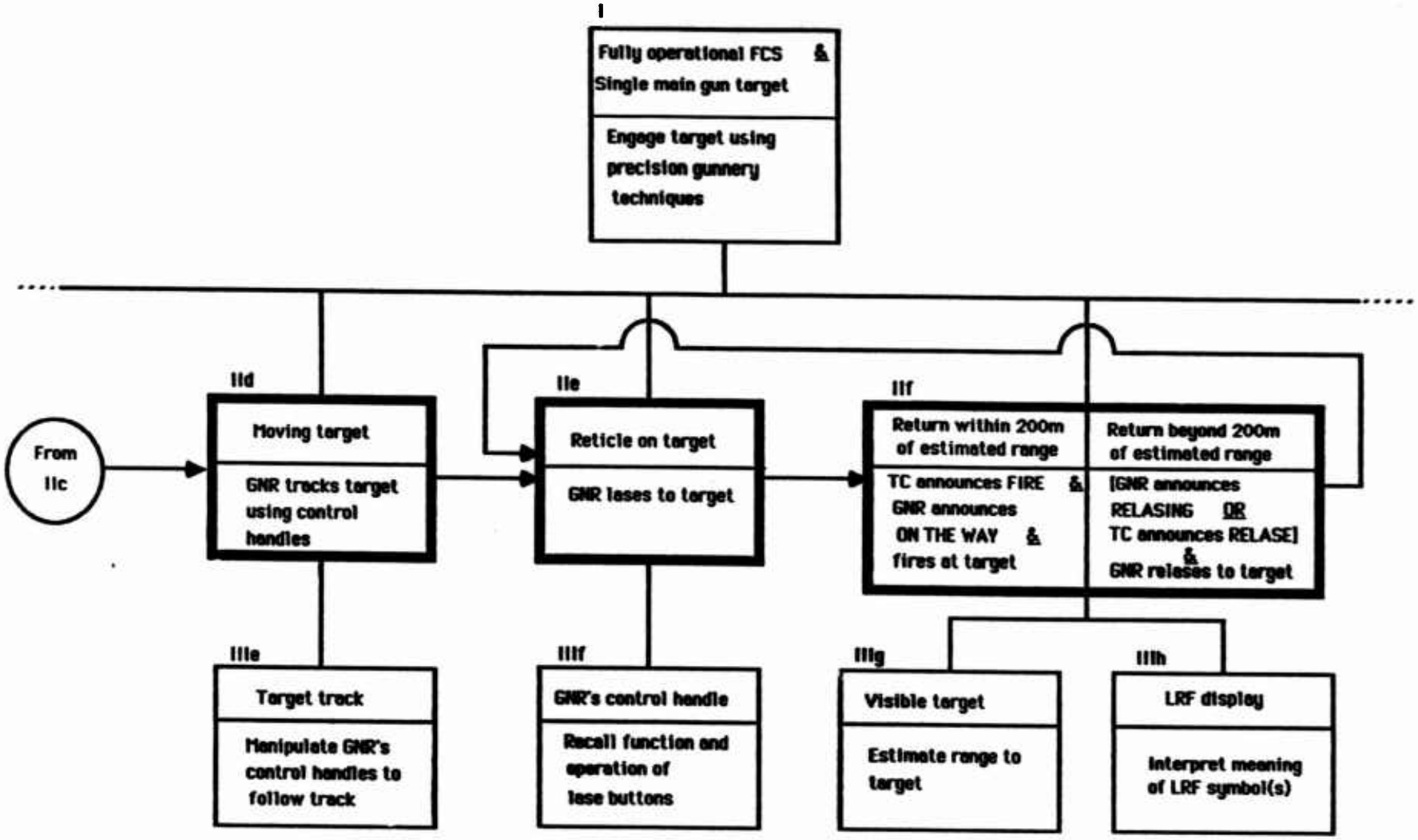

Figure E-4. Hierarchical skills analysis of Activity 4: Engage Single Target Using Precision Gunnery (cont'd).

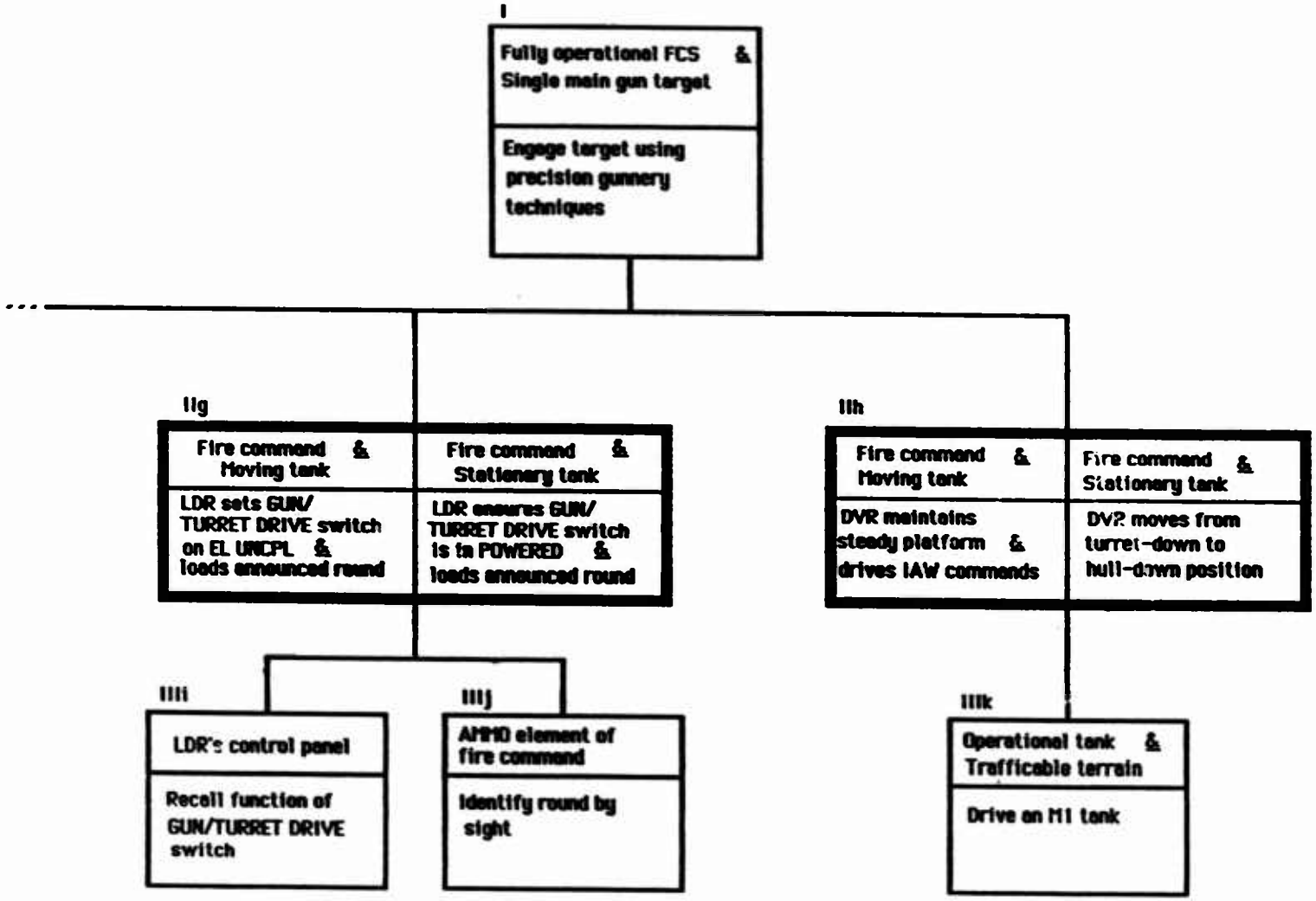

Figure E-4. Hierarchical skills analysis of Activity 4: Engage Single Target Using Precision Gunnery (cont'd).

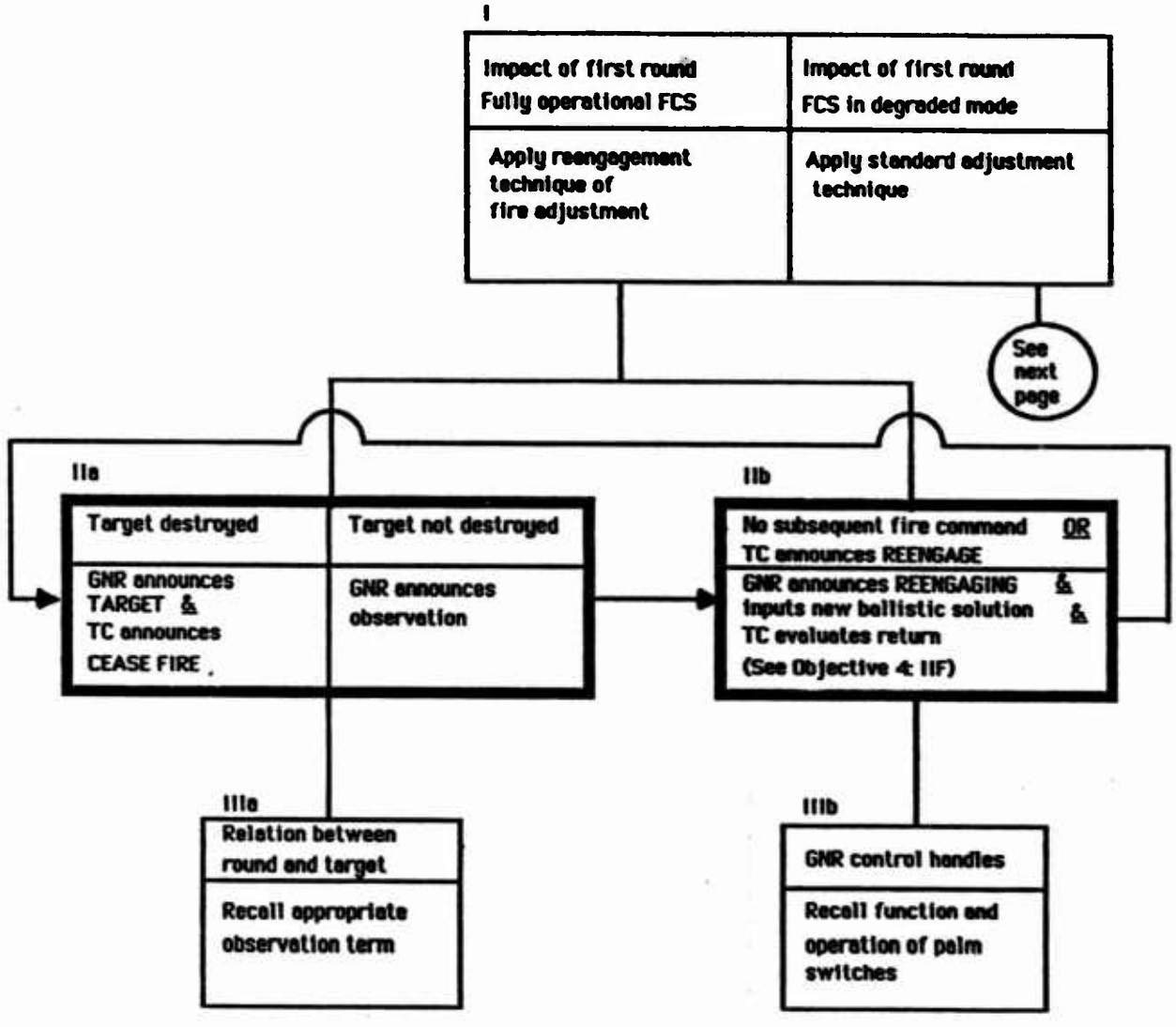

Figure E-5. Hierarchical skills analysis of Activity 5: Adjust Fire.

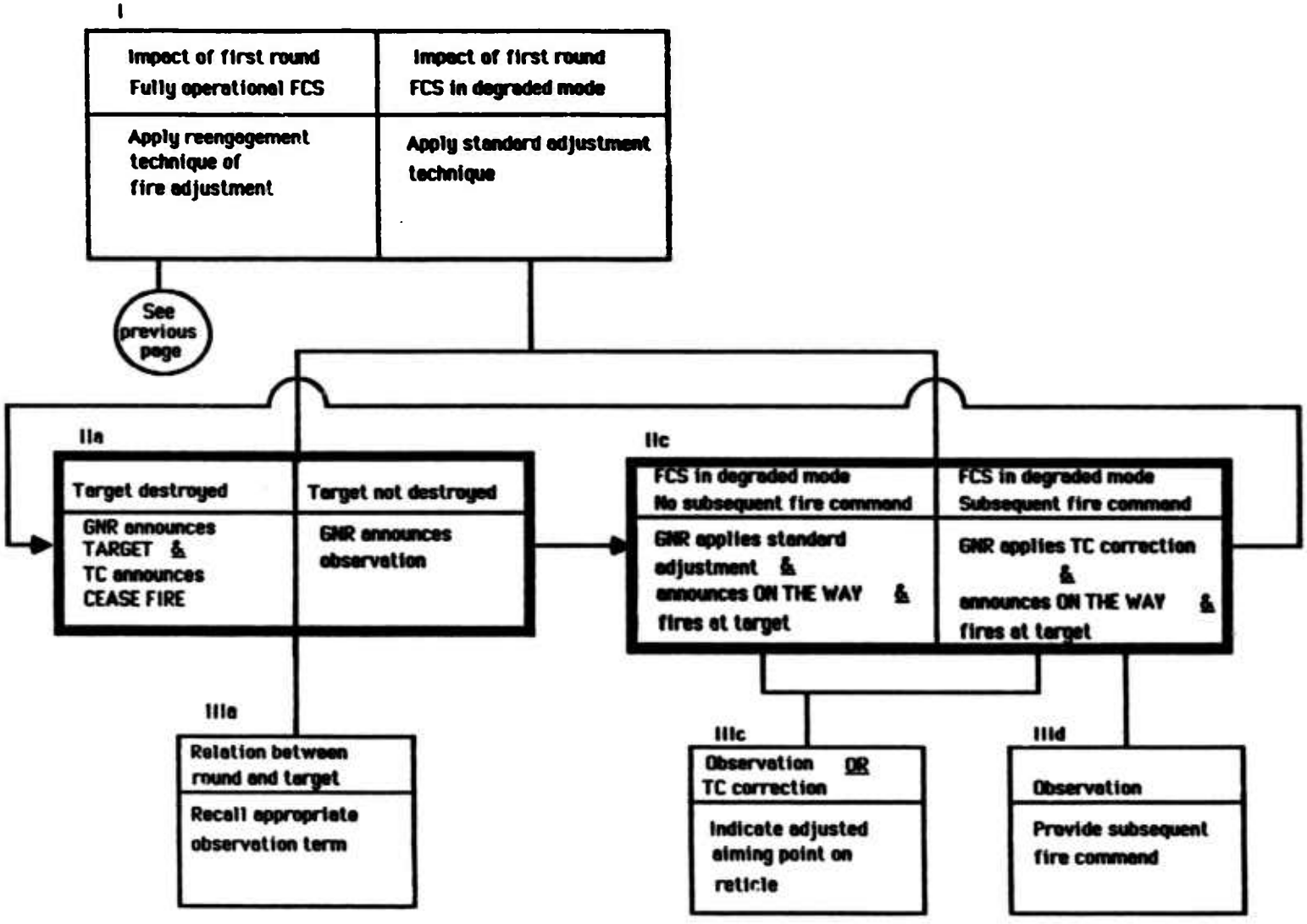

Figure E-5. Hierarchical skills analysis of Activity 5: Adjust Fire (cont'd).

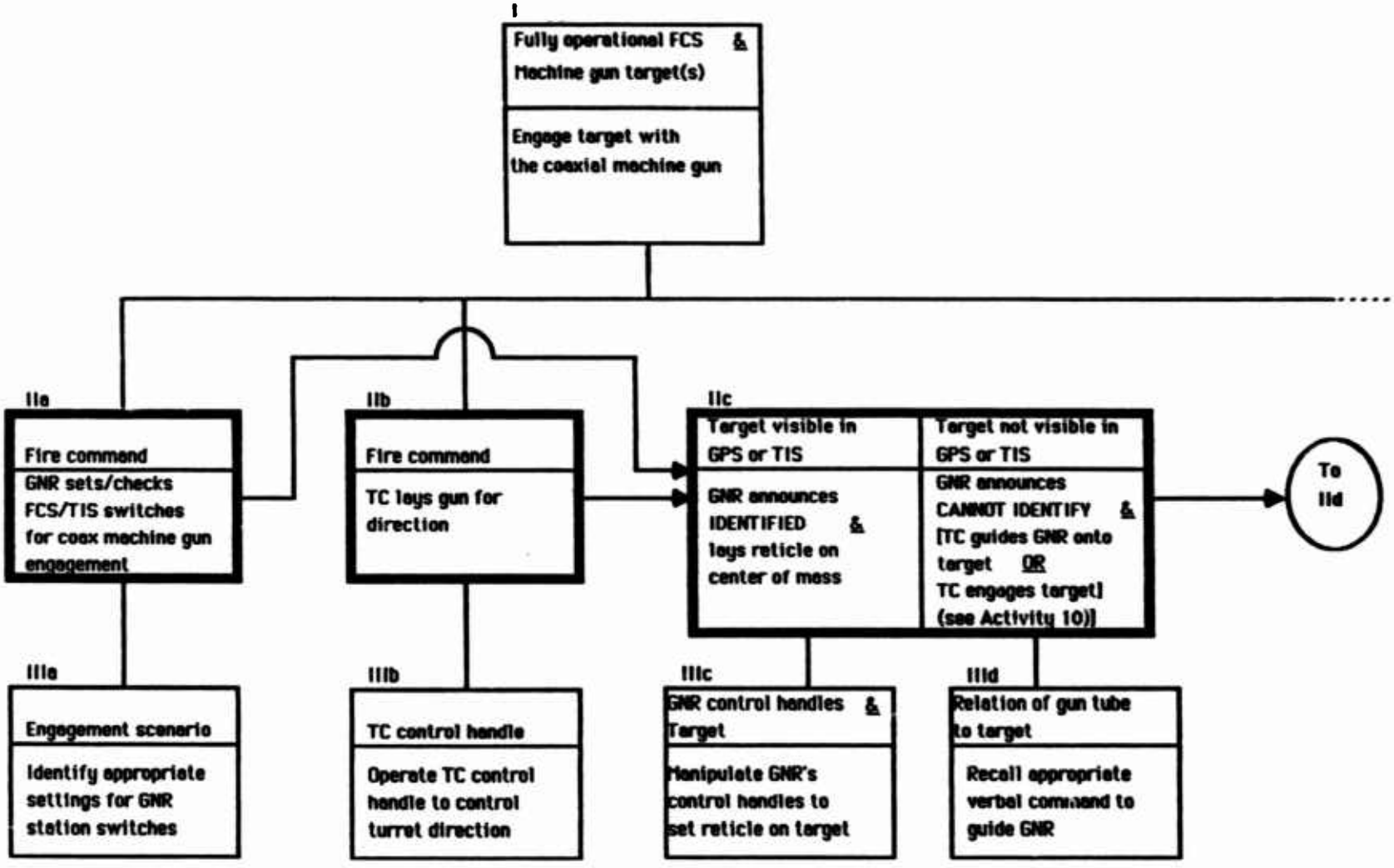

Figure E-6. Hierarchical skills analysis for Activity 6: Engage Target(s) With the Coax.

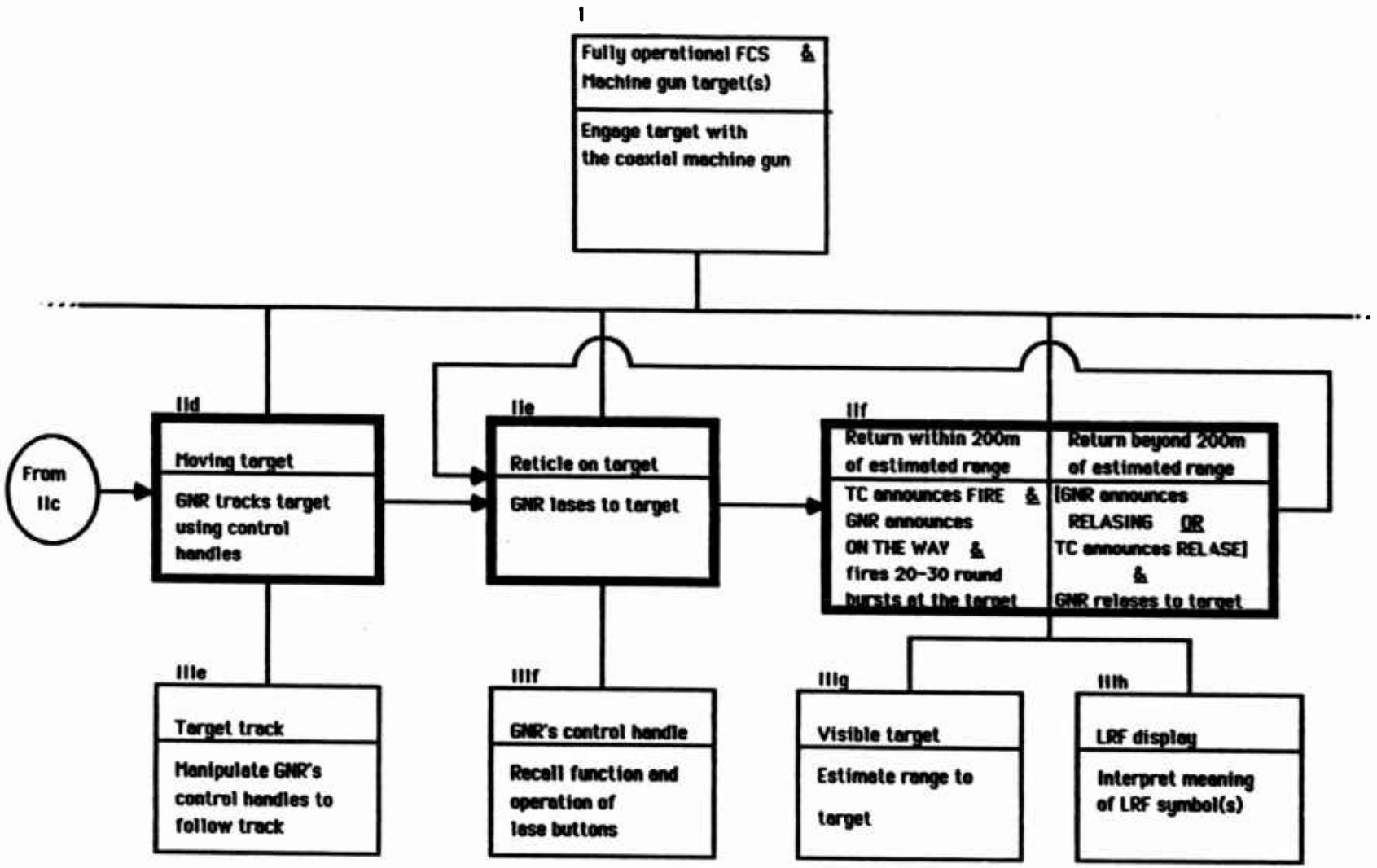

Figure E-6. Hierarchical skills analysis for Activity 6: Engage Target(s) With the Coax (cont'd).

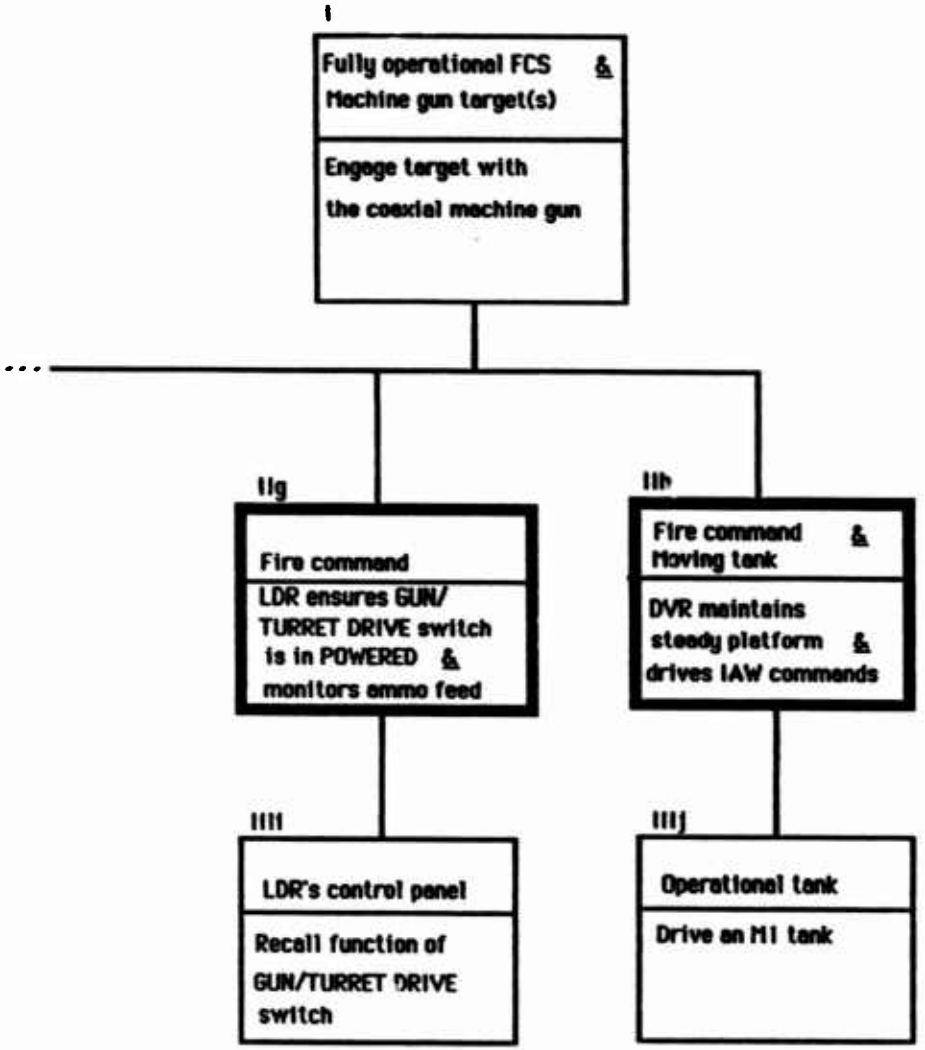

Figure E-6. Hierarchical skills analysis for Activity 6: Engage Target(s) With the Coax (cont'd).

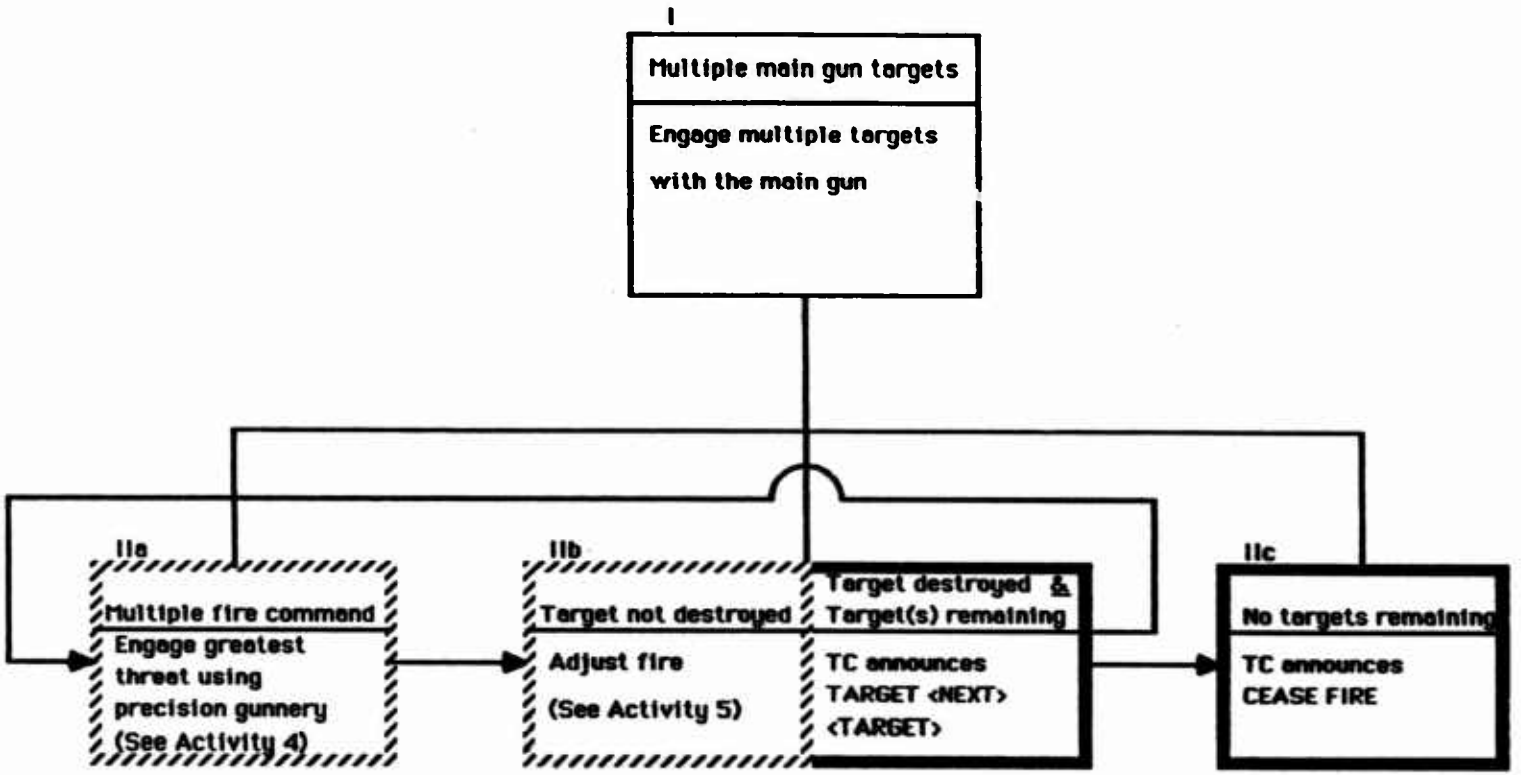

Figure E-7. Hierarchical skills analysis of Activity 7: Engage Multiple Targets.

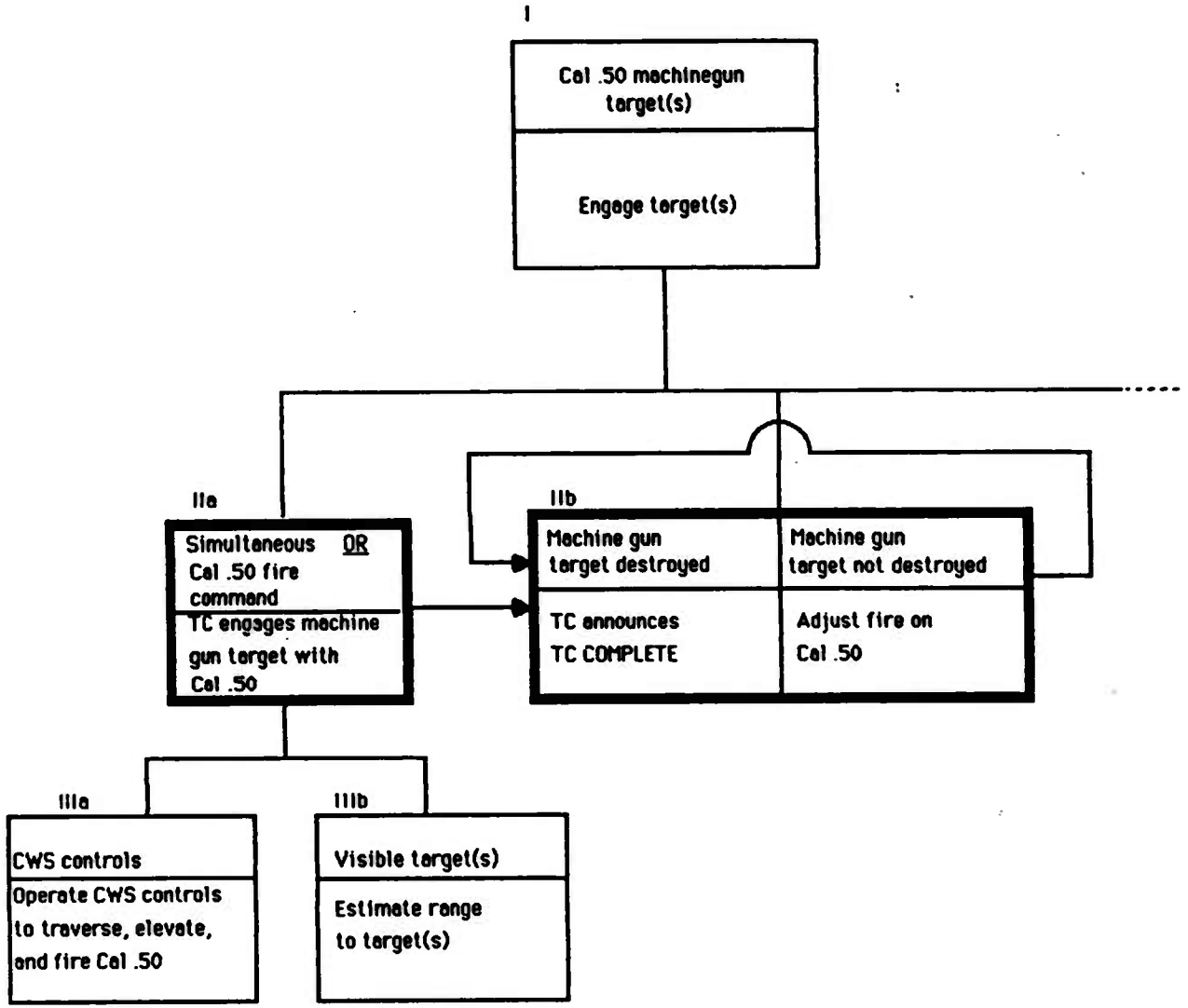

Figure E-8. Hierarchical skills analysis of Activity 8: Engage Cal .50 Targets.

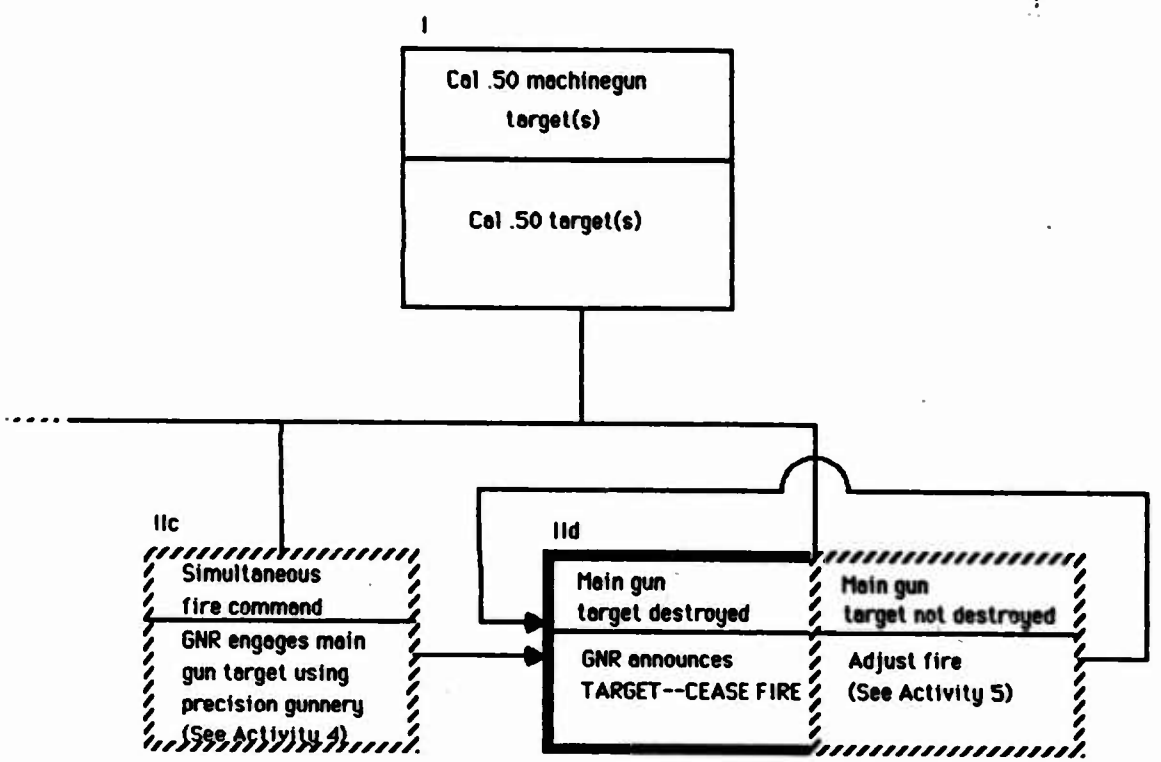

Figure E-8. Hierarchical skills analysis of Activity 8: Engage Cal .50 Targets (cont'd).

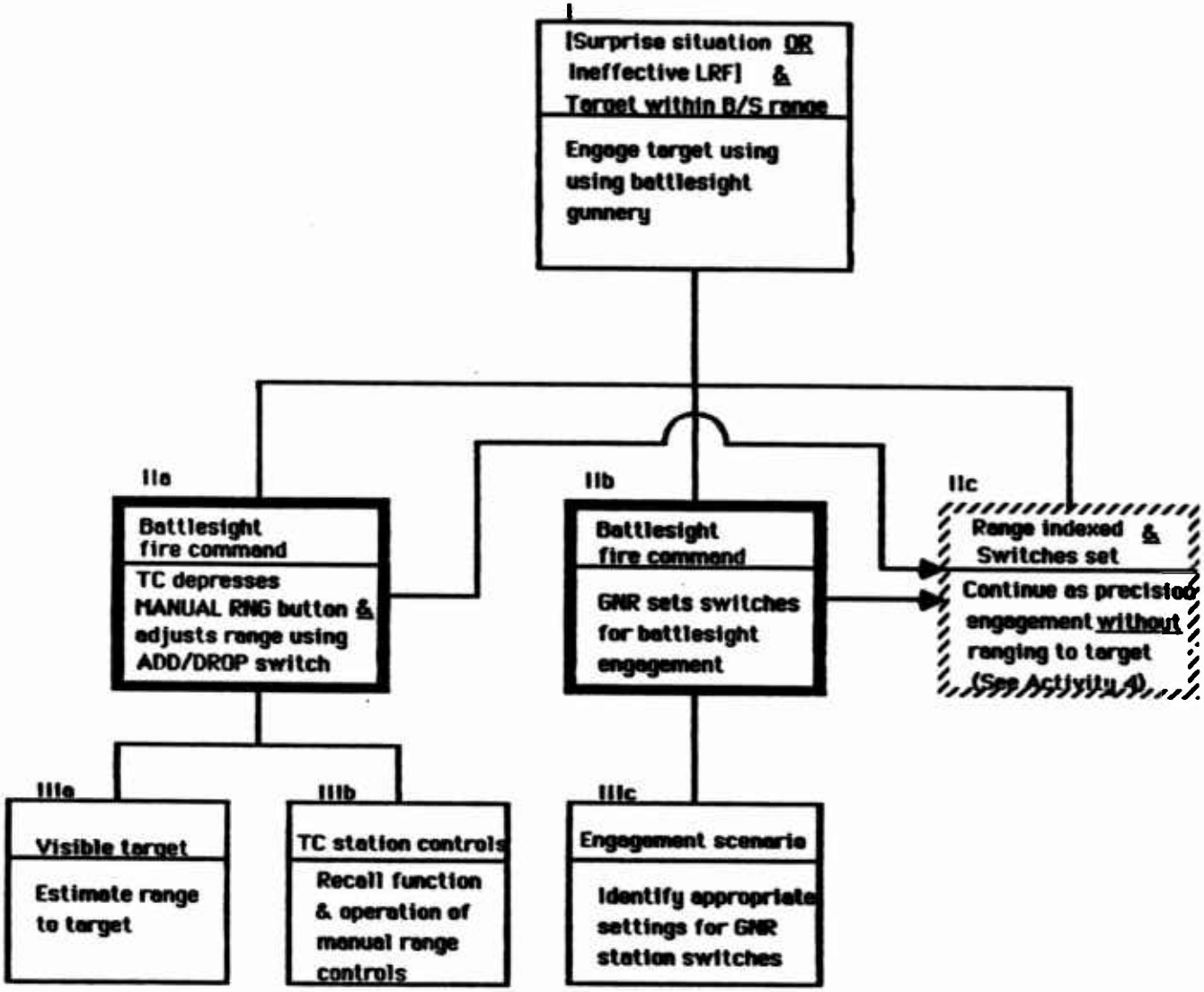

Figure E-9. Hierarchical skills analysis of Option 9.1: Engage target using battlesight gunnery.

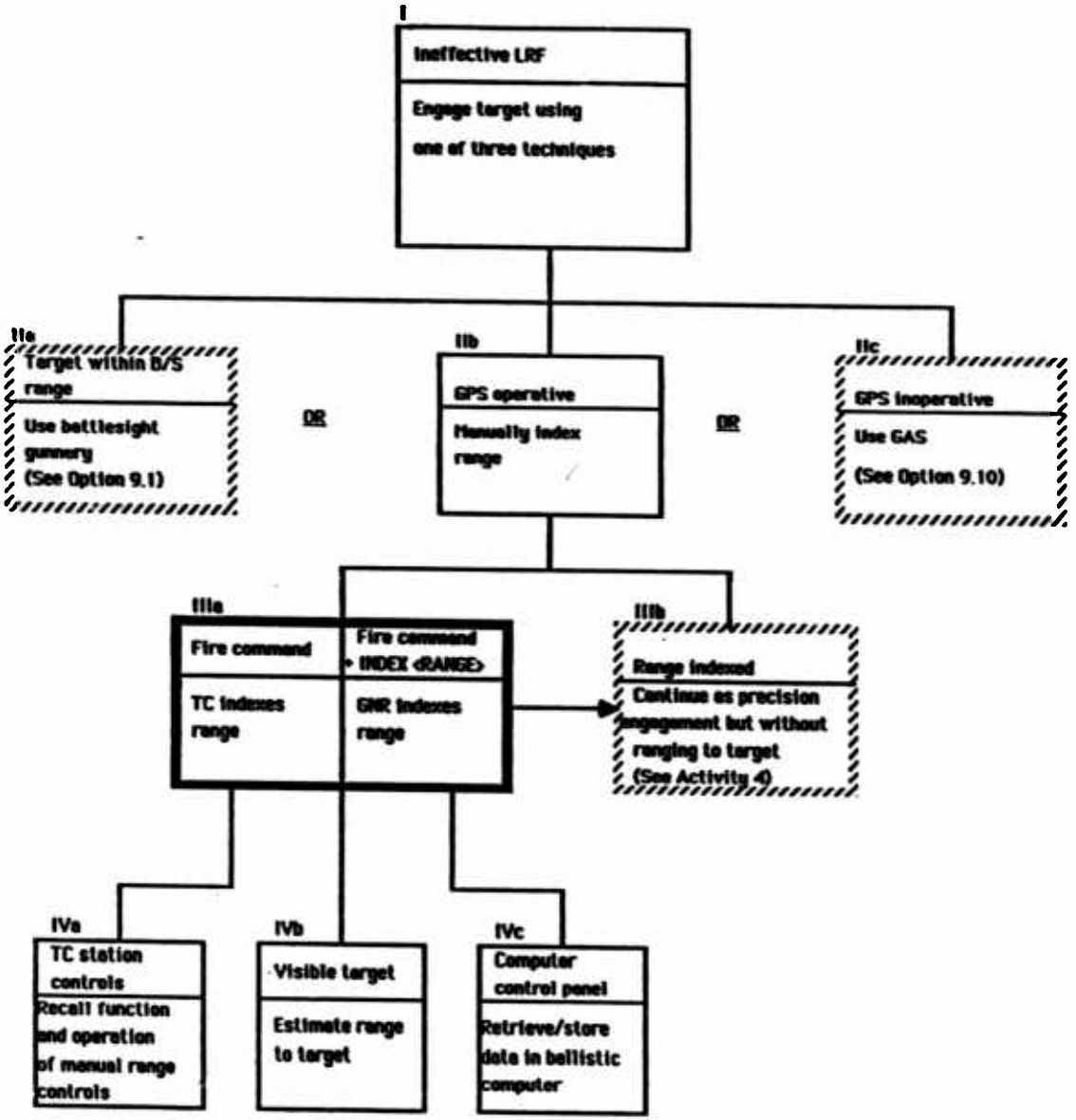

Figure E-10. Hierarchical skills analysis of Option 9.2: Engage target given ineffective LRF.

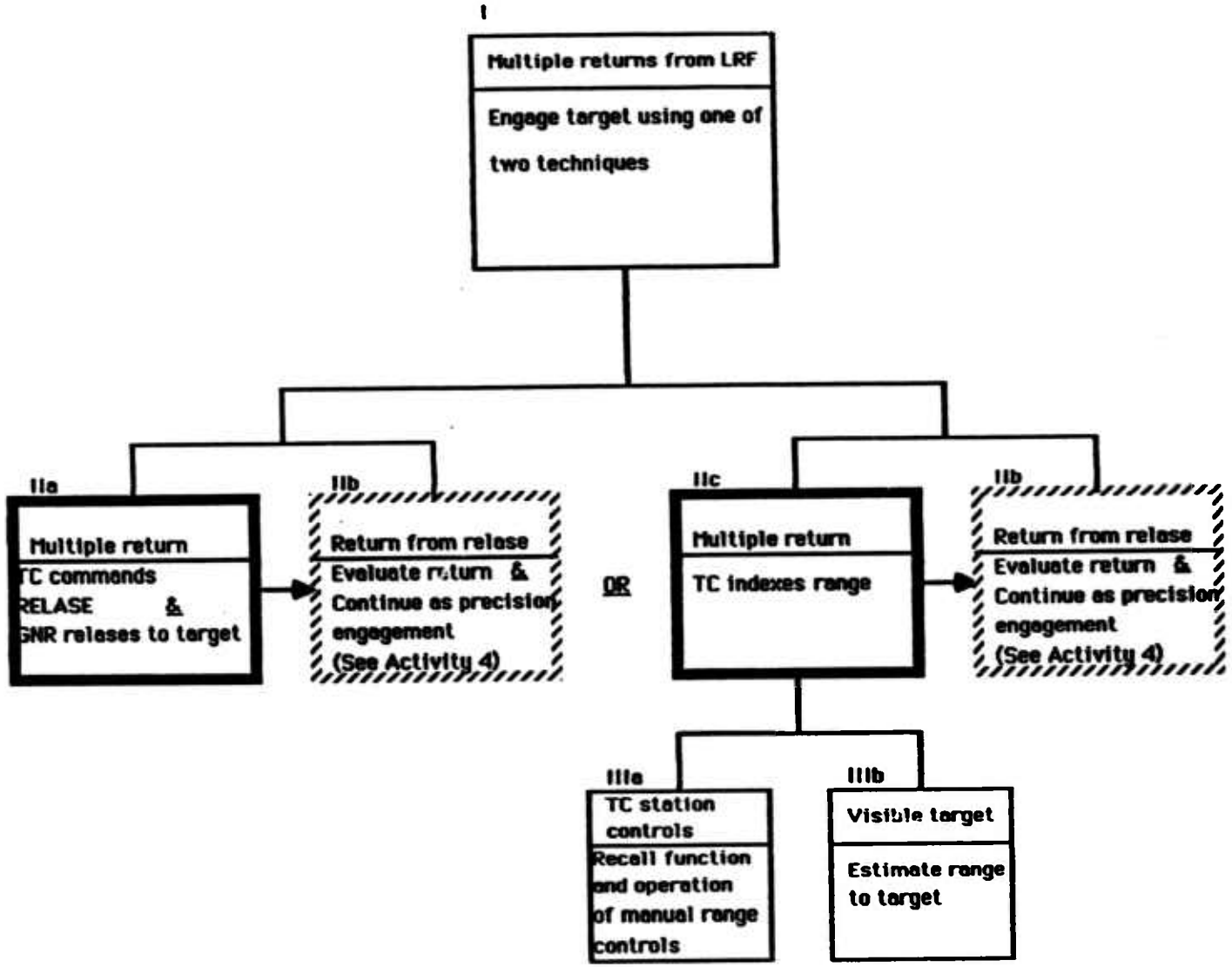

Figure E-11. Hierarchical skills analysis of Option 9.3: Engage target given multiple returns from LRF.

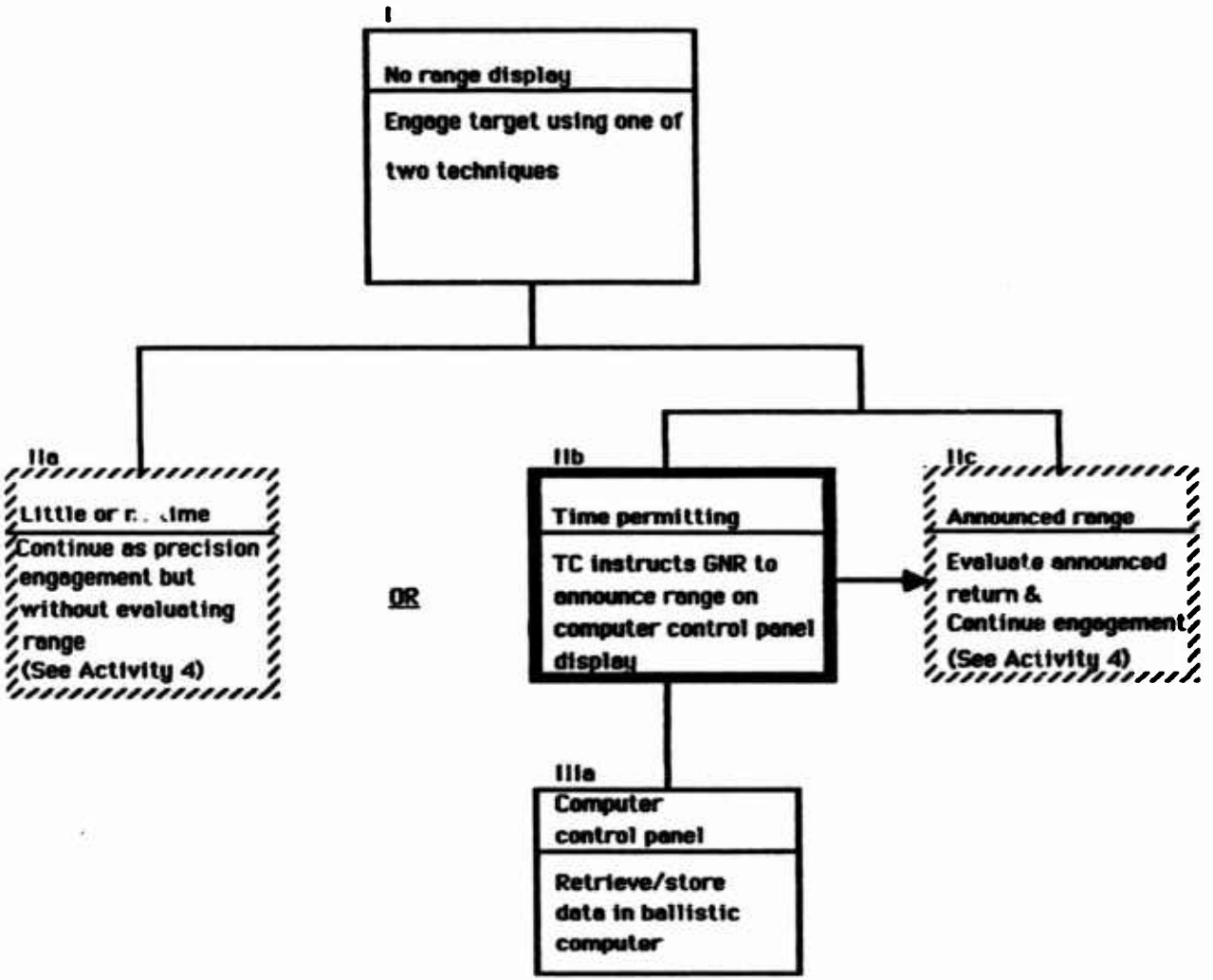

Figure E-12. Hierarchical skills analysis of Option 9.4: Engage target given no range display (loss of symbology).

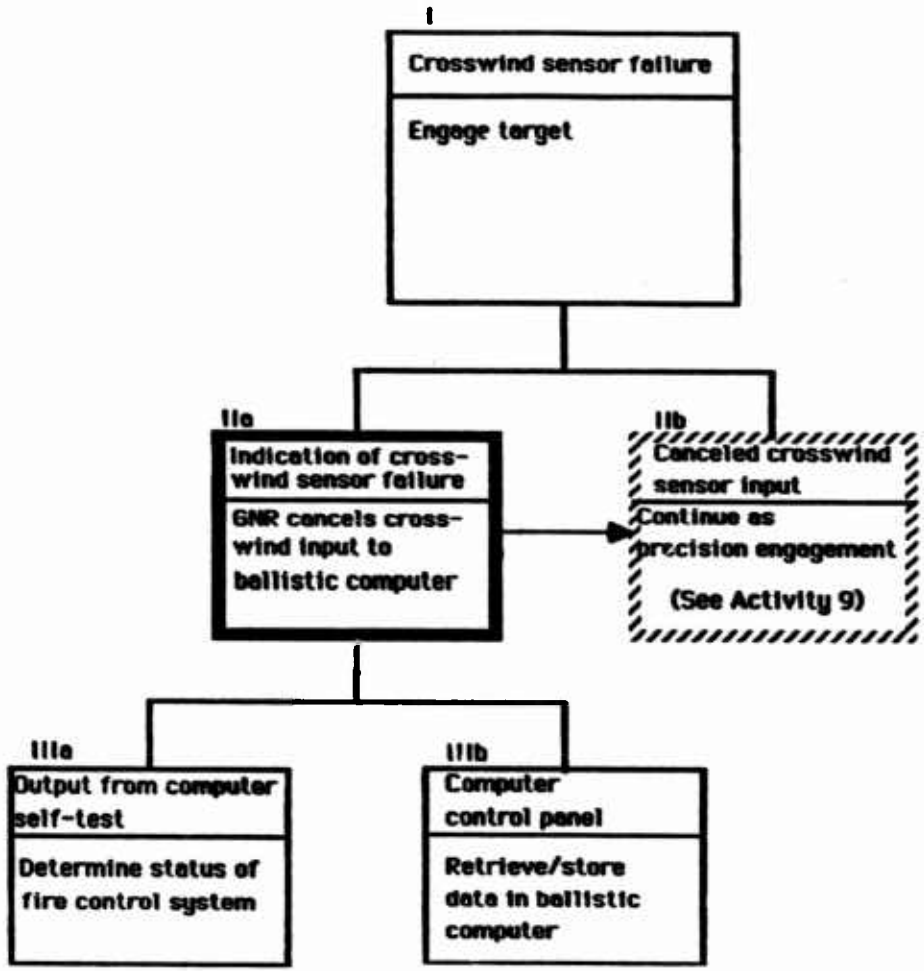

Figure E-13. Hierarchical skills analysis of Option 9.5: Engage target given crosswind sensor failure.

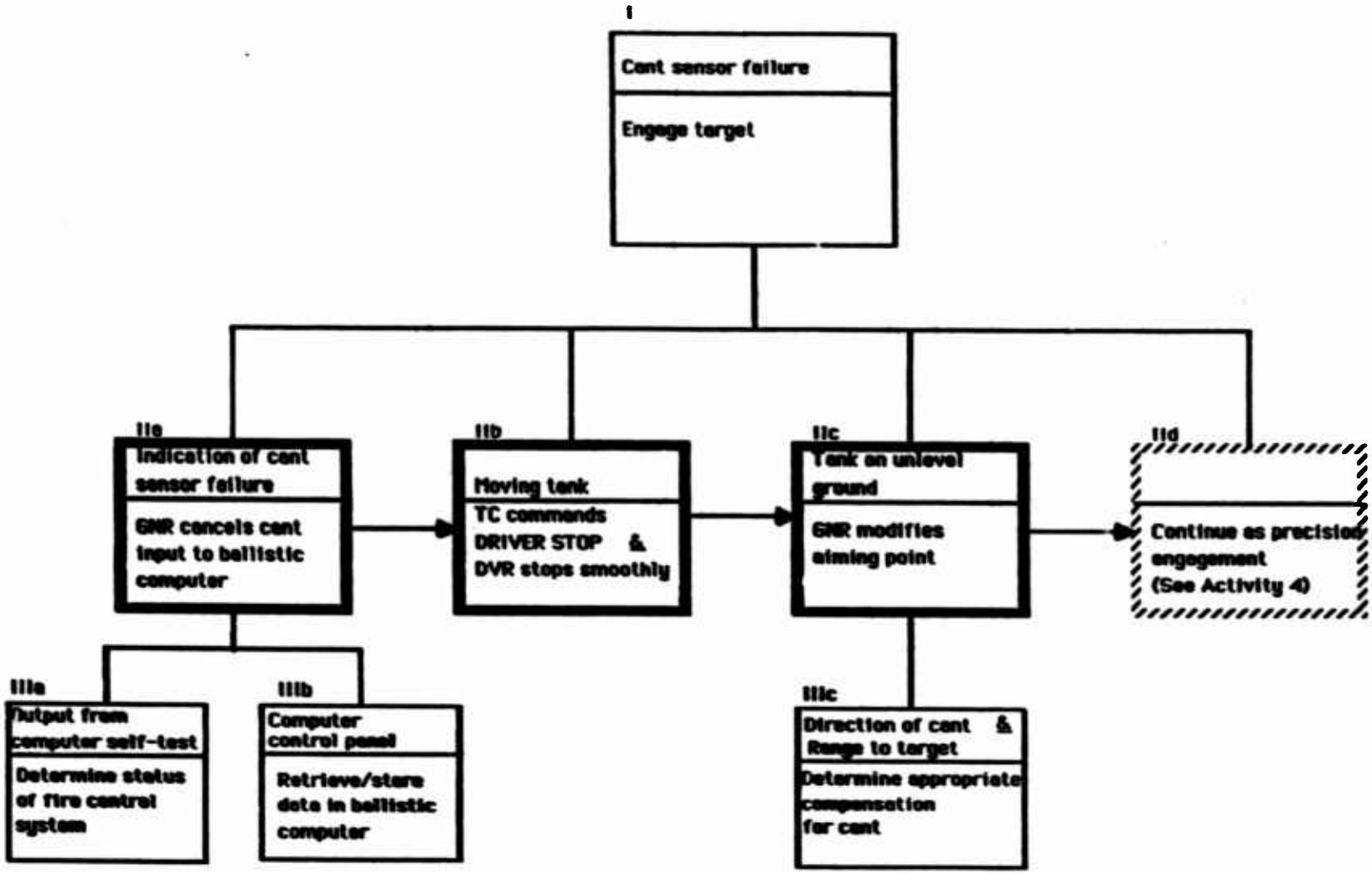

Figure E-14. Hierarchical skills analysis of Option 9.6: Engage target given cant sensor failure.

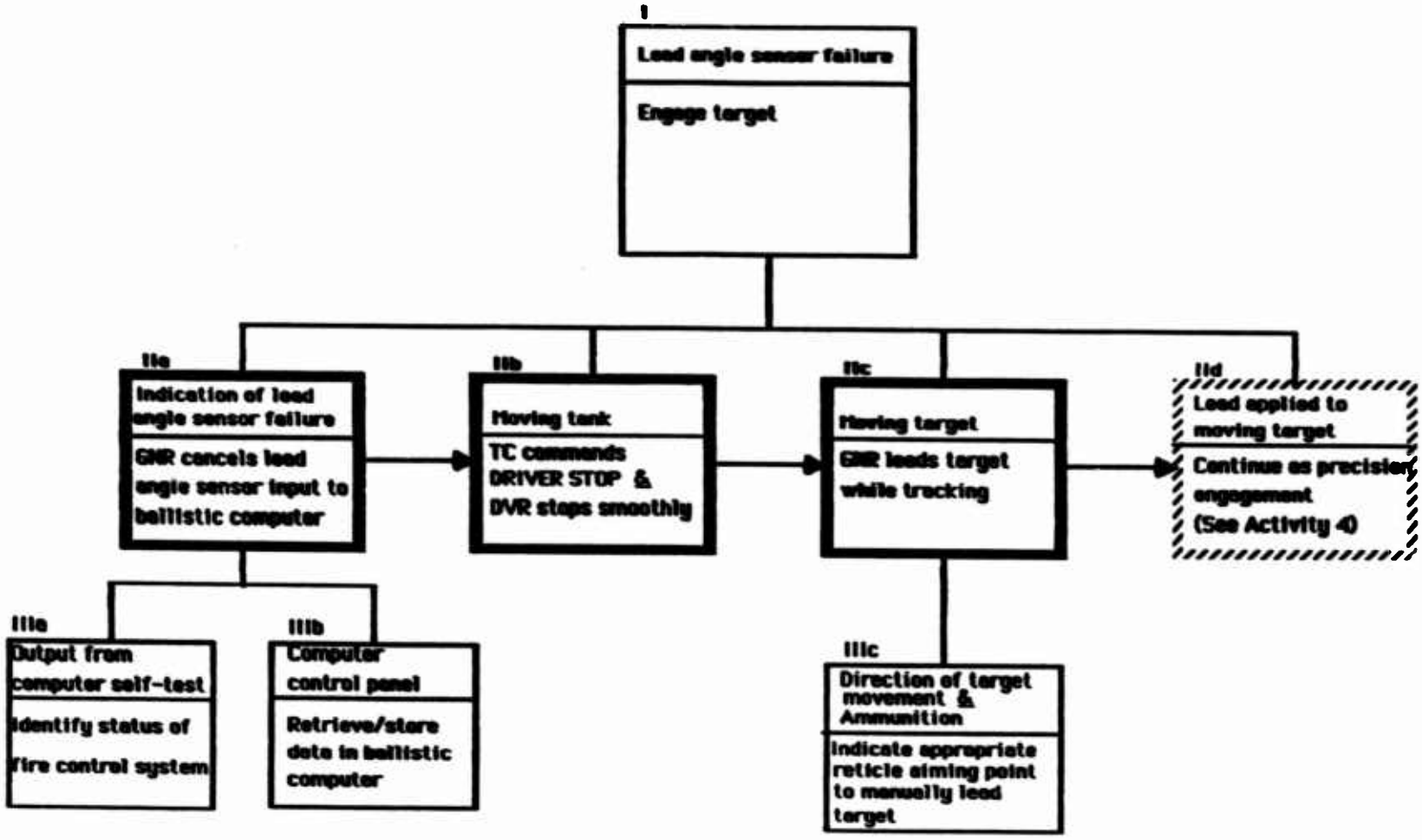

Figure E-15. Hierarchical skills analysis of Option 9.7: Engage target given lead angle sensor failure.

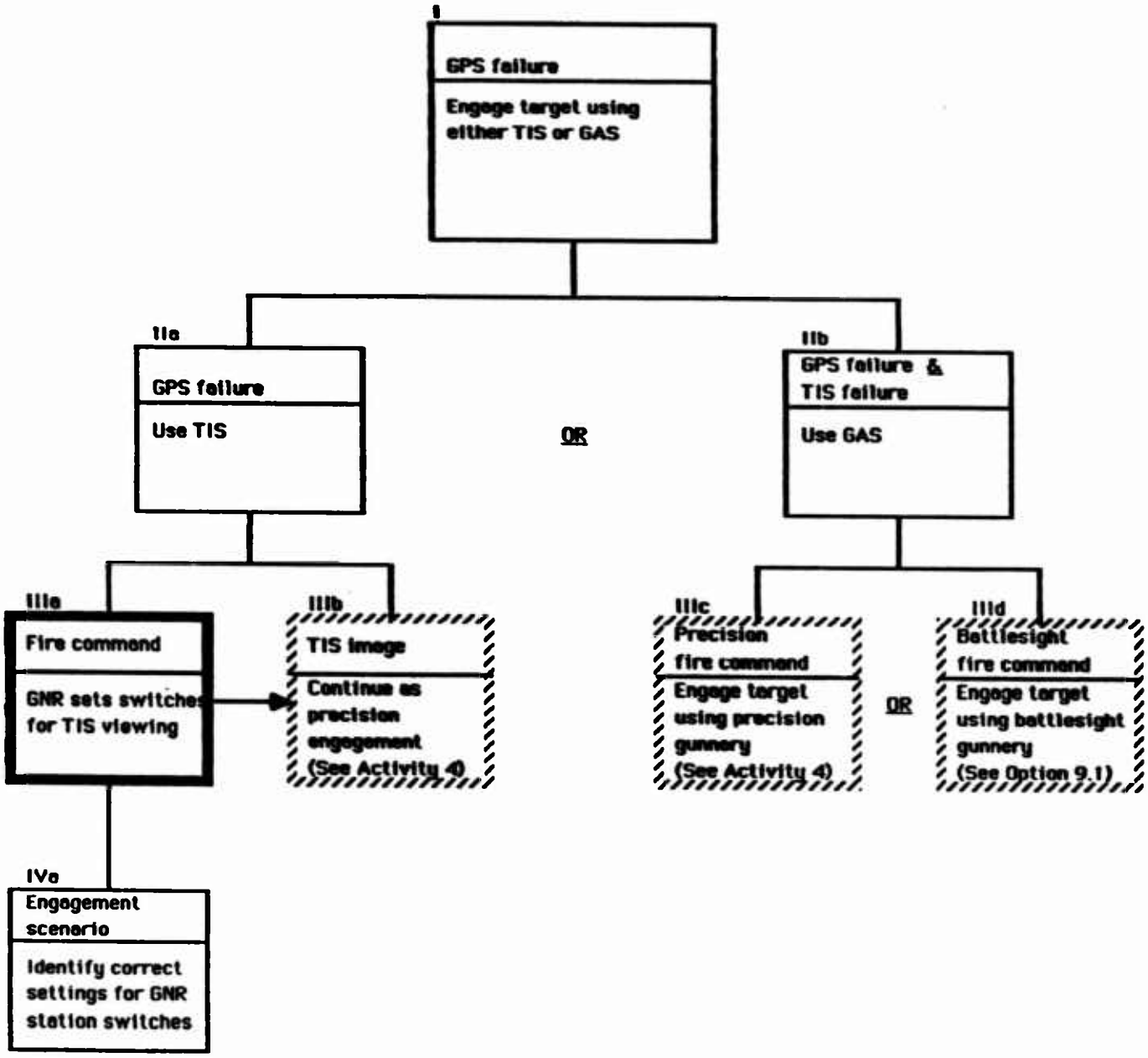

Figure E-16. Hierarchical skills analysis of Options 9.8 and 9.9: Engage target given GPS failure.

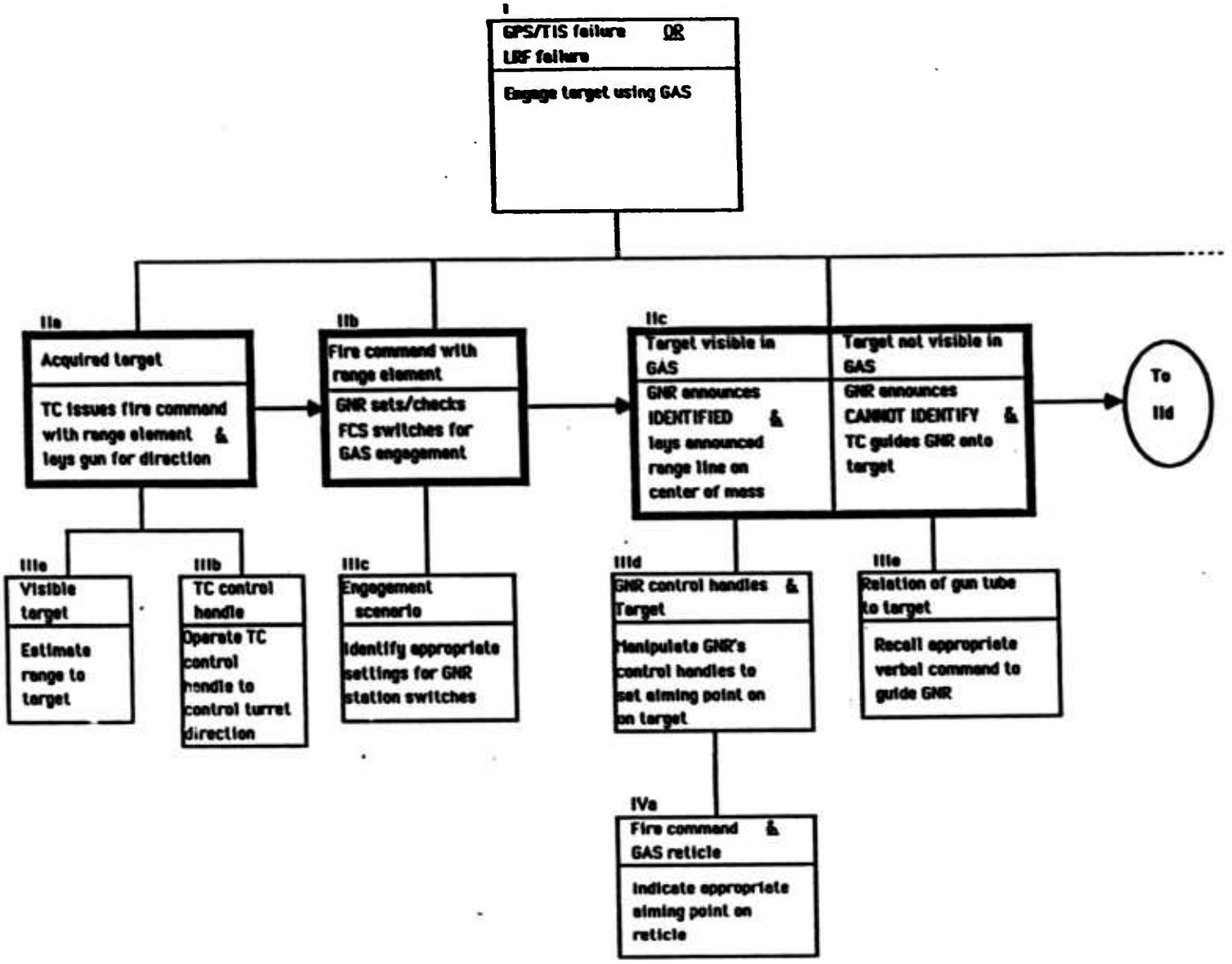

Figure E-17. Hierarchical skills analysis of Option 9.10: Engage target using GAS.

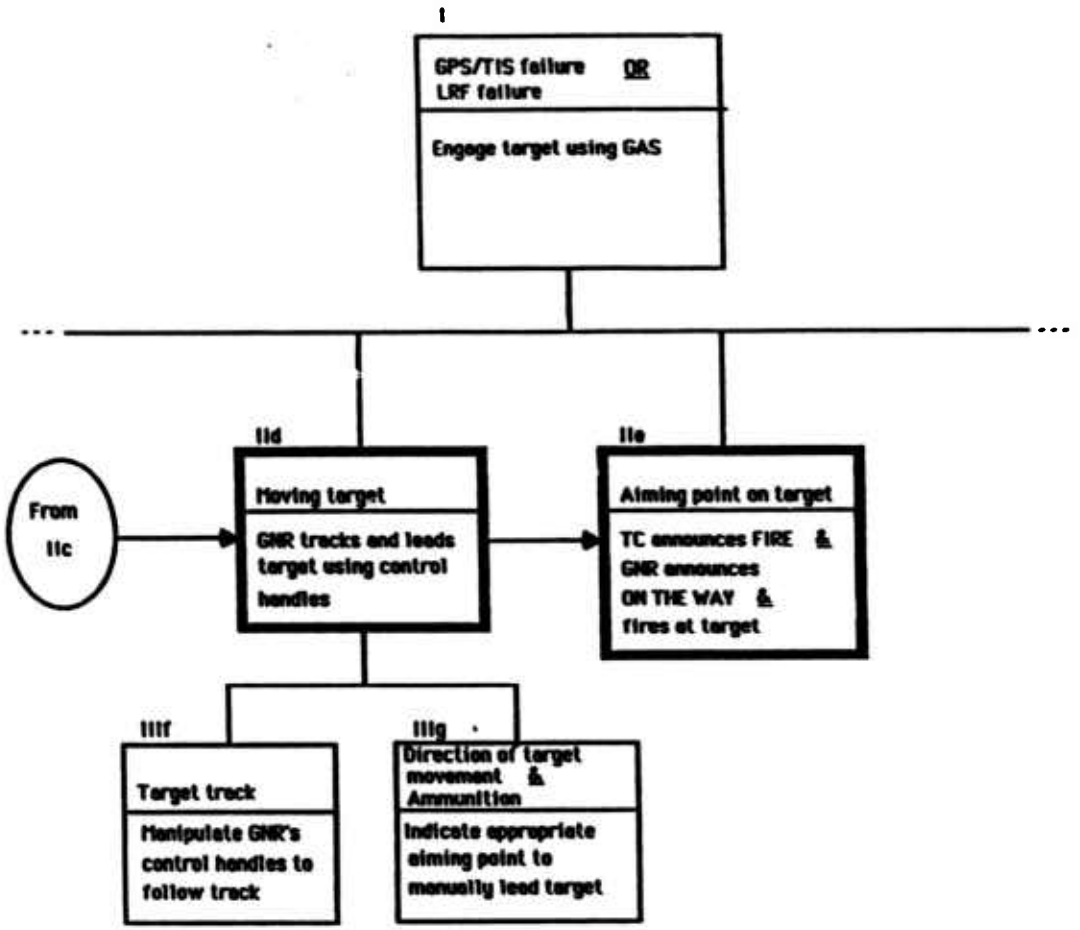

Figure E-17. Hierarchical skills analysis of Option 9.10: Engage target using GAS (cont'd).

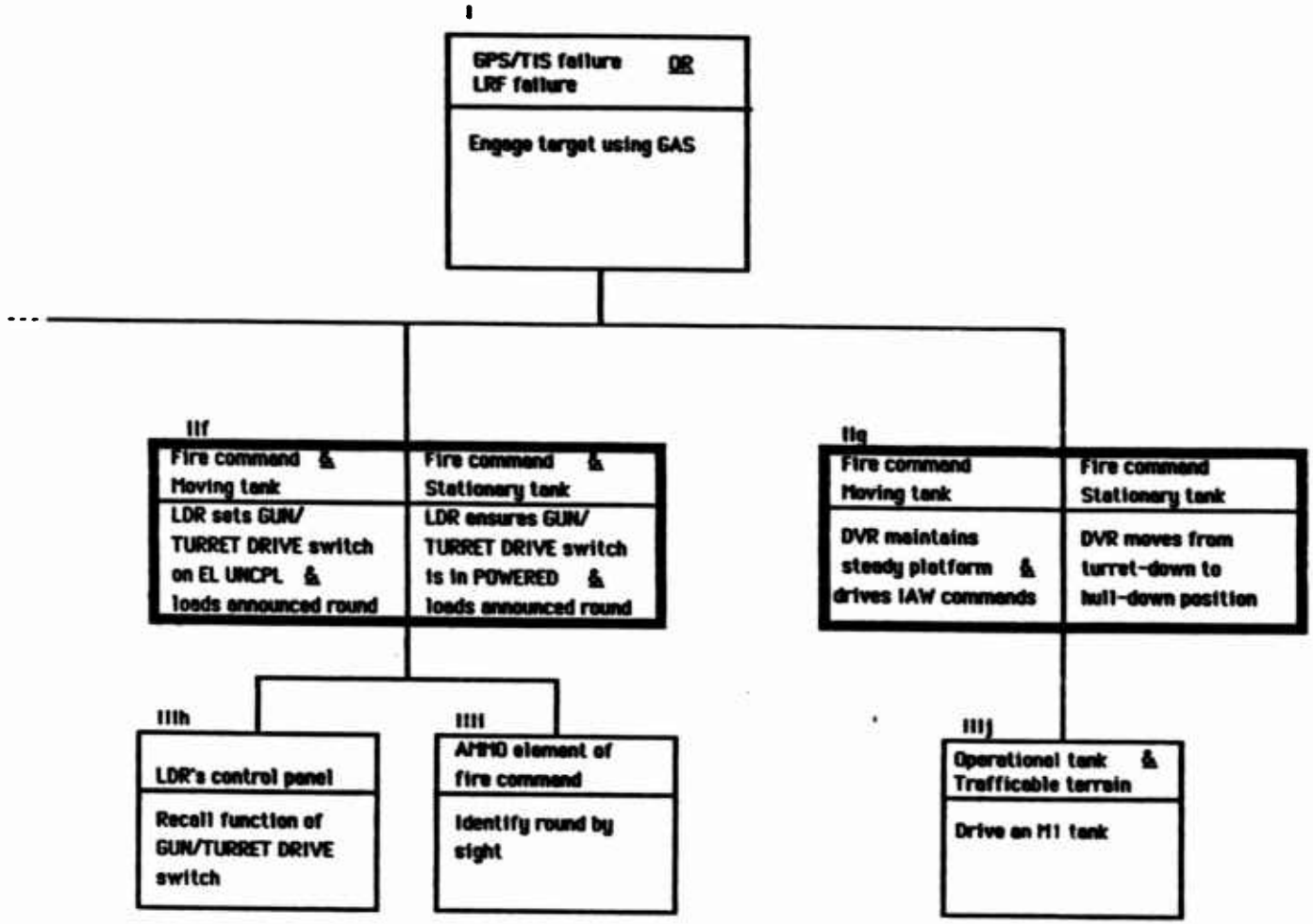

Figure E-17. Hierarchical skills analysis of Option 9.10: Engage target using GAS (cont'd).

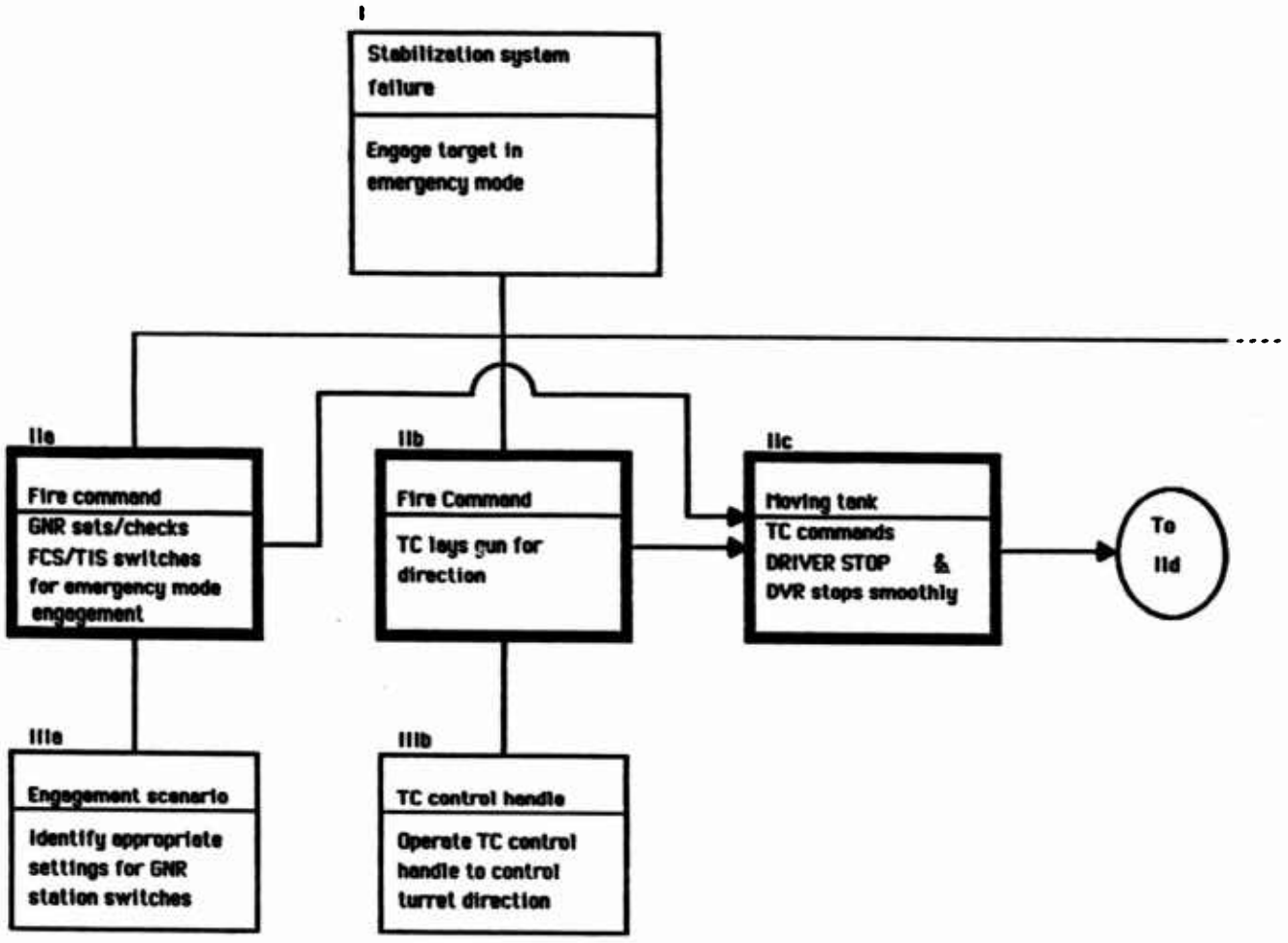

Figure E-18. Hierarchical skills analysis of Option 9.11: Engage target in emergency mode.

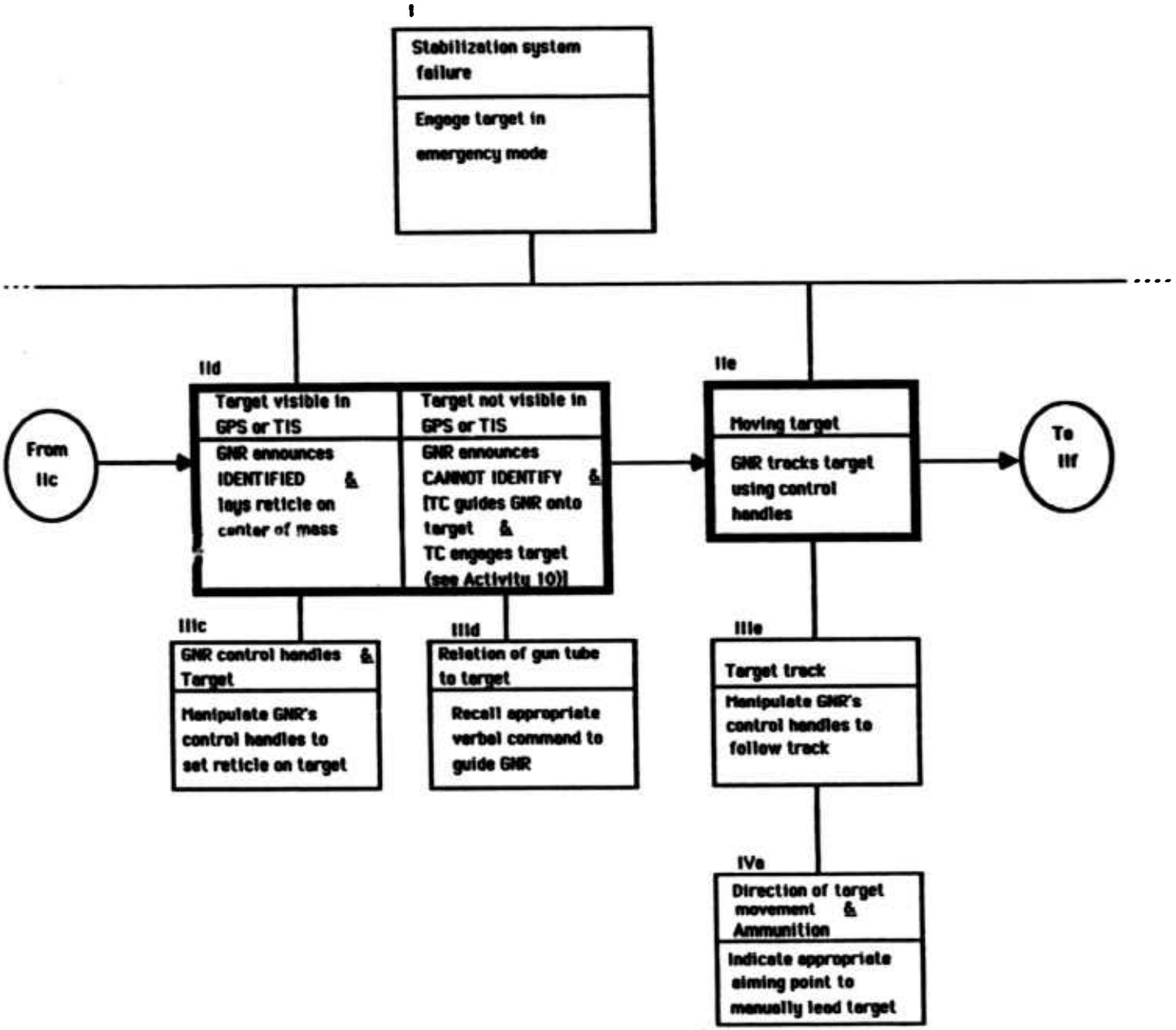

Figure E-18. Hierarchical skills analysis of Option 9.11: Engage target in emergency mode (cont'd).

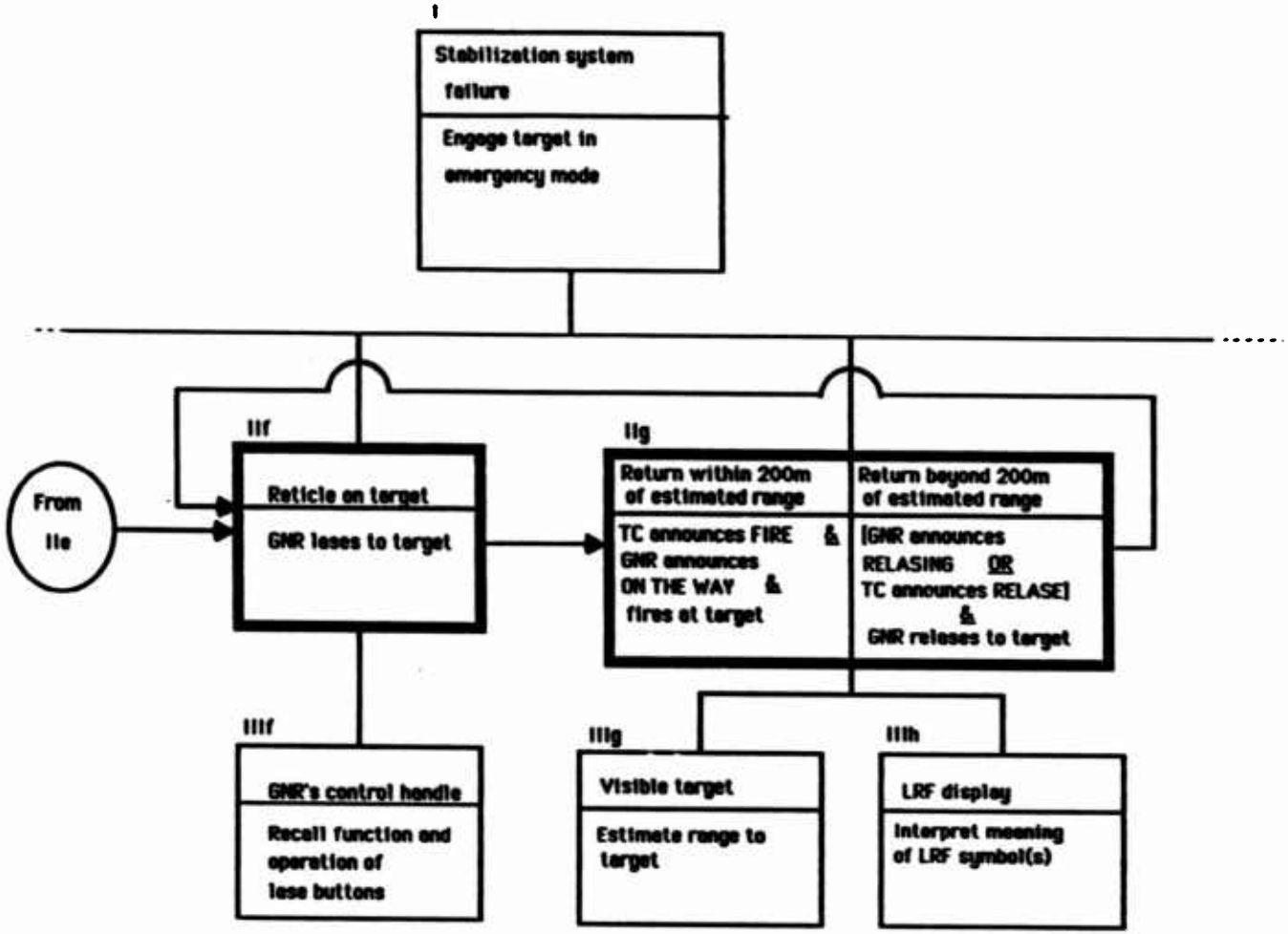

Figure E-16. Hierarchical skills analysis of Option 9.11: Engage target in emergency mode (cont'd).

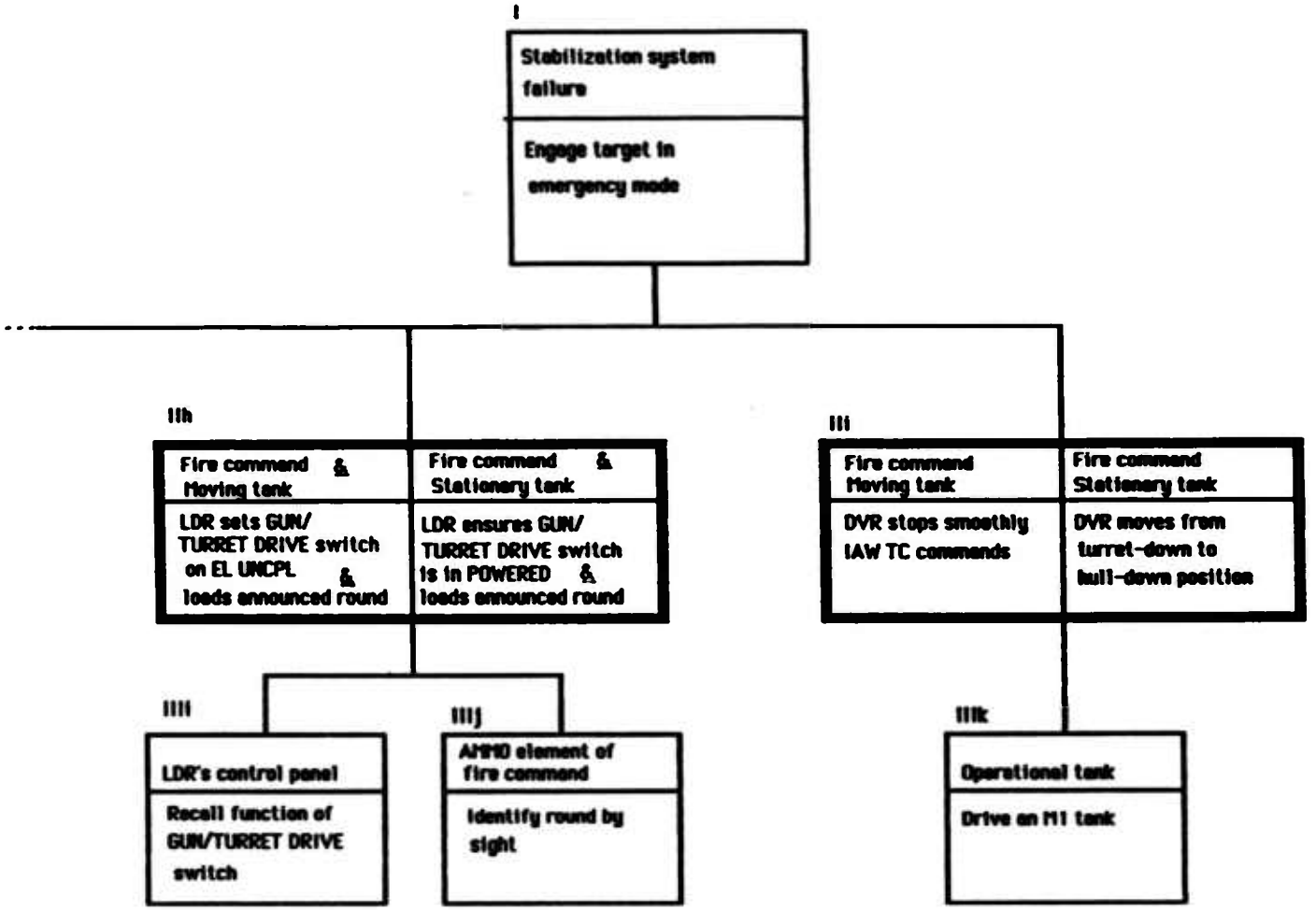

Figure E-18. Hierarchical skills analysis of Option 9.11: Engage target in emergency mode (cont'd).

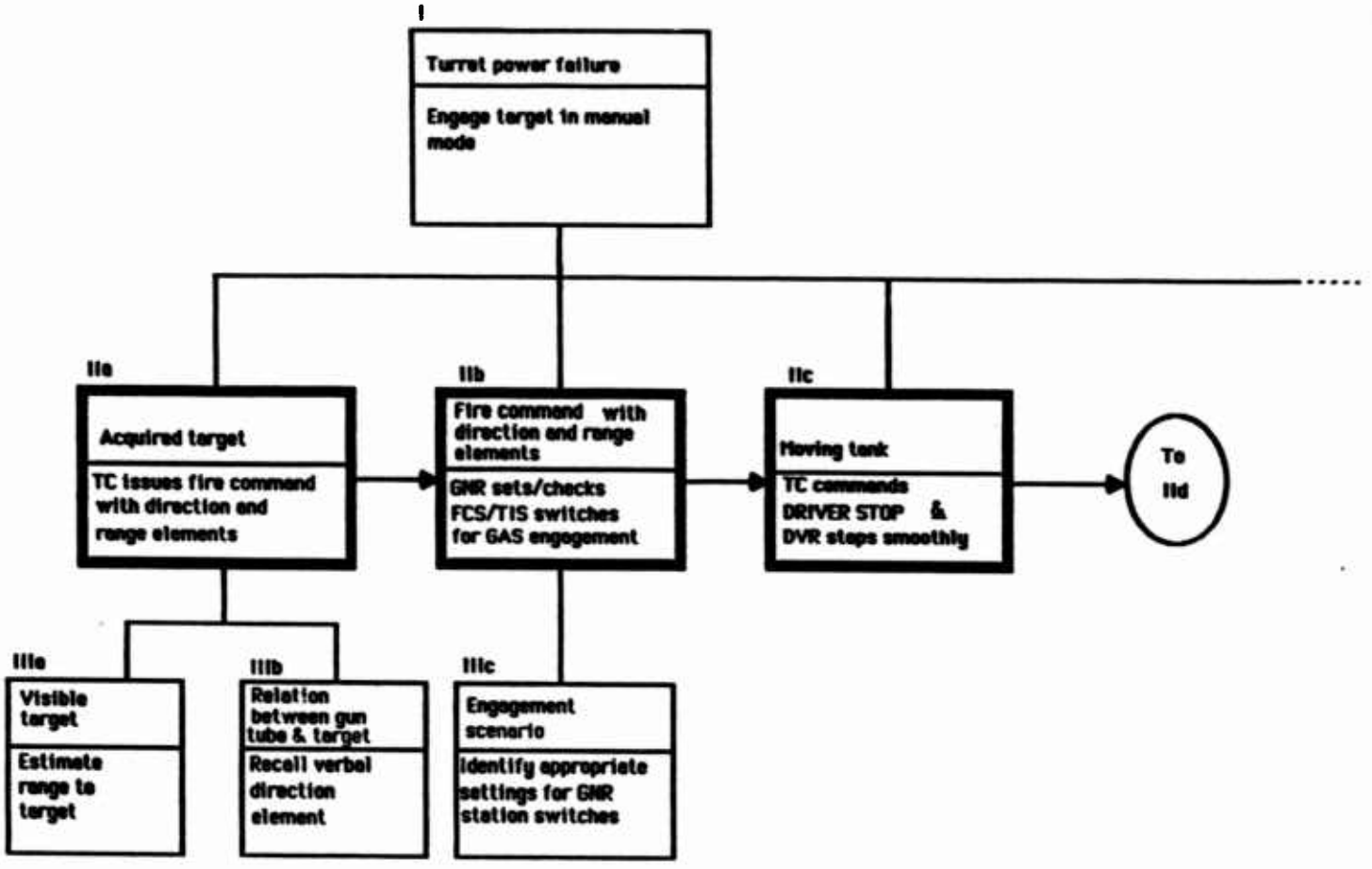

Figure E-19. Hierarchical skills analysis of Option 9.12: Engage target in manual mode.

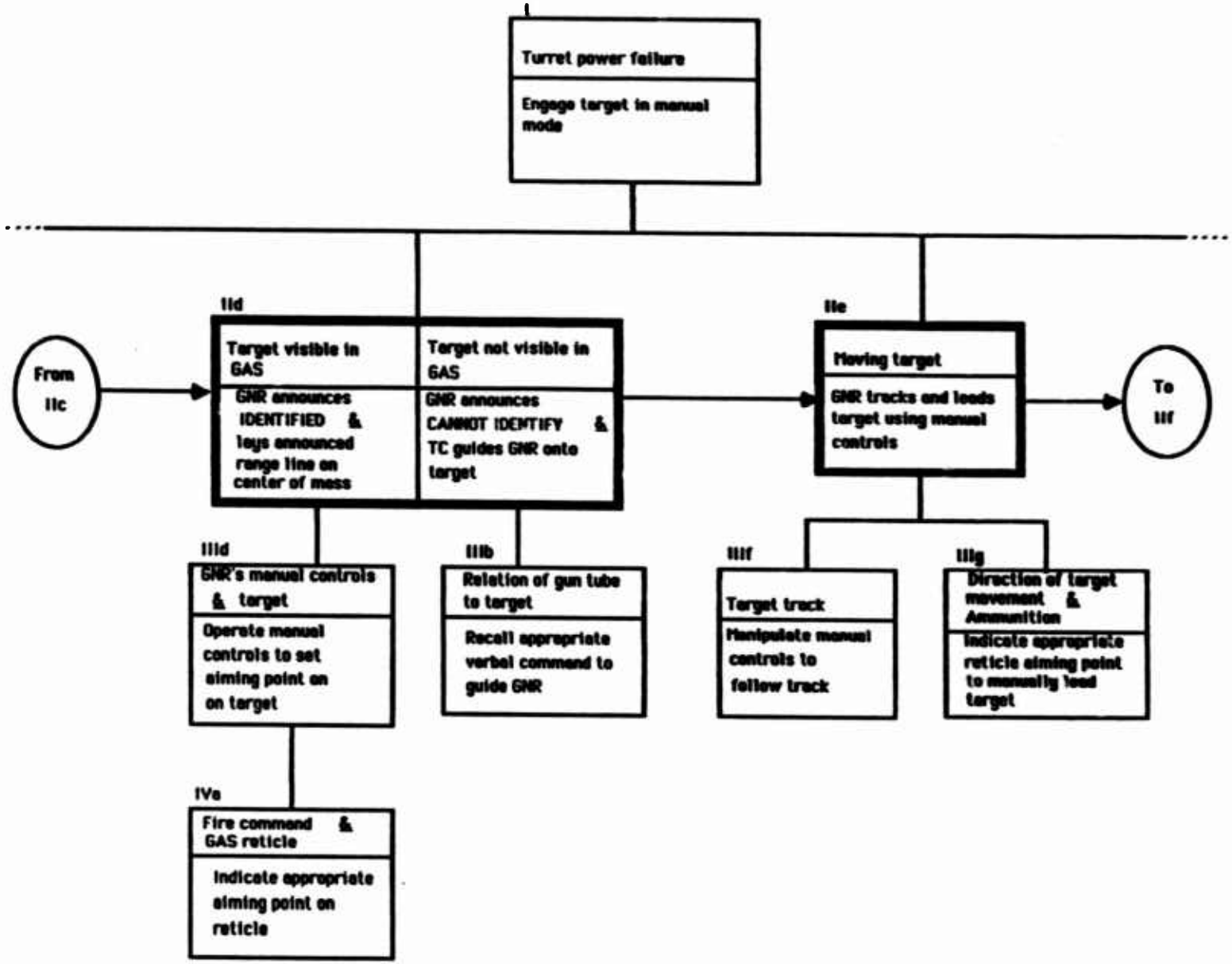

Figure E-19. Hierarchical skills analysis of Option 9.12: Engage target in manual mode (cont'd).

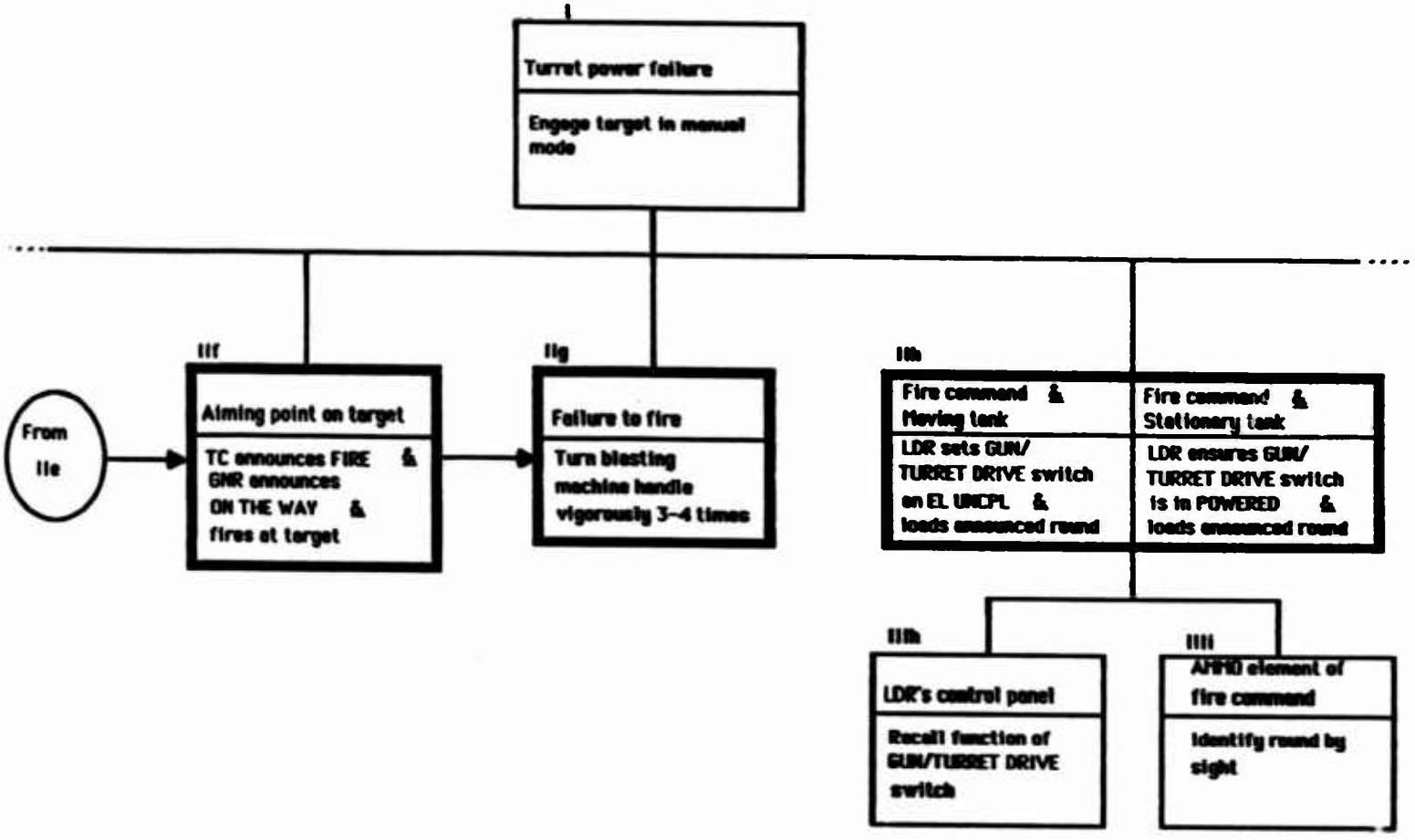

Figure E-19. Hierarchical skills analysis of Option 9.12: Engage target in manual mode (cont'd).

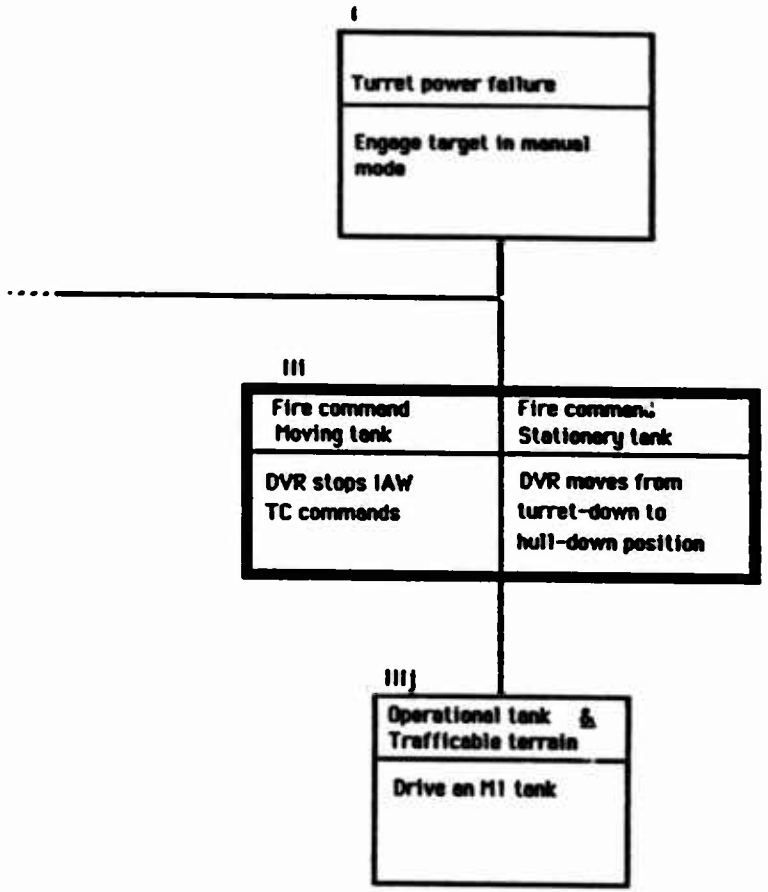

Figure E-19. Hierarchical skills analysis of Option 9.12: Engage target in manual mode (cont'd).

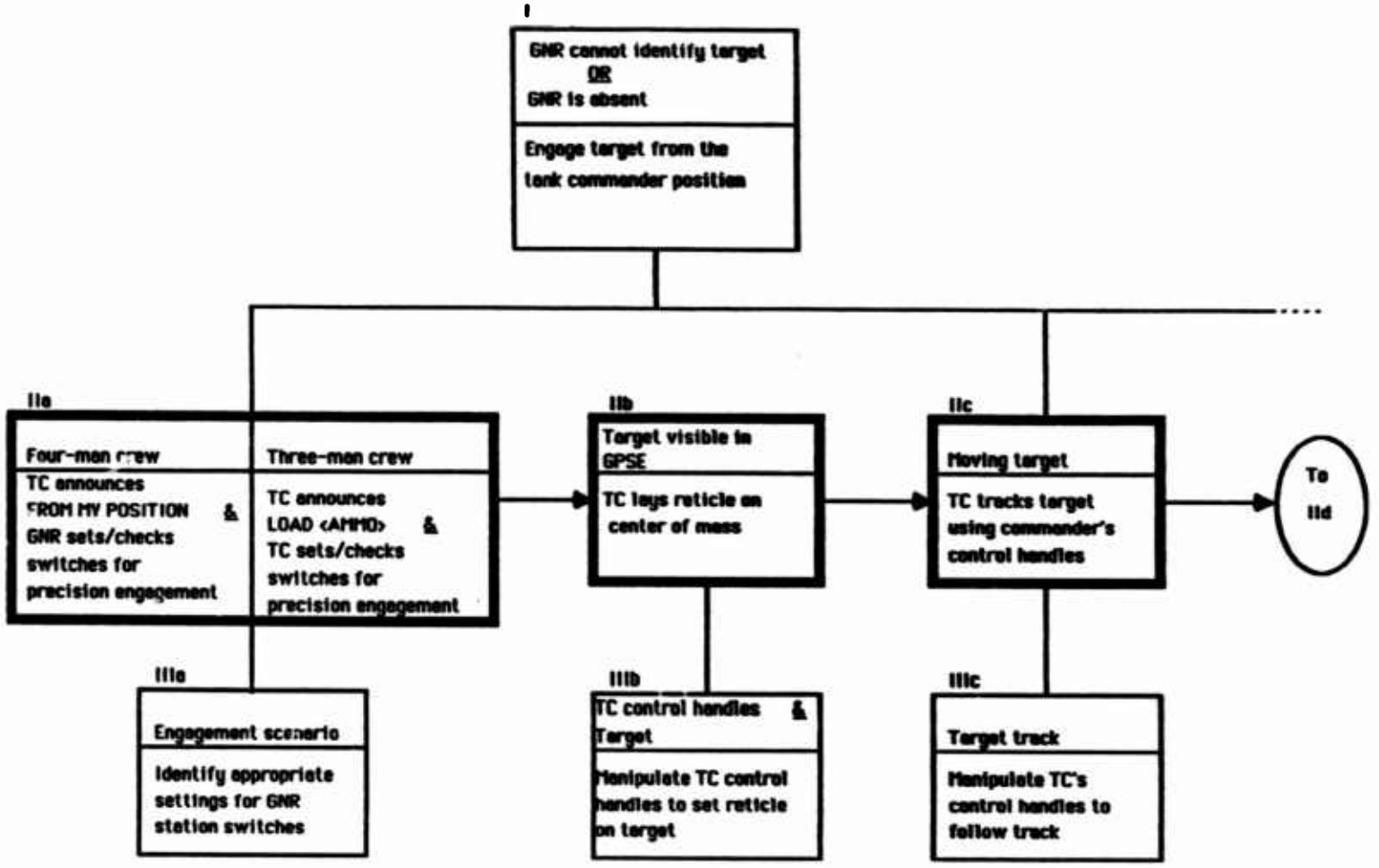

Figure E-20. Hierarchical skills analysis of Activity 10: Engage Target from TC Position.

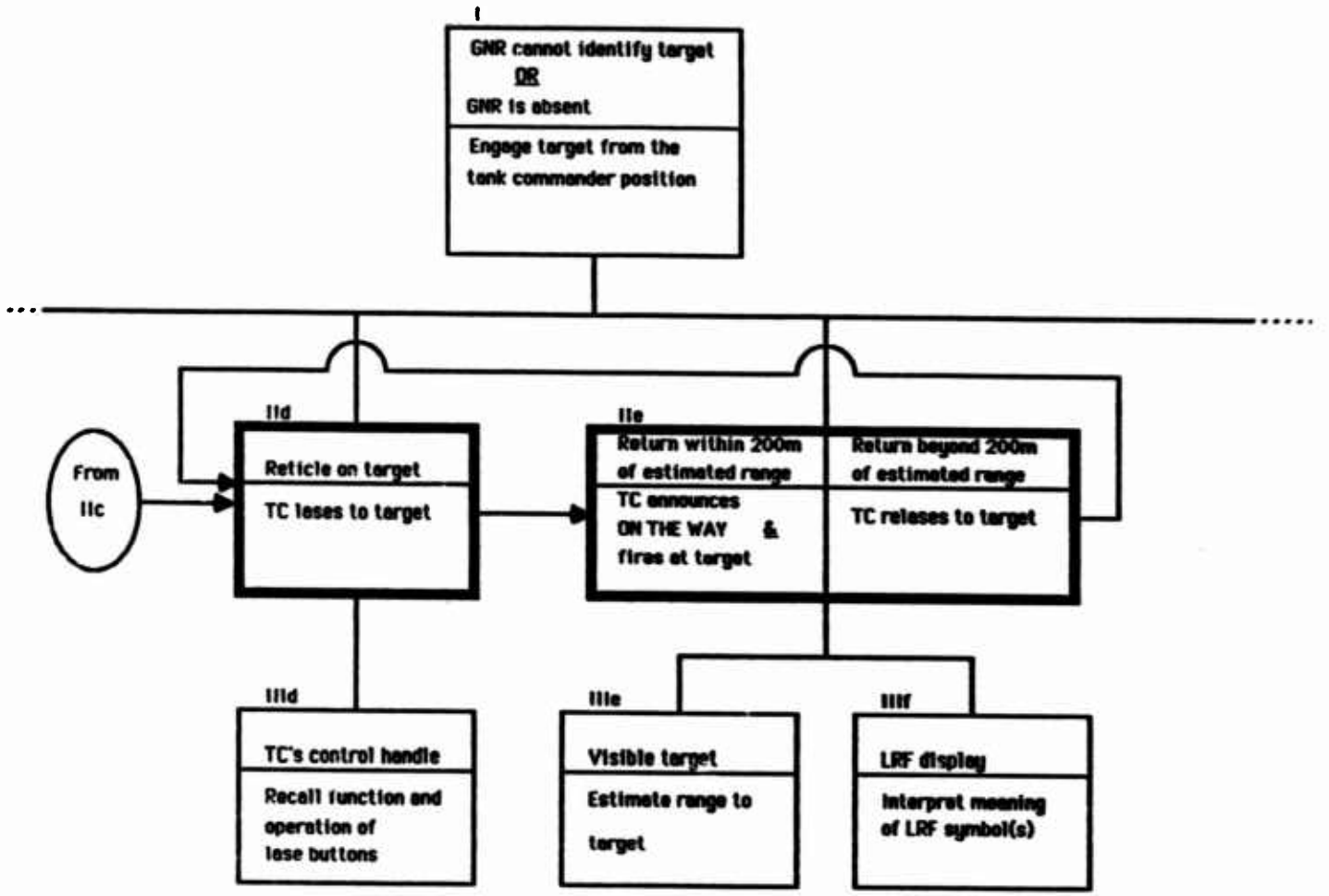

Figure E-20. Hierarchical skills analysis of Activity 10: Engage Target from TC Position (cont'd).

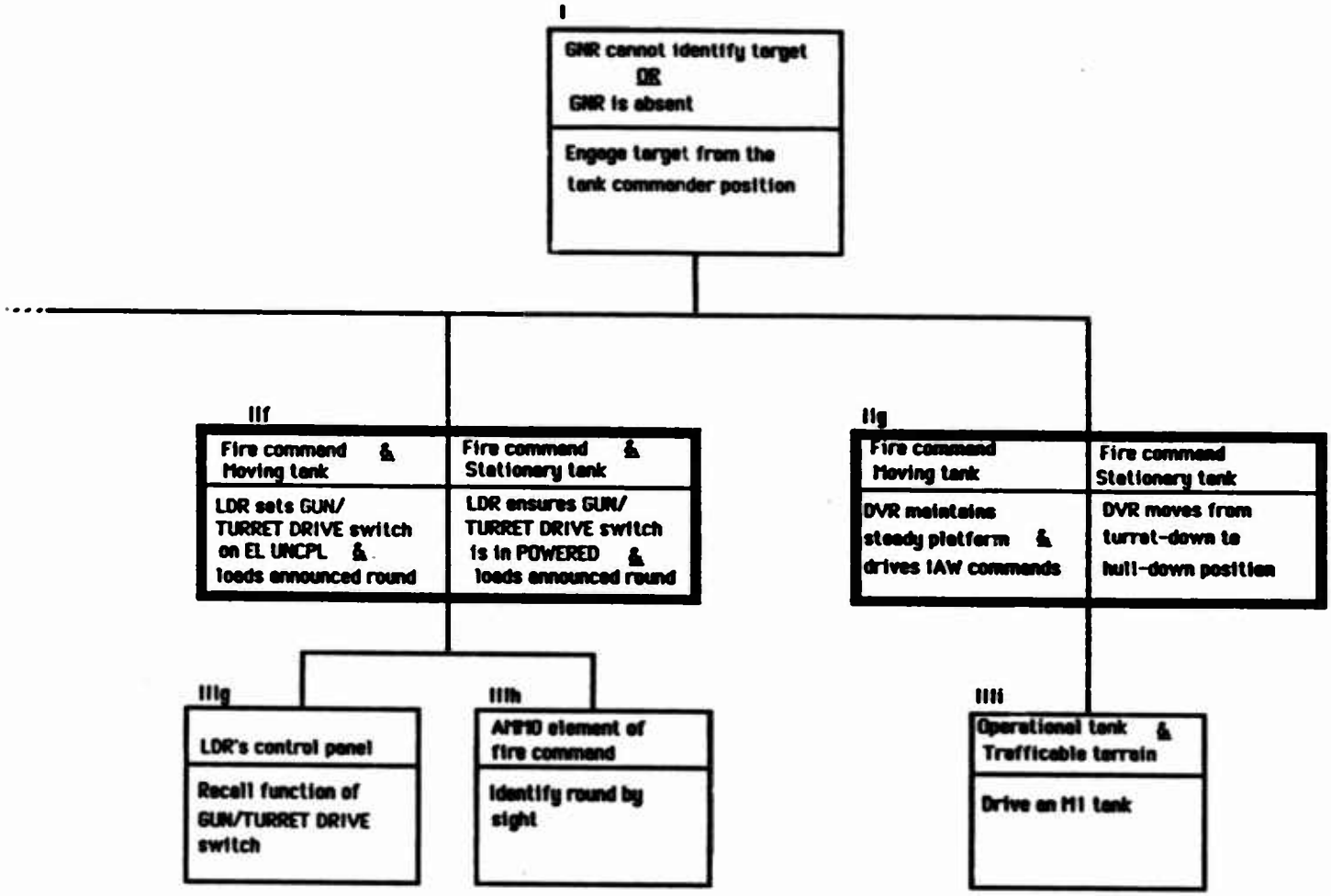

Figure E-20. Hierarchical skills analysis of Activity 10: Engage Target from TC Position (cont'd).

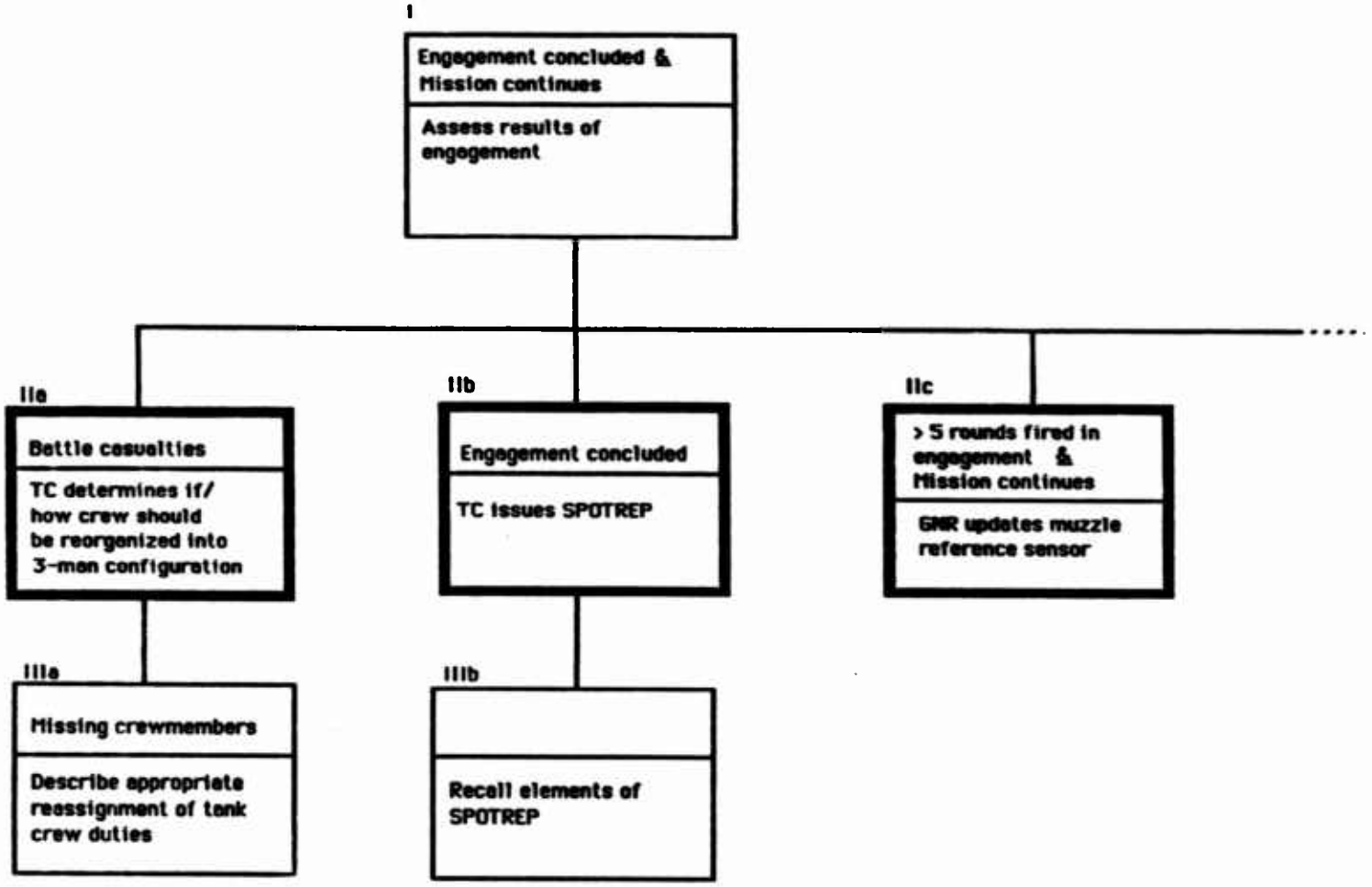

Figure E-21. Hierarchical analysis of Activity 11: Assess Results of Engagement.

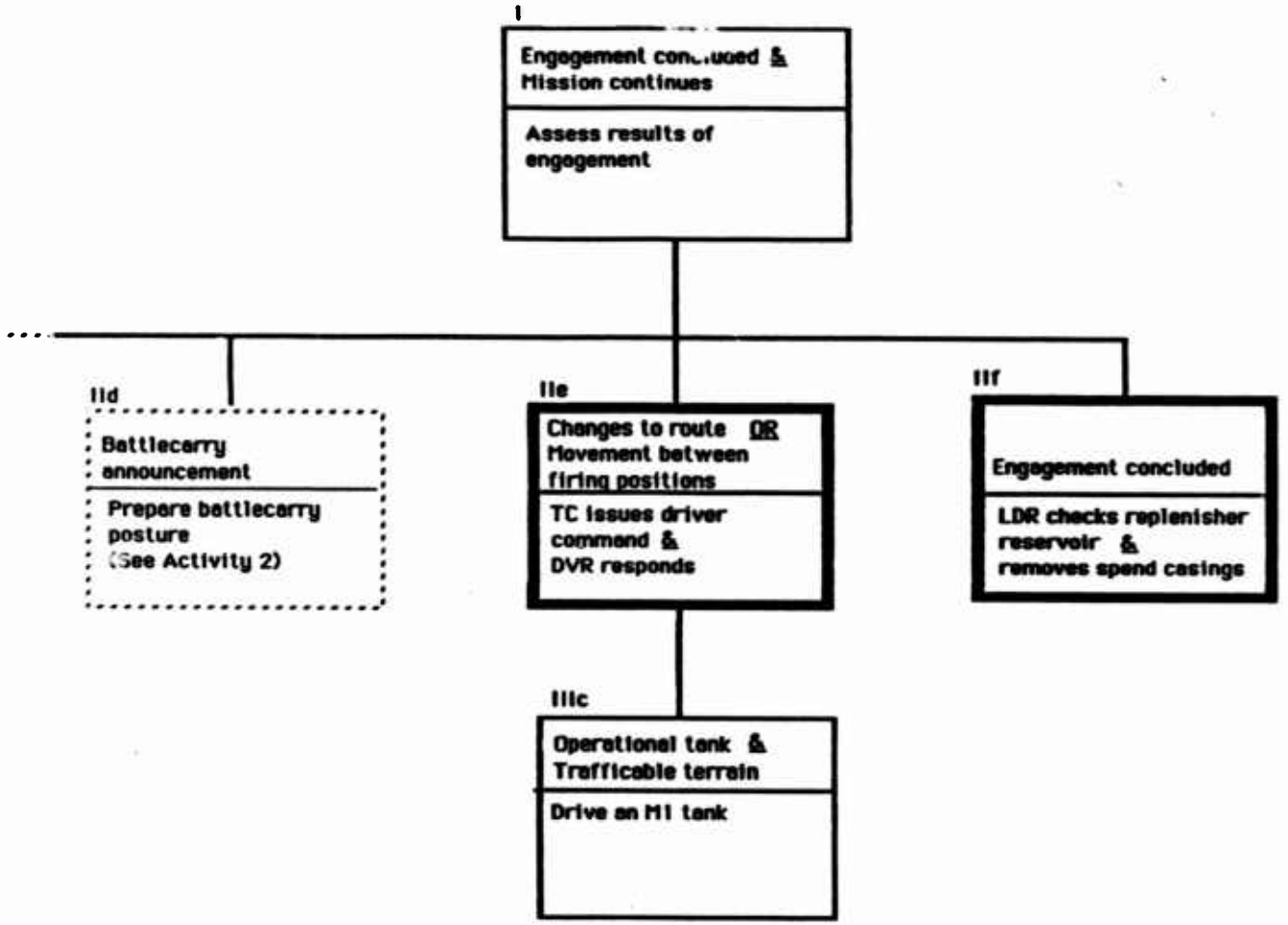

Figure E-21. Hierarchical analysis of Activity 11: Assess Results of Engagement (cont'd).

APPENDIX F

ANALYSIS OF DEVICE CONDITIONS

APPENDIX F

ANALYSIS OF DEVICE CONDITIONS

Parameters	Conditions	Devices			
		VIGS	TopGun	U-COFT	SIMNET
1. Target Type	a. tank	Yes	Yes	Yes	Yes
	b. pers. carrier	Yes	No	Yes	Yes
	c. helicopter	No	No	Yes	No
	d. bunkers	No	No	No	No
	e. antitank	No	No	No	No
	f. truck	Yes	No	Yes	Yes
	g. troops	No	No	Yes	No
	h. aircraft	No	No	No	No
2. Target Movement	a. sta. front	Yes	Yes	Yes	Yes
	b. sta. flank	No	Yes	Yes	Yes
	c. sta. oblique	No	Yes	Yes	Yes
	d. mov. flank	Yes	Yes	Yes	Yes
	e. mov. oblique	No	Yes	Yes	Yes
	f. mov. zig-zag	Yes	Yes	Yes	Yes
	g. mov. approach	Yes	Yes	Yes	Yes
	h. mov. retreating	No	Yes	Yes	Yes
3. Target Cover/ Concealment	a. fully exposed	Yes	Yes	Yes	Yes
	b. hull defilade	Yes	Yes	Yes	Yes
	c. turret defilade	No	Yes	Yes	Yes
	d. fully hidden	No	Yes	Yes	Yes
4. Target Array	a. single targets	Yes	Yes	Yes	Yes
	b. mult. targets	Yes	Yes	Yes	Yes
	c. both sgl & mult	No	Yes	No	Yes
5. Target Orientation	a. owntank	Yes	Yes	Yes	Yes
	b. elsewhere	Yes	Yes	Yes	Yes
6. Target Range	a. < 900 meters	Yes	No	Yes	Yes
	b. 900-1800 meters	Yes	Yes	Yes	Yes
	c. > 1800 meters	No	Yes	Yes	Yes
7. Target Sector	a. forward	Yes	Yes	Yes	Yes
	b. flanks	No	Yes	No	Yes
	c. rear	No	No	No	Yes
8. IFFN	a. all threat	Yes	Yes	Yes	Yes
	b. all friendly	Yes	Yes	Yes	Yes
	c. mix	No	Yes	Yes	Yes

Parameters	Conditions	Devices			
		VIGS	TopGun	U-COFT	SIMNET
9. Enemy Activity	a. no contact	Yes	Yes	Yes	Yes
	b. direct fire	No	Yes	Yes	Yes
	c. indirect fire	No	No	No	Yes
	d. obstacles	No	No	No	No
	e. minefields	No	No	No	No
	f. elec c-meas	No	No	No	No
10. NBC Conditions	a. free of hazards	Yes	Yes	Yes	Yes
	b. contaminated	No	No	No	No
11. Equipment Status	a. fully oper'l	Yes	Yes	Yes	Yes
	b. ineffective LRF	No	No	Yes	No
	c. mult rtns	No	No	Yes	Yes
	d. no symbols	No	No	No	No
	e. crswnd snr fail	No	No	No	No
	f. cant snr fail	No	No	No	No
	g. lead snr fail	No	No	No	No
	h. GPS fail	No	No	No	No
	i. GPS/TIS fail	No	Yes	Yes	No
	j. stab fail	No	No	Yes	No
	k. turret pwr fail	No	No	Yes	No
12. Number of Crewmen	a. four	Yes	Yes	Yes	Yes
	b. three	No	No	Yes	Yes
13. Supply Shortages	a. none	Yes	Yes	Yes	Yes
	b. ammo	Yes	Yes	No	Yes
	c. fuel	No	No	No	Yes
	d. food	No	No	No	No
14. Mission	a. offense (moving)	No	No	Yes	Yes
	b. defense (st'ry)	No	No	No	No
15. Fire Control	a. single tank	Yes	Yes	Yes	Yes
	b. frontal (sc'n)	No	No	No	Yes
	c. cross (sc'n)	No	No	No	Yes
	d. depth (sc'n)	No	No	No	Yes
	e. frontal (pltn)	No	No	No	Yes
	f. cross (pltn)	No	No	No	Yes
	g. depth (sc'n)	No	No	No	Yes

Parameters	Conditions	Devices			
		IGS	TopGun	U-COFT	SIMNET
16. Movement Formation	a. column	No	No	No	Yes
	b. echelon lft/rt	No	No	No	Yes
	c. stgr'd column	No	No	No	Yes
	d. line	No	No	No	Yes
	e. wedge	No	No	No	Yes
	f. Herringbone	No	No	No	Yes
	g. vee	No	No	No	Yes
	h. coil	No	No	No	Yes
17. Special Engagement Requirements	a. surprise tgts	No	No	No	Yes
	b. assault fire	No	No	No	Yes
	c. support by fire	No	No	No	Yes
18. Space	a. spt-by-fire int	No	No	No	Yes
	b. fire & man int	No	No	No	Yes
	c. assault int	No	No	No	Yes
	d. fire pos int	No	No	No	Yes
19. Visibility	a. unlimited-day	Yes	Yes	Yes	Yes
	b. limited-day	Yes	No	Yes	Yes
	c. w/o ill-nite	No	No	No	Yes
	d. w/ill-nite	No	No	No	No
20. Terrain Grade	a. flat	No	No	Yes	Yes
	b. hilly	Yes	Yes	Yes	Yes
21. Terrain Vegetation	a. none	No	No	Yes	Yes
	b. brush	Yes	No	Yes	Yes
	c. trees	Yes	Yes	Yes	Yes

APPENDIX G

EVALUATION OF TRAINING DEVICE FIDELITY

APPENDIX G EVALUATION OF TRAINING DEVICE FIDELITY

CONTENTS

APPENDIX G-1
EVALUATION OF VIGS ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Enter gunner station	NO				1-Turret interior not represented.
Operate domelight	NO				1-No domelight.
Operate intercom	NO				1-No intercom.
Install coax	NO				1-No coax.
Adjust seats	NO				1-No seat.
Adjust browpads	NO				1-"Browpads" do not adjust.
Adjust chestrest	NO				1-Chestrest not represented.
Power up station	NO				1-Related components not represented.
Perform GPS function check	NO				1-Lights work but sights don't respond correctly.
Adjust GPS	NO				1-Drift knobs don't work/GPS eyepiece doesn't adjust.
Perform computer self-test	NO				1-CCP not represented.
Perform computer data check	NO				1-CCP not represented. 2-TRU READY & FAULT lights not represented. 2-SYMBOLS brightness not represented. 2-UNIT TEST PATTERN switch is painted in OFF position. 2-GPS THERMAL ballistic door not represented. 2-THERMAL MAGNIFICATION lever not represented. 2-FOCUS knob not represented. 3-For TIS engagements, FLTR/CLEAR/SHTR in CLEAR will give no image. 3-For day engagements, FLTR/CLEAR/SHTR in SHTR will give a green tint to day picture. 3-On ARI thermal disk, images are set for black hot; white hot setting makes image difficult/impossible to interpret. 3-On demo disk, thermal images are set for white hot; black hot setting will cause image to flicker.
Perform TTS check	YES	NO	NO	NO	4-Too many inconsistencies with actual equipment.
Perform GAS adjust	NO				1-GAS not represented.
Check power control handles	YES	NO	NO	YES	3-"Turret" cannot be fully traversed. 2-FIRE CONTROL MODE switch not represented.
Check manual elevation/traverse cranks	NO				1-Manual controls not represented.

Activity 1. PREPARE STATIONS FOR OPERATION (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Perform lead system check	NO				4-No observable reticle movement.
Perform firing circuits check	NO				1-No firing circuit tester.
Perform crosswind sensor check	NO				1-No crosswind sensor.
Perform hydraulic pressure check	NO				1-No hydraulic pressure gage.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Boresight main gun	NO				1-No boresight knobs. No CCP.
Zero coax	NO				1-No coax.
Report weapon status	YES	YES	YES	YES	
Index battlecarry ammo on AMMO SEL switch	YES	YES	YES	YES	1-ARI thermal disk retains and prints out indexed ammo for each round fired.
Introduce battlesight range into CCP	NO				1-No CCP.
Option 2.1. Prepare for Offense					
Receive TC briefing	YES	YES	YES	YES	
Option 2.2. Prepare for Defense					
Inspect terrain through GPS/TIS GPS/TIS	NO				1-No time to inspect terrain.
Check GAS clearance	NO				1-No GAS.
Learn TRP locations/ranges	NO				1-No time to learn TRPs.

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Part 3.1. - Search					
Option 3.1.1. Open Hatch - Day					
VIGS does not simulate open-hatch viewing					
Option 3.1.2. Closed Hatch - Day					
Select GPS/TIS magnification	NO				1-No magnification lever.
Search on gun axis using GPS	NO				1-No time for searching.
Alternate using GPS with TIS	NO				1-Exercises are eight day or thermal; students cannot use both channels in a particular exercise.
Execute search techniques	NO				1-No time for searching.
Option 3.1.2. Night					
Search on gun axis using TIS	NO				1-No time for searching.
Part 3.2. Detection/Location/Identify					
Detect target(s)/signature(s)/ obstacles	NO				1-Engagement starts after fire command.
Locate target(s)	NO				1-Engagement starts after fire command.
Identify target(s) by:					
· IFFN	NO				1-Engagement starts after fire command.
· Nomenclature	NO				1-Engagement starts after fire command.
If target detected, announce GUNNER REPORT, <target>, <location>	NO				1-Engagement starts after fire command.
Confirm acquisition report	NO				1-Engagement starts after fire command.
Estimate range to evaluate LRF return	YES	YES	NO	YES	3-Clarity of videodisc image varies; however, some range cues are actually quite good.

Activity 3. ACQUIRE TARGET(S) (cont'd)	Provide Comment if Response Is NO				Comments
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	
Part 3.3. Evaluate Situation					
No gunner actions					

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.1. Precision Engagement - Moving (Offense)					
VIGS does not simulate owntank movement					
Option 4.2. Precision Engagement - Defense					
Set/check switches:					
' FIRE CONTROL MODE: NORMAL	NO				1-No FIRE CONTROL MODE switch.
. LRF: ARM LAST RTN	YES	YES	NO	NO	3/4-No apparent effect of setting this switch; laser will fire even if in SAFE.
. GPS: 3X	NO				1-GPS MAGNIFICATION lever is painted in 10X position.
. GUN SELECT: MAIN	YES	YES	YES	YES	
. AMMO SELECT as announced	YES	YES	YES	YES	
Sight through GPS	YES	YES	YES	YES	
Grasp palm switches	YES	YES	NO	NO	3/4-On Perceptronics demo, turret may be traversed and gun may be fired w/o depressing palm switch; may be of negative transfer. 3/4-On ARI thermal disk, turret cannot be traversed w/o depressing palm switch but gun will fire; may be source of negative transfer.
Look through GAS to determine when gun clears defilade	NO				1-No GAS. 1-Assures hull-down position w/no defilade blocking main gun.
Announce DRIVER STOP	NO				1-No "driver" or owntank movement. 1-Assures hull-down position w/no defilade blocking main gun.
Look through GPS	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	NO				1-GPS MAGNIFICATION lever is painted in 10X position.
Lay on center mass of target	YES	YES	NO	YES	3-Cadillac is too sensitive. 3/4-Must continue to track after firing at target; experienced gunners may not.
Track moving target	YES	YES	NO	NO	3/4-No simulation of lead sensor system; lead to learning "ambushing" behaviors. 3-Turret hydraulic noise is unrealistic.
Depress lase button(s)	YES	YES	NO	NO	3/4-Incorrect range will cause round to miss on 1st round; but firing at target causes correct range to be input subsequent rounds.**

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Evaluate range display	YES	YES	YES	YES	
Check ready-to-fire and fault symbols	YES	NO	YES	NO	2/4-Fault symbols do not appear; may train student to ignore.
Make control lay	YES	YES	YES	YES	
Listen for UP	YES	YES	YES	NO	3-Initial UP is provided by synthesized voices; subsequent UP's are presented on viewing screen.
Listen for FIRE	YES	YES	YES	NO	3-"TC" does not wait for GNR's IDENTIFIED.
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	NO	NO	3/4-Must continue tracking to hit moving target; put experienced GNR at disadvantage.
Option 4.3. Gunner cannot identify announced target					
Case 4.3.A.					
Announce CANNOT IDENTIFY or does not respond	NO				1-"TC" will not respond to announcement.
Case 4.3.B.					
Announce IDENTIFY <DIFFERENT TARGET>	NO				1-"TC" will not identify incorrectly; will not respond to GNR's announcement.
Option 4.4. Use TIS					
Same as Options 1-2 with alternate switch settings:					
* THERMAL MODE: ON	YES	YES	YES	YES	
. FLTR/CLEAR/SHTR: SHTR	YES	YES	NO	YES	3-On thermal engagements, no image on CLEAR or FLTR.
. THERMAL MAGNIFICATION: 3X to 10X	NO				1-GPS MAGNIFICATION lever is painted in 10X position.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
. POLARITY SWITCH: WHITE or BLACK HOT, as desired	YES	NO	NO	NO	2/3/4-Unlike actual TIS, polarity depends on videodisc: Perceptronics TIS is best on WHITE HOT; ARI TIS is better on BLACK HOT; may cause problems for experienced GNRs.
· SENSITIVITY, CONTRAST, and FOCUS for best image	YES	NO	YES	YES	2-Focus ring is not represented.

Activity 5. ADJUST FIRE	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Recover sight picture	YES	NO	NO	NO	2/3-Sight picture is not list, i.e., no recoil. 3-No obscuration effects. 3-Other effects of firing (smell, smoke, etc.) are not simulated. 4-Expected transfer is nil.
Observe/announce round effects	YES	YES	NO	NO	3-Bursts are cartoonish and of uniform size. 3-Glitch in ARI thermal videodisc provides two bursts. 4-Zero transfer because bursts are difficult to interpret.
Option 5.1. Reengage					
Announce REENGAGING	YES	YES	YES	YES	
Release/reengage palm switches	YES	YES	NO	NO	3/4-Releasing/reengaging palm switches has no effect on outcome.
----- REMAINDER OF ENGAGEMENT SAME AS PRECISION -----					
Option 5.2. Standard Adjustment					
Observe/announce deflection and range error	YES	NO	NO	YES	2/3-There are no degrade mode exercises to cue gunner to use standard adjustment.
Release/reengage palm switches	YES	YES	NO	NO	3/4-Releasing/reengaging palm switches has no effect on outcome.
Adjust 1 mil deflection	YES	YES	NO	NO	3/4-Standard adjustment will cause a miss.
Adjust 200 meters range	YES	YES	NO	NO	3/4-Standard adjustment will cause a miss.
----- REMAINDER OF ENGAGEMENT SAME AS PRECISION -----					
Option 5.3. TC Adjustment					
VIGS does not provide TC station nor simulate TC adjustments.					
----- REMAINDER OF ENGAGEMENT SAME AS PRECISION -----					

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	NO				1-No FIRE CONTROL MODE switch.
• LRF: ARM LST RTN	YES	YES	NO	NO	3/4-No effect of setting this switch; LRF will fire in any position, even SAFE.
• GPS: 3X	YES				1-GPS MAGNIFICATION is painted in 10X position.
• GUN SELECT: COAX	YES	YES	YES	YES	
Grasp palm switches	YES	YES	NO	NO	3/4-On Perceptronics demo, turret may be traversed and gun may be fired w/o depressing palm switch; may be source of negative transfer. 3/4-On ARI thermal disk, turret cannot be traversed w/o depressing palm switch but gun will fire; may be source of negative transfer.
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	NO				1-GPS MAGNIFICATION is painted in 10X position.
Lay center of mass	YES	YES	NO	YES	3-Cadillac is too sensitive.
Depress lase button(s)	YES	YES	NO	NO	3/4-Errors in lasing.**
Evaluate range display	YES	YES	YES	YES	
Listen for FIRE	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Fire 20-30 round burst (5-6 tracers) to destroy/ suppress point/area targets	YES	NO	NO	YES	2-No area targets, e.g., troops. 2-Targets cannot be "suppressed." 3-Tracers are not clearly visible; makes VIGS task more difficult than M1.
Adjust fire	YES	NO	NO	YES	2-"Effects" of MG fire (smoke, blower) not represented. 3-Tracers are not clearly visible; makes VIGS task more difficult than M1.

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Engage first target using precision gunnery (Option 4.1 or 4.2)					
If first target is not destroyed, adjust fire as described in Activity 5	YES	YES	NO	NO	3/4-Releasing/reengaging palm switches has no effect on outcome.
Engage second target using precision gunnery (Option 4.1 or 4.2)					

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)	Provide Comment if Response Is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
VIGS does not provide for simulation of cal .50 or TC station. Therefore it cannot support simultaneous engagements.					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.1. Engage targets using battlesight gunnery					
Set/check switches:					
· FIRE CONTROL MODE: NORMAL	NO				1-No FIRE CONTROL MODE switch.
. LRF: SAFE	YES	YES	NO	NO	3/4-No apparent effect of setting this switch; laser will fire even if in SAFE.
. GPS: 3X	NO				1-GPS MAGNIFICATION lever is painted in 10X position.
. GUN SELECT: MAIN	YES	YES	YES	YES	
. AMMO SELECT: battlecarry ammo	YES	YES	YES	YES	
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	YES	YES	NO	NO	3/4-Ranges to target on ARI thermal disk (as indicated by LRF) are too short for battlesight techniques.
Option 9.2. Ineffective LRF					
VIGS does not simulate ineffective LRF.					
Option 9.3. Multiple return indicator bar					
VIGS does not present multiple returns.					
Option 9.4. No range display (loss of symbology)					
VIGS does not simulate loss of symbology.					
Option 9.5. Crosswind sensor failure					
VIGS does not simulate crosswind sensor failure.					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

Option 9.6. Cant sensor failure

VIGS does not simulate cant sensor failure.

Option 9.7. Lead angle sensor failure

VIGS does not simulate lead angle sensor failure.

Option 9.8. GPS failure (day channel)

VIGS does not simulate GPS failure.

Option 9.9. GPS/TIS failure

VIGS does not simulate GPS/TIS failure.

Option 9.10. GAS gunnery

VIGS does not simulate GAS gunnery.

Option 9.11. Emergency mode

VIGS does not simulate stab failure; leading target will result in miss.

Option 9.12. Turret power failure

VIGS does not simulate turret power failure; no manual controls.

Activity 10. ENGAGE TARGET FROM TC POSITION	Provide Comments if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

VIGS does not provide TC position.

Activity 11. ASSESS RESULTS OF ENGAGEMENT	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Check/adjust MRS	NO				1-CCP not represented.
Index battlecarry ammo	YES	NO	NO	NO	3/4/5-No ammo given by TC.
Announce <AMMO> INDEXED	YES	YES	YES	YES	

APPENDIX G-2
EVALUATION OF TOPGUN ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Enter gunner station	NO				1-Turret interior not represented.
Operate domelight	NO				1-No domelight.
Operate intercom	NO				1-No intercom.
Install coax	NO				1-No coax.
Adjust seats	NO				1-No seat.
Adjust browpads	NO				1-No browpads.
Adjust chestrest	NO				1-No chestrest.
Power up station	NO				1-Related components not represented.
Perform GPS function check	NO				1-GUN SELECT is only switch on Fire Control Panel that is represented, and it will not be functional in initial version.
Adjust GPS	NO				1-None of the switches/hits on the Reticle Control Panel are represented.
Perform computer self-test	NO				1-CCP not represented.
Perform computer data check	NO				1-CCP not represented.
Perform TIS check	NO				1-Only THERMAL MODE switch, POLARITY switch, and MAGNIFICATION selectors are represented. 1-TIS sight is activated by a sight toggle switch which is not in tank, or is autoselected by software.
Perform GAS adjust	NO				1-No GAS adjust controls.
Check power control handles	YES	NO	NO	YES	2-FIRE CONTROL mode switch not represented. 3-GUN SELECT switch does not function.
Check manual elevation/traverse cranks	NO				1-No manual controls.
Perform lead system check	NO				4-No observable reticle movement.
Perform firing circuits check	NO				1-No firing circuit tester.
Perform crosswind sensor check	NO				1-No crosswind sensor.
Perform hydraulic pressure check	NO				1-No hydraulic pressure gage.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Boresight main gun	NO				1-No boresight knobs. 1-No CCP.
Zero coax	NO				1-No coax.
Report weapon status	YES	YES	YES	YES	
Index battlecarry ammo on AMMO SEL switch	NO				1-No AMMO SELECT switch.
Introduce battlesight range into CCP	NO				1-No CCP.
Option 2.1. Prepare for Offense					
Receive TC briefing	YES	YES	YES	YES	
Option 2.2. Prepare for Defense					
Inspect terrain through GPS/TIS GPS/TIS	NO				1-No time to inspect terrain.
Check GAS clearance	NO				1-No GAS.
Learn TRP locations/ranges	NO				1-No time to learn TRPs.

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Part 3.1. - Search					
Option 3.1.1. Open Hatch - Day					
TopGun does not simulate open-hatch viewing.					
Option 3.1.2. Closed Hatch - Day					
Select GPS/TIS magnification	YES	YES	YES	YES	
Search on gun axis using GPS	YES	YES	YES	YES	
Alternate using GPS with TIS	YES	YES	NO	NO	3/4-Toggle switch is used to select GPS, TIS, or GAS; expected transfer is nil. 2/3-Terrain not varied. 2/3-No air targets.
Execute search techniques	YES	NO	NO	NO	4-Top-down wide field of view, which is not available in M1, is used to search for targets; experienced GNRs will not know of feature.
Option 3.1.3. Night					
Search on gun axis using TIS	YES	YES	YES	YES	
Part 3.2. Detection/Location/Identify					
Detect target(s)/signature(s)/ obstacles	YES	NO	NO	NO	2/3/4-Only target signature is gun flash; expected transfer is nil.
Locate target(s)	YES	YES	YES	YES	
Identify target(s) by:					
· IFFN	NO				1-All targets are threats.
· Nomenclature	NO				1-Only one threat target: T62.

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
If target detected, announce GUNNER REPORT, <target>, <location>	YES	YES	NO	NO	3/4-Since there is no TC, behavior would normally not occur; consequently, expected transfer is nil.
Confirm acquisition report	NO				1-No other crewman to provide acquisition report.
Estimate range to evaluate LRF return	YES	YES	NO	NO	3/4-Range cues from CRT display are substantially different from real-world cues.

Part 3.3. Evaluate Situation

No gunner actions specified

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.1. Precision Engagement - Moving (Offense)					
Top Gun does not simulate owntank movement					
Option 4.2. Precision Engagement - Defense					
Set/check switches:					
' FIRE CONTROL MODE: NORMAL	NO				1-No FIRE CONTROL MODE switch.
. LRF: ARM LAST RTN	YES	YES	YES	YES	
. GPS: 3X	YES	YES	YES	YES	
. GUN SELECT: MAIN	YES	YES	NO	NO	3/4-Switch and indicator lamps are represented but not-operational; zero/negative transfer is expected.
. AMMO SELECT as announced	NO				1-No AMMO SELECT switch.
Sight through GPS	YES	NO	NO	NO	2/3/4/5-Large (15") CRT display, viewed binocularly, substitutes for all sights; choice of GPS/TIS/GAS is controlled by toggle switch which is not in M1 tank.
Grasp palm switches	YES	YES	YES	YES	
Look through GAS to determine when gun clears defilade	NO				1-Assumes hull-down position w/no defilade blocking main gun. 1-GAS reticle is obtained by a toggle switch.
Announce DRIVER STOP	NO				1-No "driver" or owntank movement. 1-Assumes hull-down position w/no defilade blocking main gun.
Look through GPS	NO				1-Large (15") CRT display, viewed binocularly, substitutes for all sights.
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	YES	YES	YES	YES	
Lay on center mass of target	YES	YES	YES	YES	
Track moving target	YES	YES	YES	YES	
Depress lase button(s)	YES	YES	NO	YES	3/4-Software requires lase button press for auto lead.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Evaluate range display	YES	YES	YES	YES	
Check ready-to-fire and fault symbols	YES	NO	NO	NO	2/3/4-Fault symbols are not presented.
Make control lay	YES	YES	YES	YES	
Listen for UP	YES	YES	NO	YES	3-Generated by computer synthesis.
Listen for FIRE	YES	YES	NO	NO	3/4-Pseudo "TC" does not wait for GNR's IDENTIFIED.
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	
Option 4.3. Gunner cannot ident.'v announced target					
Case 4.3.A.					
Announce CANNOT IDENTIFY or does not respond	NO				1-Pseudo "TC" will not respond to announcement.
Case 4.3.B.					
Announce IDENTIFY <DIFFERENT TARGET>	NO				1-Pseudo "TC" will not identify incorrectly; will not respond to announcement.
Option 4.4. Use TIS					
Same as Options 1-2 with alternate switch settings: · THERMAL MODE: ON	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO				Comments
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	
. FLTR/CLEAR/SHTR: SHTR	NO				1-No FLTR/CLEAR/SHTR switch.
* THERMAL MAGNIFICATION: 3X to 10X	YES	YES	YES	YES	
. POLARITY SWITCH: WHITE or BLACK HOT, as desired	YES	YES	YES	YES	
* SENSITIVITY, CONTRAST, and FOCUS for best image	NO				1-No SENSITIVITY, CONTRAST, or FOCUS knobs.

Activity 5. ADJUST FIRE	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
					3-Other effects of firing (smell, smoke) are not simulated.
Recover sight picture	YES	NO	NO	NO	2/3-Sight picture is not list, i.e., no recoil. 4-Expected transfer is nil.
Observe/announce round effects	YES	YES	YES	YES	
Option 5.1. Reengage					
Announce REENGAGING	YES	YES	YES	YES	
Release/reengage palm switches	YES	YES	YES	YES	
----- ENGAGEMENT SAME AS PRECISION -----					
Option 5.2. Standard Adjustment					
Observe/announce deflection and range error	YES	YES	YES	YES	
Release/reengage palm switches	YES	YES	YES	YES	
Adjust 1 mil deflection	YES	YES	YES	YES	
Adjust 200 meters range	YES	YES	YES	YES	
----- ENGAGEMENT SAME AS PRECISION -----					
Option 5.3. TC Adjustment					

Top Gun does not provide TC station nor simulate TC adjustments.

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

Top Gun does not simulate coax engagements.

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Engage first target using precision gunnery (Option 4.1 or 4.2)					
If first target is not destroyed, adjust fire as described in Activity 5	YES	YES	YES	YES	
Engage second target using precision gunnery (Option 4.1 or 4.2)					

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGMENTS	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

Top Gun does not provide for simulation of cal .50 or TC station.
Therefore, it cannot support simultaneous engagements.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	Provide Comment if Response Is NO				Comments
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	

Option 9.1. Engage targets using battlesight gunnery

TC does not announce battlesight engagements. Battlesight range cannot be preindexed. Therefore, TopGun does not support battlesight engagements.

Option 9.2. Engage target given ineffective LRF

TopGun does not simulate ineffective LRF.

Option 9.3. Engage targets given multiple returns from LRF

TopGun does not simulate multiple returns from LRF.

Option 9.4. Engage target given no range display (loss of symbology)

TopGun does not simulate loss of symbology.

Option 9.5. Engage target given crosswind sensor failure

TopGun does not simulate crosswind sensor failure.

Option 9.6. Engage target given cant sensor failure

TopGun does not simulate cant sensor failure.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comments If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.7. Engage target given lead angle sensor failure					
TopGun does not simulate lead angle sensor failure.					
Option 9.8. Engage target given GPS failure (day channel)					
Engage target using TIS (Option 4.4)					
Option 9.9. Engage target given GPS/TIS failure					
Case 9.9.A. Use GAS					
Engage targets using GAS gunnery (Option 9.9)					
Case 9.9.B. Index estimated range and use precision gunnery					
Open CCP door	NO				1-No CCP.
Press RANGE button	NO				1-No CCP.
Enter <RANGE>	NO				1-No CCP.
Press ENTER button	NO				1-No CCP.
Close CCP door	NO				1-No CCP.
Engage target using precision gunnery (Option 4.1 or 4.2)					
Case 9.9.C. Use battlesight gunnery					
Engage target using battlesight gunnery (Option 9.1)					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.10. Engage target using GAS					
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	NO				1-No FIRE CONTROL MODE switch.
• LRF: SAFE	YES	YES	YES	YES	
• GUN SELECT: MAIN	YES	YES	NO	NO	3/4-Switch and indicator lamps are represented but non-operational; zero/negative transfer is expected.
• AMMO SELECT: as announced	NO				1-No AMMO SELECT switch.
Sight through GAS	YES	NO	NO	NO	2/3/4-Large (15") CRT display, viewed binocularly, substitutes for all sights; choice of GPS/TIS/GAS is controlled by toggle switch which is not in M1 tank.
Grasp palm switches	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Lay announced range line on target	YES	NO	YES	YES	2-Range lines for APDS only.
Lead moving target	YES	YES	YES	YES	
Listen for FIRE	YES	YES	NO	NO	3/4-FIRE may occur whether or not GNR has announced IDENTIFIED.
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	

Option 9.11. Engage target given stabilization system failure (emergency mode)

TopGun does not simulate stabilization system failure.

Option 9.12. Engage target given turret power failure

TopGun does not simulate turret power failure.

Activity 10. ENGAGE TARGET FROM TC POSITION	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

TopGun does not provide TC station.

Activity 11. ASSESS RESULTS OF ENGAGEMENT	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Check/adjust MRS	NO				1-No CCP button.
Index battlecarry ammo	NO				1-No AMMO SELECT switch.
Announce <AMMO> INDEXED	NO		NO		1-No AMMO SELECT switch.

APPENDIX G-3
EVALUATION OF U-COFT ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Enter gunner station	NO				1-GNR enters gunner station through curtains at rear of U-COFT.
Operate domelight	YES	YES	YES	YES	
Operate intercom	YES	NO	NO	YES	2-Amp (LDR's station) is assumed ON. 3-Footswitch does not function.
Install coax	NO				1-Coax mockup is permanently installed.
Adjust seats	YES	YES	YES	YES	
Adjust browpads	YES	YES	NO	YES	3-Browpads have extra "play" due to simulation of recoil.
Adjust chestrest	YES	YES	YES	YES	
Power up station	YES	NO	NO	YES	2-Turret elevation/traverse locks are not simulated. 2-LDR's gun/turret switch is not simulated. 3-Hydraulic pressure gage is painted on and always reads 1600 psi.
Perform GPS function check	YES	NO	NO	YES	2-LDR's gun/turret switch is not simulated. 3-Turret blower noise is faintly simulated through CVC only.
Adjust GPS	YES	YES	YES	YES	
Perform computer self-test	YES	NO	NO	YES	2-CANT and CROSSWIND failures cannot be simulated. 3-Hydraulic pressure gage is painted on and always reads 1600 psi.
Perform computer data check	YES	YES	NO	YES	3-Hydraulic pressure gage is painted on and always reads 1600 psi.
Perform TIS check	YES	YES	YES	YES	
Perform GAS adjust	YES	YES	YES	YES	
Check power control handles	YES	YES	YES	YES	
Check manual elevation/traverse cranks	YES	NO	NO	YES	2-Main gun elevation/traverse travel locks are not represented. 3-Traverse resistance is constant and too light.
Perform lead system check	YES	NO	NO	YES	2/3-No turret motion after handles are centered.
Perform firing circuits check	NO				1-Firing circuit tester/indicator light is not represented. 1-Breechblock is not represented. 1-LDR panel is not represented.
Perform crosswind sensor check	NO				1-Crosswind sensor on tank exterior is not represented. 1-Crosswind cannot be induced.
Perform hydraulic pressure check	NO				1-Hydraulic pressure gage is painted on and always reads 1600 psi. 1-"Engine" cannot be shut off.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
					2-Pye-Watson device is not represented. 2-Tank cannot be on unlevel ground. 2-Breech cannot be opened. 2-Machineguns cannot be cleared. 3-Boresight panel is exactly at 1200 m with range preindexed in the fire control system.
Boresight main gun	YES	NO	NO	NO	4-GNR practices incorrect procedure w.r.t. averaging boresight readings.
					1-Coax mockup cannot be loaded. 3-Turret blower noise is faintly simulated through CVC only. 3-"Tracers" are too tightly clustered. 4-Software "glitch" prevents machinegun strike errors from being adjusted out.
Zero coax	YES	NO	NO	NO	4-One shouldn't zero on boresight target.
Report weapon status	YES	YES	YES	YES	
Index battlecarry ammo on AMMO SEL switch	YES	YES	YES	YES	
Introduce battlecarry range into CCP	YES	YES	YES	YES	
Option 2.1. Prepare for offense					
Receive TC briefing	YES	YES	YES	NO	
Option 2.2. Prepare for defense					
Inspect terrain through GPS/TIS	YES	YES	NO	YES	3-Terrain is cartoonish and objects are subject to misinterpretation.
Check GAS clearance	YES	YES	NO	YES	3-All defensive engagements start behind berm; no need to check.
Learn TRPs	YES	YES	NO	YES	3-Terrain is cartoonish and objects are subject to misinterpretation.

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Part 3.1. - Search					
Option 3.1.1. Open hatch - day					
U-COFT does not simulate open-hatch viewing conditions.					
Option 3.1.2. Closed hatch - day					
Select 3X GPS/TIS magnification	YES	YES	NO	YES	3-Shapes/details of objects change as a function of magnification.
Search on gun axis using GPS	YES	YES	NO	YES	3-Visual scene is stylized/cartoonish.
Alternate using GPS with TIS	YES	YES	NO	NO	
Execute search techniques to acquire targets	YES	YES	YES	YES	
Option 3.1.2. Night					
Search on gun axis using TIS	YES	YES	NO	YES	3-Thermal image is too consistent and too good; images are too uniform.
Part 3.2. Detection/Location/ID/Reporting					
Detect target(s)/signature(s)/ obstacle(s)	YES	NO	NO	NO	2-No target signatures other than flashes from direct fire. 2-Limited array of potential vehicles. 3-Obstacles have no effect on tank movement; TC cannot control movement. 4-Expected transfer is nil.
Locate target(s)	YES	YES	YES	YES	
Identify target(s) making the following determinations:					
· IFFN	YES	NO	NO	YES	
· Nomenclature	YES	NO	NO	YES	2/3-Target array is limited; consequently target ID is easier than actual task.
If target detected, announce GUNNER REPORT, <TARGET> <LOCATION>	YES	YES	YES	YES	2/3-Target array is limited; consequently target ID is easier than actual task.

Activity 3. ACQUIRE TARGET(S) (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Confirm target	YES	YES	YES	YES	3/4-Targets appear closer than they are because distant objects are too distinct and saturated in color. 3/4-Objects are difficult to distinguish (e.g., trees = hills) making relative size judgments difficult. 3/4-Lay of land is difficult to determine.
Estimate range (approximate in order to evaluate LRF return)	YES	YES	NO	NO	4-Anecdotal evidence indicates that range estimation on U-COFT may be difficult for the expert at first, but he quickly adjusts.

Part 3. Evaluate situation

No gunner actions

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.1. Precision engagement - moving (offense)					
Set/check switches:					
' FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
. LRF: ARM LAST RTN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming LRF before fire command.
. GPS: 3X	YES	YES	YES	YES	
. GUN SELECT: MAIN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming main gun before fire command.
. AMMO SELECT as announced	YES	YES	YES	YES	
Sight through GPS	YES	YES	YES	YES	
Grasp palm switches	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	YES	YES	NO	YES	3-Shapes/details change as a function of magnification.
Lay on center mass of target	YES	YES	YES	YES	
Track moving target	YES	YES	NO	YES	3-No turret motion cues. 3-U-COFT handles are too sensitive; real handles are "smoother."
Listen for driver alerts	NO				1-Driver verbal inputs are not simulated.
Depress lase button(s)	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Check ready-to-fire and fault symbols	YES	YES	YES	YES	
Make control lay	YES	YES	YES	YES	
Listen for UP	YES	YES	NO	YES	3-Computer synthesized voice.
Listen for FIRE	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	

Activity 4. ENGAGE STABLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.2. Precision engagement - stationary (defense)					
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
. LRF: ARM LAST RTN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming LRF before fire command.
. GPS: 1X	YES	YES	YES	YES	
. GUN SELECT: MAIN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming main gun before fire command.
. AMMO SELECT as announced	YES	YES	YES	YES	
Sight through GPS	YES	YES	YES	YES	
Grasp palm switches	YES	YES	YES	YES	
Look through GAS to determine when gun clears defilade	YES	YES	YES	YES	
Announce DRIVER STOP	YES	YES	YES	YES	
Look through GPS	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	YES	YES	NO	YES	3-Shapes/details change as a function of magnification.
Lay on center mass of target	YES	YES	YES	YES	
Track moving target	YES	YES	NO	YES	3-U-COFT handles are too sensitive; real handles are "smoother."
Depress lase button(s)	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Check ready-to-fire and fault symbols	YES	YES	YES	YES	
Make control lay	YES	YES	YES	YES	
Listen for FIRE	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	
Option 4.3. Gunner cannot identify announced target					
Case 4.3.A.:					
Announces CANNOT IDENTIFY or does not respond	YES	YES	YES	YES	
Case 4.3.B.:					
Announces IDENTIFY <DIFFERENT TARGET>	YES	YES	YES	YES	
Option 4.4. Use TIS					
Engage targets using precision gunnery (Option 4.1 or 4.2) with the following alternate switch settings:					
* THERMAL MODE: ON	YES	YES	NO	YES	3-Thermal image is too good/consistent.
. FLTR/CLEAR/SHTR: SHTR	YES	YES	NO	YES	3-Thermal image is too good/consistent.
. THERMAL MAGNIFICATION: 3X to 10X	YES	YES	NO	YES	3-Thermal image is too good/consistent.
. POLARITY SWITCH: WHITE or BLACK HOT, as desired	YES	YES	NO	YES	3-Thermal image is too good/consistent.
* SENSITIVITY, CONTRAST, and FOCUS for best image	YES	YES	NO	YES	3-Thermal image is too good/consistent.

Activity 5. ADJUST FIRE	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Recover sight picture	YES	NO	NO	YES	2/3-Simulated recoil is too weak to cause total loss of sight picture. 2/3-Other effects of firing (smell, smoke, etc.) are not simulated.
Observe/announce strike of every round	YES	YES	NO	YES	3-Round bursts are uniform, cartoonish flashes. 3-Probability of "LOST" is practically nil.
Option 5.1. Reengage					
Announce REENGAGING	YES	YES	YES	YES	
Release/reengage palm switches	YES	YES	YES	YES	
- - - - - ENGAGEMENT SAME AS PRECISION - - - - -					
Option 5.2. Standard adjustment					
Observe/announce deflection and range error	YES	YES	YES	YES	
Release/reengage palm switches	YES	YES	YES	YES	
Adjust 1 mil deflection	YES	YES	YES	YES	
Adjust 200 meters range	YES	YES	YES	YES	
- - - - - ENGAGEMENT SAME AS PRECISION - - - - -					
Option 5.3. TC adjustment					
Release/reengage palm switches	YES	YES	YES	YES	
Apply TC correction	YES	YES	YES	YES	
- - - - - ENGAGEMENT SAME AS PRECISION - - - - -					

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Check/positions switches:					
• FIRE CONTROL MODE NORMAL	YES	YES	YES	YES	
• LRF: ARM LST RTN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming LRF prior to fire command.
• GPS: 3X	YES	YES	YES	YES	
• GUN SELECT: COAX	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming coax before fire command.
Grasp palm switches	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	YES	YES	YES	YES	
Lay center of mass	YES	YES	YES	YES	
Depress lase button(s)	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Listen for FIRE	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Fire 20-30 round burst (5-6 tracers) to destroy/suppress point area targets	YES	NO	NO	YES	2-Targets cannot be "suppressed." 3-Personnel are represented as flashing dots.
Adjust fire	YES	NO	NO	YES	2-"Effects" of MG fire (smoke, blower) not represented. 3-Tracer rounds are not dispersed enough making U-COFT easier than M1.

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Engage first target using precision gunnery (Option 4.1 or 4.2)					
If first target is not destroyed, adjust fire as described in Activity 5	YES	YES	YES	YES	
Engage second target using precision gunnery (Option 4.1 or 4.2)					

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 8.2. Simultaneous targets					
Engage main gun target using precision gunnery (Option 4.1 or 4.2)					
Adjust fire using gunner's standard adjustment (Option 5.2)					
Announce TARGET--CEASE FIRE	YES	YES	YES	YES	
Option 8.2. Cal .50 targets					
Aid in adjusting TC's weapon	YES	YES	YES	YES	

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.1. Engage targets using battlesight gunnery					
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
• LRF: SAFE	YES	YES	YES	NO	3-U-COFT does not penalize GNR for arming LRF before fire command.
• GPS: 3X	YES	YES	YES	YES	3-U-COFT does not penalize GNR for arming LRF before fire command.
• GUN SELECT: MAIN	YES	YES	YES	NO	3-U-COFT does not penalize GNR for arming main gun before fire command.
• AMMO SELECT: battlecarry ammo	YES	YES	YES	YES	3-U-COFT does not penalize GNR for arming main gun before fire command.
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	YES	YES	YES	YES	3-U-COFT does not penalize GNR for arming main gun before fire command.
Option 9.2. Engage target given ineffective LRF					
Case 9.2.A. Use battlesight gunnery					
Engage target using battlesight gunnery (Option 9.1)					
Case 9.2.B. TC indexes range					
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target					
Announce IDENTIFIED	YES	YES	YES	YES	
Case 9.2.C. TC indexed range					
Open CCP door	YES	YES	YES	YES	
Press RANGE button	YES	YES	YES	YES	
Enter <RANGE>	YES	YES	YES	YES	
Press ENTER button	YES	YES	YES	YES	
Close CCP door	YES	YES	YES	YES	
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Case 9.2.0. GNR manually applies range					
Engage target using GAS (Option 9.10)					
Option 9.3. Engage target given multiple returns from LRF					
Depress lase button(s)	YES	YES	YES	YES	
If multiple return symbol appears in GPS, announce RANGE <IN METERS>	YES	YES	YES	YES	
Switch LRF setting in accordance with TC instructions	YES	YES	YES	YES	
Relay on target	YES	YES	YES	YES	
Depress lase button(s)	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Option 9.4. Engage target given no range display (loss of symbology)					
U-COFT does not simulate loss of symbology					
Option 9.5. Engage target given crosswind failure					
U-COFT does not simulate crosswind sensor failure					
Option 9.6. Engage target given cant sensor failure					
U-COFT does not simulate cant sensor failure					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.7. Lead angle sensor failure					
U-COFT does not simulate lead sensor failure independent of stab failure					
Option 9.8. GPS Failure (Day Channel)					
Engage target using TIS (Option 4.4)	NO				2/3-In U-COFT, inducing GPS failure induces TIS failure as well.
Option 9.9. Engage target given GPS/TIS failure					
Case 9.9.A.					
Engage targets using GAS gunnery (Option 9.9)					
Case 9.9.B. Use GAS battlesight techniques					
Engage target using battlesight gunnery (Option 9.1) but with GAS instead of GPS					
Option 9.9. Engage target using GAS					
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
• LRF: SAFE	YES	YES	YES	YES	
• GUN SELECT: MAIN	YES	YES	YES	YES	3-U-COFT does not penalize GNR for arming main gun prior to fire command.
• AMMO SELECT: as announced	YES	YES	YES	YES	3-U-COFT does not penalize GNR for arming main gun prior to fire command.
Sight through GAS	YES	YES	YES	YES	
Grasp palm switches	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Lay announced range line on target	YES	YES	NO	NO	3/4-Software error causes fall of round to disagree with range as announced by I/O (Witmer).

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Lead moving target	YES	YES	YES	YES	
Listen for FIRE	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	
Option 9.11. Engage target given stabilization system failure (emergency mode)					
Set/check switches:					
• FIRE CONTROL MODE: EMERGENCY	YES	YES	YES	YES	
• LRF: ARM LAST RTN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming laser prior to fire command.
• GPS: 3X	YES	YES	YES	YES	
• GUN SELECT: MAIN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming main gun prior to fire command.
• AMMO SELECT: as announced	YES	YES	YES	YES	4-U-COFT does not penalize GNR for arming main gun prior to fire command.
Sight through GPS	YES	YES	YES	YES	
Grasp palm switches	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
If target is moving, apply lead	YES	YES	YES	YES	
Listen for FIRE	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Sens?	(4) Positive Trans/Cor?	Comments
Option 9.12. Engage target given turret power failure (manual mode)					
Set/check switches:					
* FIRE CONTROL MODE: MANUAL	YES	YES	YES	YES	
* GPS: IX	YES	YES	YES	YES	
* GUN SELECT: MAIN	YES	YES	YES	NO	4-U-COFT does not penalize GNR for arming main gun before fire command.
* AMMO SELECT: as announced	YES	YES	YES	YES	4-U-COFT does not penalize GNR for arming main gun before fire command.
Sight through GAS	YES	YES	YES	YES	
Traverse/elevate with manual controls	YES	YES	NO	YES	3-Traverse resistance too light/uniform.
Announce IDENTIFIED	YES	YES	YES	YES	
Lay announced range line on target	YES	YES	NO	NO	3/4-Software error causes fall of round to disagree with range as announced by I/O (Witmer).
If target is moving, apply lead	YES	YES	YES	YES	3/4-Software error causes fall of round to disagree with range as announced by I/O (Witmer).
Listen for FIRE	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Press elevation knob firing trigger	YES	YES	YES	YES	
If gun fails to fire, vigorously turn blasting machine handle 3-4 times	YES	YES	YES	YES	

Activity 10. ENGAGE TARGET FROM TC POSITION	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
(TC performs these behaviors in 3-man engagements)					
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
• TIS: STBY/ON	YES	YES	YES	YES	
• LRF: ARM LAST RTN	YES	YES	YES	YES	
• GPS: 10K	YES	YES	YES	YES	
• GUN SELECT: MAIN	YES	YES	YES	YES	
• AMMO SELECT: as announced	YES	YES	YES	YES	

Activity 11. ASSESS RESULTS OF ENGAGEMENT	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Check/adjust MRS	YES	NO	NO	YES	2-MIX PWR is not an option; "engine" is always ON. 3-Gun movements resulting from MRS update are not simulated.
Index battlecarry ammo	YES	YES	YES	YES	
Announce <AMMO> INDEXED	YES	YES	YES	YES	

APPENDIX G-4
EVALUATION OF SIMNET ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Enter gunner station	NO				1-Enter SIMNET through door at side of crew compartment.
Operate domelight	YES	NO	NO	YES	2/3-No red filter on domelight. 3-Domelight does not go completely off.
Operate intercom	YES	YES	NO	YES	3-Headset/boom mike are used instead of CVC helmet. 3-Rocker switch on cable substitutes for 3-position switch on helmet.
Install coax	NO				1-No coax.
Adjust seats	NO				1-GNR seat does not adjust.
Adjust browpads	NO				1-GPS browpads do not adjust.
Adjust chestrest	NO				1-No chestrest.
Power up GNR station	YES	NO	NO	NO	2-PANEL LIGHTS TEST button and adjust knob are painted on. 2-CCP is painted closed. 2-All thermal controls are painted on with the THERMAL MODE switch painted in the OFF position. 2-The hydraulic pressure gage is not represented. 2-The main gun travel and turret traverse locks are not represented. 3-The MANUAL indicator light of the FIRE CONTROL MODE switch is painted on. 4-Most of the components associated with this procedure are missing or are nonfunctioning; expected transfer is nil.
Perform GPS function check	YES	NO	NO	NO	2-No DEFROSTER switch on indicator light. 2-No GPS ballistic doors. 2-FLTR/CLEAR/SHTR switch is painted in the CLEAR position. 3-MANUAL indicator light of the FIRE CONTROL MODE switch is painted on. 3-COAX indicator light of the GUN SELECT switch is painted on. 3-BN and HEP indicator lights of the AMMUNITION SELECT switch are painted on. 4-Many of the components associated with this procedure are missing or nonfunctioning; expected transfer is nil.
Adjust GPS	NO				1-GPS cannot be focused. 1-Reticle drift does not exist and cannot be adjusted.
Perform computer self-test	NO				1-CCP door is painted closed.
Perform computer data check	NO				1-CCP door is painted closed.
Perform TIS check	NO				1-TIS does not function. 1-TIS controls are painted on.
Perform GAS adjust	NO				1-No GAS.
Check power control handles	YES	YES	NO	YES	3-Lase buttons operate without squeezing palm grips. 3-Gun tube does not automatically elevate over rear deck.
Check manual elevation/traverse cranks	NO				1-No manual cranks.

Activity 1. PREPARE STATIONS FOR OPERATION (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Perform lead system check	NO				1-No apparent reticle movement as a function of turret traversal.
Perform firing circuits check	NO				1-No firing circuit tester.
Perform crosswind sensor check	NO				1-No crosswind sensor.
Perform hydraulic pressure check	NO				1-No hydraulic pressure gage.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Provide Comment if Response Is NO — Comments
Boresight main gun	NO				1-Main gun is assumed to be boresighted.
Zero coax	NO				1-No coax.
Report weapon status	YES	YES	NO	YES	3-Stimuli would differ since previous procedures cannot be performed.
Index battlecarry ammo on AMMO SEL switch	YES	YES	YES	YES	
Introduce battlesight range into CCP	NO				1-CCP door is painted closed.
Option 2.1. Prepare for offense					
Receive TC briefing	YES	YES	YES	YES	
Option 2.2. Prepare for defense					
Inspect terrain through GPS/TIS	YES	NO	YES	YES	2-No TIS.
Check GAS clearance	NO				1-No GAS.
Learn TRP locations/ranges	YES	YES	YES	YES	

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Part 3.1. - Search					
Option 3.1.1. Open hatch - day					
SIMNET does not simulate open-hatch viewing conditions.					
Option 3.1.2. Closed hatch - day					
Select 3X GPS/TIS magnification	YES	YES	NO	YES	3-Shapes of objects change as a function of magnification.
Search on gun axis using GPS	YES	YES	YES	YES	
Alternate using GPS with TIS	NO				1-No TIS.
Execute search techniques to acquire targets	YES	YES	YES	YES	
Option 3.1.3. Night					
SIMNET does not simulate night viewing conditions.					
Part 3.2. Detection/Location/Identify Target(s)					
Detect targets(s)/signature(s)/ obstacles	YES	NO	NO	YES	2-No target signatures other than dust and smoke from moving vehicles. 3-Most obstacles have little effect on tank movement. 4-Expected transfer is nil.
Locate target(s)	YES	YES	YES	YES	
Identify target(s) making the following determinations:					
· IFFN	YES	YES	NO	NO	3/4-Easier than actual task due to color distinction (friend = brown/threat = green); expected transfer is nil.
· Nomenclature	YES	YES	NO	NO	3/4-Easier than actual task due to the limited array of threat targets (T72, BMP); expected transfer is nil.
If target detected, announce GUNNER REPORT, TARGET>, <LOCATION>	YES	YES	YES	YES	

Activity 3. ACQUIRE TARGET(S) (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Confirm acquisition report	YES	YES	YES	YES	
Estimate range to evaluate LRF return	YES	YES	NO	NO	3/4-Range cues from CRT displays are substantially different from real world cues; puts experienced personnel at disadvantage.

Part 3.3. Evaluate situation

No gunner actions specified

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.1. Precision engagement - moving (offense)					
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
. LRF: ARM LAST RTN	YES	YES	YES	YES	
. GPS: 3X	YES	YES	YES	YES	
. GUN SELECT: MAIN	YES	YES	YES	YES	
. AMMO SELECT as announced	YES	YES	YES	YES	
Sight through GPS	YES	YES	YES	YES	
Grasp palm switches	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	YES	YES	NO	YES	3-Shapes change as a function of magnification.
Lay on center mass of target	YES	YES	YES	YES	
Track moving target	YES	YES	NO	NO	3/4-No simulation of lead sensor system; lead to acquiring inappropriate tracking behaviors, e.g., "ambushing" targets.
Listen for driver alerts	YES	YES	YES	YES	
Depress lase button(s)	YES	YES	NO	NO	3/4-LRF will fire without squeezing palm switches; may be source of negative transfer.
Evaluate range display	YES	YES	YES	YES	
Check ready-to-fire and fault symbols	YES	YES	YES	YES	
Make control lay	YES	YES	YES	YES	
Listen for UP	YES	YES	YES	YES	
Listen for FIRE	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGET WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.2. Precision engagement - stationary (defense)					
Set/check switches:					
• FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
. LRF: ARM LAST RTN	YES	YES	YES	YES	
. GPS: 3X	YES	YES	YES	YES	
. GUN SELECT: MAIN	YES	YES	YES	YES	
. AMMO SELECT as announced	YES	YES	YES	YES	
Sight through GPS	YES	YES	YES	YES	
Grasp palm switches	YES	YES	YES	YES	
Look through GAS to determine when gun clears defilade	NO				1-No GAS.
Announce DRIVER STOP	YES	YES	NO	NO	3/4-Without GAS, it is difficult to determine when to stop; may cause problem to experienced GNR's and train new GNR's to ignore GAS.
Look through GPS	YES	YES	YES	YES	
Announce IDENTIFIED	YES	YES	YES	YES	
Switch GPS to 10X	YES	YES	YES	YES	
Lay on center mass of target	YES	YES	NO	YES	3-No turret motion cues.
Track moving target	YES	YES	NO	NO	3/4-No simulation of lead sensor system; lead to acquiring inappropriate tracking behaviors, e.g., "ambushing" targets.
Depress lase button(s)	YES	YES	YES	NO	3/4-LRF will fire without squeezing palm switches; may be source of negative transfer.
Evaluate range display	YES	YES	YES	YES	
Check ready-to-fire and fault symbols	YES	YES	YES	YES	
Make control lay	YES	YES	YES	YES	
Listen for UP	YES	YES	YES	YES	
Listen for FIRE	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGET WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	
Continue tracking	YES	YES	YES	YES	

Option 4.3. Gunner cannot identify announced target

Case 4.3.A.:

Announce CANNOT IDENTIFY or does not respond	YES	YES	YES	YES	

Case 4.3.B. GNR identifies incorrect target(s)

Announce IDENTIFY <DIFFERENT TARGET>	YES	YES	YES	YES	

Option 4.4. Use TIS

SIMNET does not simulate thermal optics viewing conditions

Activity 5. ADJUST FIRE	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Recover sight picture	YES	NO	NO	YES	2/3-Recoil is not simulated.
Observe/announce strike of every round	YES	YES	YES	YES	
Option 5.1. Reengage					
Announce REENGAGING	YES	YES	YES	YES	
Release/reengage palm switches	YES	YES	NO	NO	3/4-No simulation of lead sensor system; has no effect.
----- REMAINDER OF ENGAGEMENT SAME AS PRECISION (Option 4.1 or 4.2) -----					
Option 5.2. Standard adjustment					
Observe/announce deflection and range error	YES	YES	YES	YES	
Release/reengage palm switches	YES	YES	NO	NO	(See comments above)
Adjust 1 mil deflection	YES	YES	YES	YES	
Adjust 200 meters range	YES	YES	YES	YES	
----- REMAINDER OF ENGAGEMENT SAME AS PRECISION (Option 4.1 or 4.2) -----					
Option 5.3. TC adjustment					
Release/reengage palm switches	YES	YES	NO	NO	(See comments above)
Apply TC correction	YES	YES	YES	YES	
----- REMAINDER OF ENGAGEMENT SAME AS PRECISION (Option 4.1 or 4.2) -----					

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX

SIMNET does not simulate coax engagements.

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN

	Provide Comment if Response Is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Engage first target using precision gunnery (Option 4.1 or 4.2)					
If first target is not destroyed, adjust fire as described in Activity 5	YES	YES	YES	YES	
Engage second target using precision gunnery (Option 4.1 or 4.2)					

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS

SIMNET does not simulate cal .50 engagements.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.1. Engage targets using battlesight gunnery					
Set/check switches:					
* FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
* LRF: SAFE	YES	YES	YES	YES	
* GPS: 3X	YES	YES	YES	YES	
* GUN SELECT: MAIN	YES	YES	YES	YES	
* AMMO SELECT: battlecarry ammo	YES	YES	NO	YES	3-AMMO SELECT has no effect on BS range; for either Sabot or HEAT; the displayed range is 1200 meters.
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	YES	YES	YES	YES	
Option 9.2. Engage target given ineffective LRF					
SIMNET does not simulate ineffective LRF.					
Option 9.3. Engage target given multiple returns from LRF					
Depress lase button(s)	YES	YES	YES	YES	
If multiple return symbol appears in GPS, announce RANGE <IN METERS>	YES	YES	YES	YES	
Switch LRF setting in accordance with TC instructions	YES	YES	YES	YES	
Relay on target	YES	YES	YES	YES	
Depress lase button(s)	YES	YES	YES	YES	
Squeeze trigger(s)	YES	YES	YES	YES	

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

Option 9.4. Engage target given no range display (loss of symbology)

SIMNET does not simulate loss of symbology.

Option 9.5. Engage target given crosswind sensor failure

SIMNET does not simulate crosswind sensor failure.

Option 9.6. Engage target given cant sensor failure

SIMNET does not simulate cant sensor failure.

Option 9.7. Lead angle sensor failure

SIMNET does not simulate lead angle sensor failure.

Option 9.8. Engage target given GPS failure (day channel)

SIMNET does not simulate thermal channel viewing conditions.

Option 9.9. Engage target given GPS/TIS failure

Case 9.9.A. Use GAS

Original plans for SIMNET called for GAS reticle to automatically appear in GPS sight as a result of GPS failure. Software problems prevent this option from being used at present.

Range cannot be indexed in ballistic computer.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

Case 9.9.8. Use battlesight gunnery

Engage target using battlesight gunnery (Option 9.1)

Option 9.10. Engage target using GAS

SIMNET does not provide GAS.

Option 9.11. Engage target given stabilization system failure (emergency mode)

Original plans for SIMNET called for simulation of stabilization system failure and for the fire control system to operate in emergency mode. Software problems prevent this option being used at present.

Option 9.12. Engage target given turret power failure

SIMNET does not simulate turret power failure; manual controls are not provided.

Activity 10. ENGAGE TARGET FROM TC POSITION	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
(TC performs these behaviors in 3-man engagements)					
Set/check switches:					
* FIRE CONTROL MODE: NORMAL	YES	YES	YES	YES	
* TIS: STBY/ON	NO				1-TIS controls are painted on; THERMAL MODE switch is painted in OFF position.
* LRF: ARM LAST RTN	YES	YES	YES	YES	
* GPS: 10X	YES	YES	YES	YES	
* GUN SELECT: MAIN	YES	YES	YES	YES	
* AMMO SELECT: as announced	YES	YES	YES	YES	

Activity 11. ASSESS RESULTS OF ENGAGEMENT	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Check/adjust MRS	NO				1-No MRS; gun tube is assumed to be straight at all times.
Index battlecarry ammo	YES	YES	YES	YES	
Announce <AMMO> INDEXED	YES	YES	YES	YES	

APPENDIX G-5
EVALUATION OF U-COFT ON TANK COMMANDER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Enter station	NO				1-Enter U-COFT through curtains at rear.
Power up CWS/turret	YES	NO	YES	YES	2-Cannot practice task w/AUX HYDR POWER; "engine" always runs.
Operate domelight	YES	YES	YES	YES	
Operate intercom	YES	NO	NO	YES	2-Cannot turn on amplifier at loader's station. 3-INT switch does not function.
Adjust seat	YES	YES	YES	YES	
Adjust hatch	NO				1-"Hatch" is sealed; does not operate.
Adjust platforms	YES	NO	YES	YES	2-Cannot open hatch to adjust platform.
Install TC's weapon	NO				1-No TC weapon.
Adjust kneeguard	YES	YES	NO	YES	3-Purpose of knee guard is to protect knee from main gun's recoil, which is not simulated.
Adjust GPSE headrest, lens	YES	YES	NO	YES	3-View changes as TC moves in/out sights due to electronic eye that is not in M1. 3-Headpads have extra play due to "recoil."
Check manual range controls	YES	YES	YES	YES	
Check power control handle	YES	YES	NO	YES	3-No motion cues.
Check CWS in power/manual modes	YES	YES	NO	YES	3-Only one unity window at CWS.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
					1-TC's primary role (manipulate muzzle boresight device) cannot be performed. See additional notes at gunner's activities.
Supervise/assist boresight	NO				2-Cannot load TC's weapon.
					2-Cannot sight through barrel.
					2-Cannot check headspace/timing.
Boresight TC's weapon	YES	NO	NO	YES	3-Boresight lesson is initialized w/target exactly at 500m and w/the range preindexed.
					2-Butterfly safety switch on MG is not represented.
					3-One normally does not zero on boresight targets.
Zero TC's weapon	YES	NO	NO	NO	4-Software "glitch" prevents MG strike errors from being adjusted out.
Select/announce battlecarry AMMO, RANGE	YES	YES	YES	YES	
Option 2.1. Prepare for Offense					
Receive offensive mission/ formation/movement/commo	YES	YES	YES	YES	
					2-Terrain features (especially defiles) are difficult to identify.
					2-Cover and concealment only applies to deflade (stationary engagements).
					3-View is limited to buttoned up mode and only through GPSE, CWS sight, and FUP.
					3-Ranges are difficult to estimate (see comments at "estimate range").
					3-Obstacles are irrelevant since TC cannot control driver.
Analyze terrain	YES	NO	NO	NO	4-Because of preceding problems, transfer would be nil.
Check map overlay	NO				1-Maps have not been prepared for U-COFT terrain.
Brief crew	YES	NO	NO	YES	2/3-Loader/driver are not present.
Control driver, if necessary to maintain position in plt formation, and to exploit cover and concealment	NO				1-TC can only start/stop "driver"; no real control over movement. 1-U-COFT limited to single tank gunnery.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS (cont'd)	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 2.2. Prepare for Defense					
Move with platoon to occupy battle position	NO				1-U-COFT limited to single tank gunnery. 1-Cannot select battle position.
Receive defensive mission/ position comno	YES	YES	YES	YES	
Prepare primary/alternate/ supplementary positions	NO				1-Cannot exit "tank." 1-Cannot move between defensive positions.
Analyze terrain	YES	NO	NO	NO	2-Trafficability cannot be determined. 2-Terrain features (especially defiles) are difficult to identify. 2-Cover and concealment only applies to defilade (stationary engagements). 3-View is limited to buttoned up mode and only through GPSE, CWS sight, and FUP. 3-Ranges are difficult to estimate (see comments at "estimate range"). 3-Obstacles are irrelevant since TC cannot control driver. 4-Because of preceding problems, transfer would be nil.
Prepare tank sketch card	YES	NO	NO	NO	2-Sectors of fire are irrelevant because U-COFT is limited to single tank gunnery. 3-No open-hatch or dismounted recon of terrain. 3-Only limited target reference points can be noted, e.g., no friendly artillery cites are represented. 4-Because of problems transfer would be practically nil.

Activity 3. ACQUIRE TARGET(S)	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Part 3.1. - Search for Target(s)					
Option 3.1.1. Search open hatch - day					
U-COFT does not simulate open-hatch viewing					
Option 3.1.2. Search closed hatch - day					
Search 360°	YES	YES	NO	NO	3/4-Must use FUP and traverse; experienced crewman would use all UPs and not traverse. 3/4-Targets appear only in forward sector of view.
Perform air guard duties	YES	YES	NO	NO	3/4-Must use FUP and traverse; experienced crewman would use all UPs and not traverse. 3/4-Targets appear only in forward sector of view. 3/4-Only one sort of aircraft is represented: MIMD-D.
Execute search techniques	YES	YES	NO	YES	3-Limited by having only one UP. 3-Cartoonish display provides unrealistic search context.
Option 3.1.3. Search at night					
Search 360°	YES	YES	NO	NO	3/4-Must use FUP and traverse; experienced crewman would use all UPs and not traverse. 3/4-Targets appear only in forward sector of view.
Use off center vision	NO				1-Applies to open-hatch viewing.
Part 3.2. Detect/Locate/Identify Target(s)					
Detect target(s)	YES	NO	NO	NO	2-Limited array of targets. 2/4-TC cannot control movement around obstacles; could provide negative transfer. 3-Cartoonish images limit realism.
Locate target(s)	YES	YES	NO	YES	3-cartoonish images limit realism.
Identify target(s) by:					
· IFFN	YES	NO	NO	YES	2-Limited array of targets; makes U-COFT task easier than combat task. 3-Limited detail on targets; makes U-COFT task more difficult than combat task.
· Nomenclature	YES	NO	NO	YES	2-Limited array of targets; makes U-COFT task easier than combat task. 3-Limited detail on targets; makes U-COFT task more difficult than combat task.
Note number of target	YES	YES	YES	YES	
Classify multiple targets as most dangerous/dangerous/ least dangerous	YES	YES	YES	YES	

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Confirm acquisition report	YES	NO	YES	YES	2-Can receive report only from GNR
Estimate range to select weapon(s) and to evaluate LRF return	YES	YES	NO	NO	3-Although target sizes are appropriate for range, objects are difficult to distinguish (e.g., trees - hills) making relative size judgments difficult. 3-Lay of land is difficult to determine. 3-Depth cues relating to clarity & color saturation are absent. 4-Experienced soldier reported difficulty in judging U-COFT distances.
Send contact report to platoon leader	YES	YES	YES	YES	
Part 3.3. Evaluate Situation					
Decide whether or not to engage contingent on: · Plt mission · Platoon fire plan · Plt ldr command	NO				1-Crew always engages targets. 1-Other tanks in platoon are not represented.
Select the appropriate weapon/ammunition and the firing mode (precision/degraded) contingent on: · Target range · Type of target (hard/soft, point/area) · Tank status ammo, malfunctions	YES	NO	YES	NO	2-No LDR's MG. 4-System will score error for selecting SABOT for HIND-D, which is doctrinally incorrect.
Determine crewman (GNR, TC, LDR) and the type of fire command (single, multiple, or simultaneous) contingent on: · Number of targets · Target classification	YES	NO	YES	YES	2-No Ldr's MG.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.1. Engage single target from the offense using precision gunnery					
Issue contact report: CONTACT <DIRECTION> <TARGET>	YES	YES	YES	YES	
Decide whether to engage target while moving or from a short halt	YES	NO	YES	YES	2-TC can stop tank only in degraded ("stab out") exercises. 2-Tank cannot move into defilade.
If engaging from a short halt, issue driver command: DRIVER STOP	YES	YES	YES	YES	
Relay any action drill command	NO				1-Cannot execute action drill.
Issue fire command GUNNER <AMMO><TARGET>	YES	YES	YES	NO	4-System will score error for firing SABOT at MIND-D.
Lay gun (simultaneous with fire command)	YES	YES	YES	YES	
Release override	YES	YES	YES	YES	
Sight through GPSE	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Listen for UP	YES	YES	NO	YES	3-Computer synthesized voice.
Announce FIRE, or FIRE, FIRE <ALTERNATE AMMO>	YES	YES	YES	YES	
Option 4.2. Engage single target from the defense using precision gunnery					
Issue contact report CONTACT <DIRECTION>, <TARGET>	YES	YES	YES	YES	
Issue fire command GUNNER <AMMO> <TARGET>	YES	YES	YES	NO	4-System will score error for firing SABOT at MIND-D.
Announce DRIVER MOVE OUT, GUNNER TAKE OVER	YES	YES	YES	YES	
Lay gun (simultaneous with fire command)	YES	YES	YES	YES	
Release override	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Sight through GPSE	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Listen for UP	YES	YES	YES	YES	
Announce FIRE, or FIRE, FIRE <ALTERNATE AMMO>	YES	YES	YES	YES	
Option 4.3. Gunner cannot identify announced target					
Case 4.3.A. Gunner fails to identify target(s)					
Direct gunner onto target using					
· Command TRAVERSE <LEFT or RIGHT>, STEADY, ON	YES	YES	YES	YES	
· Use TRP	YES	YES	NO	YES	3-TRPs are cartoonish and difficult to distinguish.
· Announce WATCH MY TRACERS and use .50 caliber tracers to point to target	YES	YES	YES	YES	
OR					
Announce FROM MY POSITION and proceed with TC engagement (see Activity 10)					
Case 4.3.B. Gunner identifies incorrect target(s)					
If GNR is correct, issue a correction to the fire command	YES	YES	YES	YES	
If GNR has identified the wrong target, treat as Case 4.3.A and proceed					
Option 4.4. Use TIS					
Engage targets using precision gunnery (see Option 4.1 or 4.2)					

Activity 5. ADJUST FIRE	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Recover sight picture	YES	YES	NO	YES	2/3-Simulated recoil is too weak to cause loss of sight picture. 3-Other effects of firing (odor, smoke) are not simulated. 3-Round bursts are uniform, cartoonish flashes. 3-Probability of "LOST" is practically nil. 3-Time limitations preclude observations.
Observe strike of round	YES	YES	NO	YES	3-Target observation is easy because target changes color (green to black).
If TARGET was observed, determine whether or not target was destroyed	NO				1-Cannot hit target without "destroying" it.
Option 1.5. Use reengage technique					
Evaluate range	YES	YES	NO	YES	3-Poor range cues (see previous comments on "Estimate Range" element).
Announce FIRE	YES	YES	YES	YES	
Option 5.2. Standard adjustment					
No TC actions specified					
Option 3. TC Adjustment					
Issue subsequent fire command to adjust fire .5-3 mils in deflection and .5 - 2 mils (100-400 meters) in range	YES	YES	YES	YES	
If target is destroyed or exposure too long, command CEASE FIRE	YES	YES	YES	YES	
If in defensive posture, command DRIVER, BACK UP	YES	YES	YES	YES	

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Issue fire command GUNNER COAX <TARGET>	YES	YES	YES	YES	
Lay gun (simultaneous with fire command)	YES	YES	YES	YES	
Release override	YES	YES	YES	YES	
Evaluate range display	YES	YES	NO	YES	3-Poor range cues (see comments at "Estimate Range").
Announce FIRE	YES	YES	YES	YES	
Monitor/evaluate engagement	YES	YES	YES	YES	
Command CEASE FIRE	YES	YES	YES	YES	

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Issue fire command: GUNNER <AMMO> <NUMBER> <TARGETS>, <RIGHT/LEFT> <TARGET> FIRST	YES	YES	YES	YES	
Engage first target using precision gunnery (Option 4.1 or 4.2)					
If first target is not destroyed, adjust fire (Activity 5)					
If first target is destroyed, announce <NEXT> TARGET	YES	NO	NO	YES	2/3-Severe U-COFT time standards are difficult to meet; student may not get this far.
[Continue until all targets are destroyed]					
Announce CEASE FIRE	YES	YES	YES	YES	

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 8.1. Simultaneous targets					
Issue fire command: GUNNER <AMMO> <TARGET>, FIRE AND ADJUST	YES	YES	YES	YES	
Option 8.2. Cal .50 targets					
Announce: CALIBER FIFTY	YES	YES	YES	YES	
Charge TC's weapon	NO				1-No Cal .50 charging handle.
Lay weapon for deflection	YES	YES	YES	YES	
Estimate range to target	YES	YES	NO	NO	3-Although target sizes are appropriate for range, objects are difficult to distinguish (e.g., trees = hills) making relative size judgments difficult. 3-Lay of land is difficult to determine. 3-Depth cues relating to clarity & color saturation are absent. 4-Experienced soldier reported difficulty in judging U-COFT distances.
Lay CWS sight range line on target	YES	YES	YES	YES	
Fire bursts of 10-15 rounds	YES	YES	YES	YES	
Adjust fire if needed	YES	YES	YES	YES	
If target is destroyed, announce TC COMPLETE	YES	YES	YES	YES	

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.1. Engage targets using battlesight gunnery					
Issue fire command: GUNNER BATTLESIGHT <TARGET>	YES	YES	YES	YES	
Depress MANUAL RANGE BATTLE SGT button	YES	YES	YES	YES	
Estimate range to target	YES	YES	NO	NO	3-Although target sizes are appropriate for range, objects are difficult to distinguish (e.g., trees = hills) making relative size judgments difficult. 3-Lay of land is difficult to determine. 3-Depth cues relating to clarity & color saturation are absent 4-Experienced soldier reported difficulty in judging U-COFT distances.
If target outside of +-200 meters of battlesight range, enter range change using MAN RNG B/S ADD DROP toggle switch	YES	YES	YES	YES	
Check range readout in GPSE	YES	YES	YES	YES	
Engage target using precision gunnery (Option 4.1 or 4.2) but without evaluating LRF display					
Option 9.2. Engage target given ineffective LRF					
If LRF fails to function or is rendered ineffective due to environmental conditions, TC has the choice of using one of the following techniques:					
Case 9.2.A. Use battlesight gunnery					
Engage target using battlesight gunnery (Option 9.1)					
Case 9.2.B. TC indexes range					
Issue fire command: GUNNER <AMMO> TARGET	YES	YES	YES	YES	
Estimate range to target	YES	YES	NO	NO	3/4-Range cues in U-COFT are substantially different from real world; puts experienced TC at disadvantage.
Index range using MAN RNG B/S ADD/DROP toggle switch	YES	YES	YES	YES	

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Case 9.2.C. GNR indexes range					
Estimate range to target	YES	YES	NO	NO	3/4-Range cues in U-COFT are substantially different from real world; puts experienced TC at disadvantage.
Issue fire command: GUNNER <AMMO> INDEX RANGE	YES	YES	YES	YES	
Case 9.2.D. GNR manually applies range					
Engage target using GAS (Option 9.10)					
Option 9.3. Engage targets given multiple returns from LRF					
Estimate range	YES	YES	NO	NO	3-Although target sizes are appropriate for range, objects are difficult to distinguish (e.g., trees = hills) making relative size judgments difficult. 3-Lay of land is difficult to determine. 3-Depth cues relating to clarity & color saturation are absent. 4-Experienced soldier reported difficulty in judging U-COFT distances.
Evaluate range display	YES	YES	YES	YES	
If range appears incorrect, may instruct GNR to switch LRF setting from ARM LAST RTN to ARM 1ST RTN or vice versa	YES	YES	YES	YES	
Case 9.3.A. Gunner relases					
Announce relase	YES	YES	YES	YES	
Case 9.3.B. TC corrects range					
Correct range using MAN RNG B/S ADD/DROP toggle switch	YES	YES	YES	YES	
If displayed range is within +-200 m of estimated range, announce FIRE	YES	YES	YES	YES	

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.4. Engage target given no range display (loss of symbology)					
U-COFT does not simulate loss of symbology					
Option 9.5. Engage target given crosswind sensor failure					
U-COFT does not simulate crosswind sensor failure					
Option 9.6. Engage target given cant sensor failure					
U-COFT does not simulate cant sensor failure					
Option 9.7. Engage target given lead angle sensor failure					
U-COFT does not simulate lead angle sensor failure independent of stab failure					
Option 9.8. Engage target given GPS failure (day channel)					
If no GPS image, have GNR switch to thermal channel and engage targets using TIS (Option 4.4)	NO				1-Inducing GPS failure will also induce TIS failure; consequently TC/GNR should proceed to Option 9.
Option 9.9. Engage target given GPS/TIS failure					
If both GPS and TIS fail, the TC has the choice of using one of the following engagement techniques					
Case 9.9.A. Use GAS with precision techniques					
Engage targets using GAS gunnery (Option 9.9)					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comments If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-A Some?	(4) Positive Trans/Carr?	Comments
Case 9.9.8. Use GAS with battlesight techniques					
Engage target using battlesight gunnery (Option 9.1)					
Option 9.10. Engage target using GAS gunnery					
Estimate range to target	NO				1-Range to target is a "given" in B-COFT GAS exercises.
Issue fire command: GUNNER <ADD> <TARGET> <RANGE>	YES	YES	YES	YES	
Lay gun (simultaneous with fire command)	YES	YES	YES	YES	
Release override	YES	YES	YES	YES	
Announce FIRE	YES	YES	YES	YES	
Option 9.11. Engage target given stabilization system failure (to emergency mode)					
Issue fire command: GUNNER <ADD> <TARGET>	YES	YES	YES	YES	
Lay gun (simultaneous with fire command)	YES	YES	YES	YES	
Announce DRIVER STOP	YES	YES	YES	YES	
Release override	YES	YES	YES	YES	
Announce FIRE	YES	YES	YES	YES	
Announce DRIVER, MOVE OUT	YES	YES	YES	YES	
Option 9.12. Engage target given turret power failure (to manual mode)					
Announce DRIVER STOP	YES	YES	YES	YES	
Issue fire command: GUNNER <ADD> <TARGET> <CORRECTION> <RANGE>	YES	YES	NO	NO	3/4-Poor range cues (see previous comments).
Announce FIRE	YES	YES	YES	YES	
Announce DRIVER, MOVE OUT	YES	YES	YES	YES	

Activity 10. FIRING TARGETS FROM THE TC POSITION (Also Three Man Crew Engagements)	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-A Jump?	(4) Positive Traps/Car	Comments
Issue one of the following fire commands:					
Case 10.A. Gunner cannot identify target					
FROM MY POSITION	YES	YES	YES	YES	
or					
Case 10.B. Three-man crew (no GNR)					
LOAD <AP/HE>	YES	YES	YES	YES	
Estimate range to target	YES	YES	NO	NO	3-Although target sizes are appropriate for range, objects are difficult to distinguish (e.g., trees - hills) making relative size judgments difficult. 3-Lay of land is difficult to determine. 3-Depth cues relating to clarity & color saturation are absent. 4-Experienced soldier reported difficulty in judging U-COFT distances.
Sight through GPSE	YES	YES	YES	YES	
Lay on center mass of target	YES	YES	YES	YES	
Depress lase button	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Make control key	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger	YES	YES	YES	YES	
Announces CEASE FIRE	YES	YES	YES	YES	

Activity 11. ASSESS RESULTS OF ENGAGEMENT	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-A Same?	(4) Positive Train/Cer?	Comments
Assess battle damage/ casualties	NO				1-Battle damage/casualties are not represented.
Determine if and how crew should be reorganized to fight in a three-man configuration	NO				1-M-CDFT has only TC and GNR crew position.
Issue SPOTREP	YES	YES	NO	YES	1-Exercise may stop before SPOTREP can be given.
Case 11.A. Stationary					
Determine whether to move to primary, alternate, or supplementary firing positions	NO				1-Cannot move between firing positions.
Case 11.B. Moving					
Determine changes to route	NO				1-Cannot change routes.
Issue driver commands	YES	NO	YES	YES	2-"DVR" can only respond to stop/move out.
Determine appropriate ammo for anticipated targets	YES	YES	YES	YES	
Announce PREPARE BATTLECARRY <AMMO> or RELOAD <AMMO>	YES	YES	YES	YES	
Enter battlecarry range using the MANUAL BATTLE SGT ADD/DROP toggle switch	YES	YES	YES	YES	

APPENDIX G-6
EVALUATION OF SIMNET OM TANK COMMANDER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Car?	Comments
Enter station	NO				1-Enter SIMNET through door at side of crew compartment. 2-No CWS POWER/MANUAL lever. 2-PANEL LIGHTS adjust knob is painted on. 3-VEHICLE MASTER POWER switch is a simple toggle, not the pull-out/set switch on actual tank. 3-ENGINE FIRE and CKT BKR OPEN warning lights are painted on. 3-AUX HYDR POWER indicator light is painted on and the switch is painted in the OFF position.
Power up CWS/turret	YES	NO	NO	NO	4-Differences are so great that expected transfer is nil.
Operate dome light	YES	YES	NO	YES	2/3-No red filter on dome light. 1-Dome light does not go completely off.
Operate intercom	YES	NO	NO	YES	3-Headrest/boom mike are used instead of CVC helmet. 3-Footrest bar is not represented.
Adjust seat	YES	NO	NO	NO	2-Footrest bar is not represented. 3-TC seat does not flip down. 3-No CWS sight. 3-Expected transfer is nil.
Adjust hatch	NO				1-No hatch.
Adjust platform	NO				1-No platform.
Install TC's weapon	NO				1-No CAL .50.
Adjust kneepaard	NO				1-No kneepaard.
Adjust GPSE headrest/lens	NO				1-GPSE headrest does not adjust. 1-GPSE lens does not adjust.
Check manual range controls	YES	NO	NO	YES	2-Cannot index 3S ranges into CCP. 3-Regardless of AMMUNITION SELECT switch position, 8S range is 1200 meters.
Check power control handle	YES	YES	NO	NO	3/4-LRF will fire without squeezing palm grips.
Check CWS in power/manual modes	YES	NO	NO	YES	2-CWS operates only in power mode: no traverse ring on elevation crank. 3-Turret traverses only 300°.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Supervise/assist boresight	NO				1-SIMNET gun is always boresighted.
Boresight TC's weapon	NO				1-No CAL .50.
Zero TC's weapon	NO				1-No CAL .50.
Select/announce battlecarry AMMO, RANGE	YES	YES	NO	NO	3-TC can select and announce battlesight range, but GNR cannot input into CCP. 4-Trains TC to ignore this step.
Option 2.1. Prepare for offense					
Receive offensive mission/ formation/movement/commo	YES	YES	YES	YES	
Analyze terrain	YES	YES	NO	YES	3-Vegetation is sparse, e.g., tree lines are only one tree deep. 3-Obstacles have less effect on SIMNET than they do in real life.
Check map overlay	YES	YES	NO	YES	3-SIMNET terrain is smoothed; requires special maps.
Brief crew	YES	YES	YES	YES	
Control driver, if necessary to maintain position in plt formation and to exploit cover and concealment	YES	YES	NO	YES	3-Maneuvering vehicle is easier/faster than in real world due to terrain smoothing and lack of jostling resulting from movement. 3-Exploiting cover/concealment is more difficult because of smoothed terrain and sparse vegetation.
Option 2.3. Prepare for defense					
Move with platoon to occupy battle position	YES	YES	NO	YES	3-Tanks in platoon are identical making them difficult to distinguish.
Receive defensive mission/ position commo	YES	YES	YES	YES	
Prepare primary/alternate/ supplementary positions	NO				1-Cannot dismount to prepare positions.
Analyze terrain	YES	YES	NO	YES	3-Vegetation is sparse, e.g., tree lines are only one tree deep. 3-Obstacles have less effect on SIMNET than they do in real life.
Prepare tank sketch card	YES	YES	NO	NO	3/4-With azimuth indicator (which is not in actual tank) and LRF, it is easy to prepare a formal range card; skills may not transfer to real world where TC must prepare a sketch range card.

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Part 3.1. - Search for Target(s)					
Option 3.1.1. Search open hatch - day					
SIMNET does not simulate open-hatch viewing conditions.					
Option 3.1.2. Search closed hatch - day					
Search 360°	YES	NO	NO	NO	2-TC turret is rotatable through only 300°. 3/4-Accomplished by rotating turret instead of head; this slow and cumbersome process may confuse experienced TCs.
Perform air guard duties	YES	YES	NO	NO	3/4-No air targets at present; student TCs may learn to ignore this element.
Execute search techniques	YES	YES	YES	YES	
Option 3.1.3. Search at night					
SIMNET does not simulate night viewing conditions.					
Part 3.2. Detect/Locate/Identify Target(s)					
Detect target(s)/signature(s)/ obstacle(s)	YES	NO	NO	YES	2-No target signatures other than dust and smoke from other vehicles. 3-Most obstacles have little or no effect on tank movement.
Locate target(s)	YES	YES	YES	YES	
Identify target(s) by . IFFN	YES	YES	NO	NO	3/4-Easier than actual task due to color distinction (friend = brown/threat = green); expected transfer is nil.
· Nomenclature	YES	YES	NO	NO	3/4-Easier than actual task due to the limited array of threat targets (T72, BMP); expected transfer is nil.
Note number of target	YES	YES	YES	YES	

Activity 3. ACQUIRE TARGET(S) (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Classify multiple targets as most dangerous/dangerous/ least dangerous	YES	NO	YES	YES	2-No truly "lease dangerous" targets, e.g., trucks, troops.
Confirm acquisition report	YES	YES	YES	YES	
Estimate range to select weapon(s) and to evaluate LRF return	YES	YES	NO	NO	3/4-Range cues from SIMNET displays are substantially different from real world; puts experienced TC at disadvantage.
Send contact report to platoon leader	YES	YES	YES	YES	
Part 3.3. Evaluate situation					
Decide whether or not to engage contingent on: · Plt mission · Platoon fire plan · Plt ldr command	YES	YES	YES	YES	
Select the appropriate weapon/ ammunition and the firing mode (precision/degraded) contingent on: · Target range · Type of target (hard/soft, point/area) · Tank status (ammo, malfunctions)	YES	NO	NO	YES	2/3-SIMNET does not simulate the following M1 weapons: the coax, the LDR's M240, and the TC cal .50. 2/3-SIMNET does not support most modes of degraded gunnery.
Determine crewman (GNR, TC, LDR) and the type of fire command (single, multiple, or simultaneous) contingent on: · Number of targets · Target classification	YES	NO	NO	YES	2/3-SIMNET does not simulate the following crewman/weapon combinations: LDR/M240, GNR/coax, and TC/CAL .50. 2-A simultaneous fire command is not appropriate.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comments if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.1. Engage single target from the offense using precision gunnery					
Issue contact report: CONTACT <DIRECTION> <TARGET>	YES	YES	YES	YES	
Decide whether to engage target while moving or from a short halt	YES	NO	NO	NO	2/3/4-Since SIMNET does not simulate degraded mode gunnery, there is no reason to halt; students trained on SIMNET may forget to make this decision.
If engaging from a short halt, issue driver command: DRIVER STOP	YES	YES	YES	YES	
Relay any action drill command	YES	YES	YES	YES	
Issue fire command: GUNNER <AMMO> <TARGET>	YES	YES	YES	YES	
Lay gun (simultaneous with fire command)	YES	YES	YES	YES	
Release override	YES	YES	YES	YES	
Sight through GPSE	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Listen for UP	YES	YES	YES	YES	
Announce FIRE, or FIRE, FIRE <ALTERNATE AMMO>	YES	YES	YES	YES	
Option 4.2. Engage single target from the defense using precision gunnery					
Issue contact report: CONTACT <DIRECTION> <TARGET>	YES	YES	YES	YES	
Issue fire command: GUNNER <AMMO> <TARGET>	YES	YES	YES	YES	
Announce DRIVER MOVE OUT, GUNNER TAKE OVER	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Lay gun (simultaneous with fire command)	YES	YES	YES	YES	
Release override	YES	YES	YES	YES	
Sight through GPSE	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Listen for UP	YES	YES	YES	YES	
Announce FIRE, or FIRE,FIRE <ALTERNATE AMMO>	YES	YES	YES	YES	
Option 4.3. Gunner cannot identify announced target					
Case 4.3.A.: Gunner fails to identify target(s)					
Direct gunner onto target using one of the following techniques:					
* Verbal command: TRAVERSE <LEFT or RIGHT>, STEADY, ON	YES	YES	YES	YES	
* TRPs	YES	YES	YES	YES	
* Announce WATCH MY TRACERS and use .50 caliber tracers to point to target	NO				1-No cal .50.
or					
Announce FROM MY POSITION and proceed with TC engagement (see Activity 10)	YES	YES	YES	YES	
Case 4.3.B. Gunner identifies incorrect target(s)					
If GNR is correct, issue a correction to the fire command	YES	YES	YES	YES	
If GNR identifies the wrong target, treat as Case 4.3.A. and proceed	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

Option 4.4. Engage target using TIS

SIMNET does not simulate thermal optics viewing conditions.

Activity 5. ADJUST FIRE	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Recover sight picture	YES	NO	NO	YES	2/3-Recoil is not simulated.
Observe strike of round	YES	YES	YES	YES	
If TARGET was observed, determine whether or not target was destroyed	YES	YES	NO	NO	3/4-SIMNET uses coded graphs for different eyes of types of hits.
Option 5.1. Use reengage technique					
Evaluate range display	YES	YES	NO	YES	3-Poor range cues.
Announce FIRE	YES	YES	YES	YES	
Option 5.2. Use standard adjustment					
No TC actions specified					
Option 5.3. Use TC adjustment					
Issue subsequent fire command to adjust fire .5-3 mils in deflection and .5-2 mils (100-400 meters) in range	YES	YES	YES	YES	
If target is destroyed or exposure too long, command CEASE FIRE	YES	YES	YES	YES	
If in defensive posture, command DRIVER, BACK UP	YES	YES	YES	YES	

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX

SIMNET does not simulate coax engagements.

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Provide Comments if Response is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Issue fire command: GUNNER <AMMO> <NUMBER> <TARGETS>, <RIGHT/LEFT> <TARGET> FIRST	YES	YES	YES	YES	
Engage first target using precision gunnery (Option 4.1 or 4.2)					
If first target is not destroyed, adjust fire (Activity 5)					
If first target is destroyed, announce <NEXT> TARGET	YES	YES	YES	YES	
[Continue until all targets are destroyed]					
Announce CEASE FIRE	YES	YES	YES	YES	

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMUL-TANEOUS MAIN GUN ENGAGEMENTS

SIMNET does not simulate cal .50 engagements.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	Provide Comment If Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 9.1. Engage targets using battlesight gunnery					
Issue fire command: GUNNER BATTLESIGHT <TARGET>	YES	YES	YES	YES	
Depress MANUAL RANGE BATTLE SGT button	YES	YES	NO	YES	3-AMMO SELECT has no effect on BS range; for either Sabot or HEAT, the displayed range is 1200 meters.
Estimate range to target	YES	YES	NO	NO	3/4-Range cues in SIMNET are substantially different from real world; puts experienced TC at disadvantage.
If target outside of ± 200 meters of battlesight range, enter range change using MAN RNG B/S ADD DROP toggle switch	YES	YES	YES	YES	
Check range readout in GPSE	YES	YES	YES	YES	
Engage target using precision gunnery (Option 4.1 or 4.2) but without evaluating LRF display					
Option 9.2. Engage targets given ineffective LRF					
SIMNET does not simulate ineffective LRF.					
Option 9.3. Engage targets given multiple returns from LRF					
Estimate range	YES	YES	NO	NO	3/4-Range cues in SIMNET are substantially different from real world; puts experienced TC at disadvantage.
Evaluate range display	YES	YES	YES	YES	
If range appears incorrect, may instruct GNR to switch LRF setting from ARM LAST RTN to ARM 1ST RTN or v.v.	YES	YES	YES	YES	
If multiple return symbol appears in GPSE and displayed range is outside ± 200 m of estimated range, take either one of the following actions:					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Case 9.3.A. Gunner releases					
Announce RELASE	YES	YES	YES	YES	
Case 9.3.B. TC corrects range					
Correct range using MAN RNG B/S ADD/DROP toggle switch	YES	YES	YES	YES	
If displayed range is within ± 200 m of estimated range, announce FIRE	YES	YES	YES	YES	

Option 9.4. Engage targets given no range display (loss of symbology)

SIMNET does not simulate loss of symbology.

Option 9.5. Engage target given crosswind sensor failure

SIMNET does not simulate crosswind sensor failure.

Option 9.6. Engage target given cant sensor failure

SIMNET does not simulate cant sensor failure.

Option 9.7. Engage target given lead angle sensor failure

SIMNET does not simulate lead angle sensor failure.

Option 9.8. Engage target given GPS failure (day channel)

SIMNET does not simulate thermal channel viewing conditions.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Provide Comments if Response is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Sense?	(4) Positive Trans/Cor?	Comments

Option 9.9. Engage target given GPS/TIS failure

Case 9.9.A. Use GAS

Original plans for SIMNET called for GAS reticle to automatically appear in GPS sight as a result of GPS failure. Software problems prevent this option from being used at present.

Case 9.9.B. Index estimated range and use precision gunnery

Range cannot be indexed to ballistic computer.

Case 9.9.C. Use battlesight gunnery

Engage target using battlesight gunnery (Option 9.1)

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Option 9.10. Engage target using GAS gunnery

SIMNET does not provide GAS.

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Option 9.11. Engage target given stabilization system failure (to emergency mode

Original plans for SIMNET called for simulation of stabilization system failure and for the fire control system to operate in emergency mode. Software problems prevent this option being used at present.

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Option 9.12. Engage target given turret power failure

SIMNET does not simulate turret power failure; manual controls are not provided.

Activity 10. ENGAGE TARGETS FROM THE TC POSITION (Also Three Man Crew Engagements)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-B Same?	(4) Positive Trans/Cor?	Comments
Issue one of the following fire commands:					
Case 10.A. Gunner cannot identify target					
FROM MY POSITION	YES	YES	YES	YES	
or					
Case 10.B. Three-man crew (no GNR)					
LOAD <AMMO>	YES	YES	YES	YES	
Estimate range to target	YES	YES	NO	NO	3/4-Range cues from SIMNET are substantially different from real world; puts experienced TC at disadvantage.
Sight through GPSE	YES	YES	YES	YES	
Lay on center mass of target	YES	YES	YES	YES	
Depress lase button	YES	YES	YES	YES	
Evaluate range display	YES	YES	YES	YES	
Make control lay	YES	YES	YES	YES	
Announce ON THE WAY	YES	YES	YES	YES	
Squeeze trigger	YES	YES	YES	YES	
Announce CEASE FIRE	YES	YES	YES	YES	

Activity II. ASSESS RESULTS OF ENGAGEMENT	Provide Comment if Response is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-A Same?	(4) Positive Trans/Cor?	Comments
Assess battle damage/ casualties	YES	NO	NO	YES	2/3-Damage is usually all or nothing, although a mobility kill is possible; expected transfer is all.
Determine if and how crew should be reorganized to fight in a three-man configuration	NO				1-Individual casualties are not possible.
Issue SPOTREP	YES	YES	YES	YES	
Case II.A. If tank is stationary					
Determine whether to move to primary, alternate, or supplementary firing positions	YES	YES	YES	YES	
Case II.B. If tank is moving					
Determine changes to route	YES	YES	YES	YES	
Issue driver commands	YES	YES	YES	YES	
Determine appropriate ammo for anticipated targets	YES	YES	YES	YES	
Announce PREPARE BATTLECARRY <ENTER> or RELOAD <ENTER>	YES	YES	YES	YES	
Enter battlecarry range using the MANUAL BATTLE SET ADD/SKIP toggle switch	YES	YES	YES	YES	

APPENDIX G-7
EVALUATION OF SIMNET GUNNER/LOADER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-A Same?	(4) Position Trans/Conf?	Comments
Erect crosswind sensor	NO				1-No crosswind sensor.
Install LOR's machinegun	NO				1-No LOR's machinegun.
Enter LOR's station	NO				1-Enter SIMNET through door at side of crew compartment.
Operate downlight	YES	NO	NO	YES	2/3-No red filter. 3-Downlight does not go completely off. 2-Turret blower is pointed in OFF position. 2-No antennas. 2-Amplifier is pointed on crew compartment door with switches in following positions: • MAIN PWR: OFF • PWR CKT BKR: OFF • INT ACCENT: OFF • RADIO TRANC: CDR + CRW
Power up LOR's station	YES	NO	NO	NO	4-Most of the components associated with this procedure are mission or are nonfunctioning; expected transfer is all.
Operate intercom	YES	YES	NO	YES	3-Headset/boom mike are used instead of CVC helmet. 3-Rocker switch on cable substitutes for 3-position switch on helmet.
Adjust LOR's seat/platform	NO				1-LOR's seat does not adjust. 1-No LOR's platform.
Adjust LOR's hatch	NO				1-No LOR's hatch.
Install/check LOR's sight vision viewer	NO				1-No LOR's sight vision viewer.
Position LOR's guards for firing	NO				1-No LOR's guards. 2-Turret blower switch is pointed in OFF position. 3-Ejection guard is represented by a toggle switch.
Operate LOR's panel	YES	NO	NO	NO	4-With GUN/TURRET in switch in EL UNCPL, moving ejection guard to armed position does not return fire control system to power mode; may be source of negative transfer.
Operate turret traverse lock	NO				1-No turret traverse lock. 2-Does not operate in manual mode.
Operate ready ammunition door in auto/manual modes	YES	NO	NO	NO	2-Lock shaft is not represented. 3-Door opening is represented by simulated sound and ammo indicator lights coming on. 4-Procedure is so unlike actual task that expected transfer is nil.
Operate semi-ready ammunition door	NO				1-No semi-ready ammunition door.
Operate hull ammunition door	NO				1-No hull ammunition door.
Stow 105mm ammunition	NO				1-Cannot perform any part of this procedure.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Operate main gun breechblock	YES	NO	NO	NO	2-Cannot close breech manually with wooden block. 3-Spring-loaded toggle switch represents opening/closing breechblock. 4-Procedure is so unlike actual task that expected transfer is nil.
Check replenisher	NO				1-No replenisher.
Clear/load coaxial machinegun	NO				1-No coaxial machineguns.
Fill ready rack	NO				1-Cannot perform any part of this procedure.
Report ammo status	YES	YES	NO	YES	3-Status shown by ready rack indicator lamps.
Load battlecarry ammo	YES	YES	NO	NO	3-See detailed comments on loading under precision gunnery.
Option 2.1. Prepare for offense					
Receive TC briefing	YES	YES	YES	YES	
Option 2.2. Prepare for defense					
Inspect terrain to flank/rear	YES	NO	YES	YES	2-Limited to closed-hatch viewing through periscopes.

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Part 3.1. Search for Target(s)					
Option 3.1.1. Search open hatch - day					
SIMNET does not simulate open-hatch viewing conditions.					
Option 3.1.2. Search closed hatch--day					
Search right front counter-clockwise to right rear	YES	YES	NO	NO	3/4-Turret-to-Hull reference display cannot be easily viewed from LDR's position; may present problem for experienced LDR.
Execute search techniques	YES	YES	YES	YES	
Option 3.1.3. Search at night					
SIMNET does not simulate night viewing conditions.					
Part 3.2. Detect/Locate/Identify Target(s)					
Detect target(s)/signature(s)/ obstacle(s)	YES	YES	YES	YES	2-No target signatures other than dust and smoke from moving vehicles. 3-Most obstacles have little effect on tank movement.
Locate target(s)	YES	YES	YES	YES	
Identify target(s) making the following determinations:					
· IFFN	YES	YES	NO	NO	3/4-Easier than actual task due to color distinction (friend = brown/threat = green); expected transfer is nil.
· nomenclature	YES	YES	NO	NO	3/4-Easier than actual task due to the limited array of threat targets (T72, BMPs); expected transfer is nil.
If target detected, announce LOADER REPORT (TARGET) (LOCATION)	YES	YES	YES	YES	
Part 3.3. Evaluate Situation					
No LDR actions specified					

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.1. Engage single target from the offense using precision gunnery					
Drop down into turret	NO				1-N/A since SIMNET simulates closed-hatch mode only.
Check turret ring	NO				1-No turret ring.
Set GUN/TURRET DRIVE switch in EL UNCPL position	YES	YES	NO	NO	3/4-Does not return to power mode upon arming main gun, and gun will not fire unless in power mode; since gun tube does not move in SIMNET, LDR can leave switch in POWERED; possible source of negative transfer.
Case 4.1.A. Announced round is not loaded					
Move ejection guard to SAFE	YES	YES	NO	YES	3-Ejection guard is represented by toggle switch.
Ensure SAFE light is lit	YES	YES	YES	YES	3-Scoreable only if SAFE light is not lit.
Open breech	YES	YES	NO	NO	3-Spring-loaded toggle switch represents opening/closing breechblock. 4-Procedure is so unlike actual task, expected transfer is nil.
Remove incorrect round from chamber, if necessary	YES	YES	NO	NO	3-Accomplished by pressing red load button on gun tube. 4-Procedure is so unlike actual task, expected transfer is nil.
Open ammo doors	YES	YES	YES	YES	
Stow unwanted round, if necessary	YES	YES	NO	NO	3-Accomplished by pressing unlit ammo indicator on ready rack. 4-Procedure is so unlike actual task, expected transfer is nil.
Remove correct round from stowage	YES	YES	NO	NO	3-Accomplished by pressing desired ammo indicator on ready rack. 4-Procedure is so unlike actual task, expected transfer is nil.
Load desired round	YES	YES	NO	NO	3-Accomplished by pressing red load button on gun tube. 4-Procedure is so unlike actual task, expected transfer is nil.
[Continue with Case B:]					
Case 4.1.B. Announced round loaded					
Move ejection guard to FIRE	YES	YES	NO	YES	3-Ejection guard is represented by a toggle switch.
Clear recoil path	YES	YES	NO	NO	3/4-Since there are no negative consequences associated with not cleaning recoil path, LDR may acquire bad habit
Announce UP	YES	YES	YES	YES	
Open ammo doors	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.2. Engage single target from the defense using precision gunnery					
Drop down into turret	NO				1-N/A since SIMNET simulates closed-hatch mode only.
Check turret ring	NO				1-No turret ring.
Set GUN/TURRET DRIVE switch in EL UNCPL position	YES	YES	NO	NO	3/4-Does not return to power mode upon arming main gun, and gun will not fire unless in power mode; since gun tube does not move in SIMNET, LDR can leave switch in POWERED; possible source of negative transfer.
Case 4.1.A. Announced round is not loaded					
Move ejection guard to SAFE	YES	YES	NO	YES	3-Ejection guard is represented by toggle switch.
Ensure SAFE light is lit	YES	YES	YES	YES	3-Scoreable only if SAFE light is not lit.
Open breech	YES	YES	NO	NO	3-Spring-loaded toggle switch represents opening/closing breechblock. 4-Procedure is so unlike actual task, expected transfer is nil.
Remove incorrect round from chamber, if necessary	YES	YES	NO	NO	3-Accomplished by pressing red load button on gun tube. 4-Procedure is so unlike actual task, expected transfer is nil.
Open ammo doors	YES	YES	YES	YES	
Stow unwanted round, if necessary	YES	YES	NO	NO	3-Accomplished by pressing unlit ammo indicator on ready rack. 4-Procedure is so unlike actual task, expected transfer is nil.
Remove correct round from stowage	YES	YES	NO	NO	3-Accomplished by pressing desired ammo indicator on ready rack. 4-Procedure is so unlike actual task, expected transfer is nil.
Load desired round	YES	YES	NO	NO	3-Accomplished by pressing red load button on gun tube. 4-Procedure is so unlike actual task, expected transfer is nil.
[Continue with Case B:]					
Case 4.1.B. Announced round loaded					
Move ejection guard to FIRE	YES	YES	NO	YES	3-Ejection guard is represented by a toggle switch.
Clear recoil path	YES	YES	NO	NO	3/4-Since there are no negative consequences associated with not clearing recoil path, LDR may acquire bad habits.
Announce UP	YES	YES	YES	YES	
Open ammo doors	YES	YES	YES	YES	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Option 4.3. GNR cannot identify announced target					
No LDR actions specified					
Option 4.4. Engage targets using TIS					
SIMNET does not simulate thermal channel viewing conditions					

Activity 5. ADJUST FIRE	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Set GUN/TURRET DRIVE switch in EL UNCPL position	YES	YES	YES	YES	3/4-Does not return to power mode upon arming main gun, and gun will not fire unless in power mode; since gun tube does not move in SIMNET, LDR can leave switch in POWERED; possible source of negative transfer.
Load announced round (Case A, Option 4.1)	YES	YES	NO	NO	3/4-See detailed comments on loading under precision gunnery.
Move ejection guard to FIRE	YES	YES	NO	YES	3-Ejection guard is represented by a toggle switch.
Clear recoil path	YES	YES	NO	NO	3/4-Since there are no negative consequences associated with not clearing the recoil path, LDR may acquire bad habits.
Announce UP	YES	YES	YES	YES	

Option 5.1. Use reengage technique

No LDR actions specified

Option 5.2. Use standard adjustment

No LDR actions specified

Option 5.3. Use TC adjustment

No LDR actions specified

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments

SIMNET does not simulate coax engagements.

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN

Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)

If first target is not destroyed, perform LDR's actions as described in Activity 5

Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS

SIMNET does not simulate cal .50 engagements.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES

Option 9.1-9.9

Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)

Activity 10. ENGAGE TARGET FROM THE TC POSITION	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)					
Activity 11. ASSESS RESULTS OF ENGAGEMENT					
Check replenisher reservoir	NO				1-No replenisher.
Remove spent casings	NO				1-No spent casings.
Load announced round as described in precision gunnery (Option 4.1 or 4.2)					
Announce loading status	YES	YES	YES	YES	

APPENDIX G-8
EVALUATION OF SIMNET ON DRIVER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Enter DVR's station	NO				1-Enter SIMNET DVR compartment through full-length door at side. 2-No hull networks box. 2-No hull power distribution box. 2-No parking brake system hydraulic pressure gage. 3-The following switches on the DVR master panel are painted in the OFF position, and the corresponding indicate lights are painted on: • PERSONNEL HEATER • NIGHT PERISCOPE • GAS PARTIC FILTER • BILGE PUMP • SMOKE GENERATOR • LIGHTS • HIGH BEAM 3-The FIRE EXTINGUISHER 2ND SHOT switch on the DVR instrument panel is painted in the closed position. 3-VEHICLE MASTER POWER switch does not pull out. 3- MASTER CAUTION light does remain lit after releasing PANEL LIGHTS TEST button. 2/3-The PANEL LIGHTS adjust knob is painted on and, consequently, does not function. 3-On the DVR's instrument panel the CABLE DISCONNECTED and the CIRCUIT BKE OPEN indicator lights are painted on. 3-The TANK SELECTOR switch does not have to be pushed in to set. 4-Most of the components associated with this procedure are missing or are nonfunctioning; expected transfer is nil.
Power up hull systems	YES	NO	NO	NO	2/3-No red filter.
Operate domelight	YES	NO	NO	NO	3-Domelight does not go completely off.
Check turret seal	NO				1-No turret seal.
Operate intercom	YES	YES	NO	YES	3-Headset/boom mike are used instead of CVC helmet. 3-Rocker switch on cable substitutes for 3-position switch on helmet.
Adjust seat/periscopes	NO				1-Seat/periscopes are not adjustable.
Adjust hatch	NO				1-No hatch.
Adjust steer/throttle control	NO				1-Steering/throttle control is not adjustable.
Operate drain valves	NO				1-No drain valve.
Start engine	NO				2-ABORT light is painted on; aborted start procedures cannot be performed. 3-PUSH TO START button does not have to be held in for 3 secs. to start. 2-Transmission downshift does not occur. 2-No parking brake-system hydraulic pressure gage. 3-Parking brake release handle is represented as a toggle switch below DVR master panel. 3-PARKING/SERVICE BRAKES light does not come on after holding service brake for 2 minutes.
Make after-start checks	YES	NO	NO	YES	3-Parking brake can be engaged with a short tap of the foot.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Provide Comment if Response Is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	Comments
Check fuel tanks	YES	YES	NO	YES	3-TANK SELECTOR switch does not have to be pushed in to rotate.
Report fuel status	YES	YES	YES	YES	
Option 2.1. Prepare for Offense					
Receive TC briefing	YES	YES	YES	YES	
Select routes in accordance with mission and formation	YES	YES	YES	YES	
Option 2.2. Prepare for Defense					
Drive to battle position	YES	YES	YES	YES	
Rehearse movement between primary and alternate firing positions	YES	YES	NO	NO	3/4-Because firing positions cannot be fortified otherwise marked, identifying exact positions is more difficult than real world task; may cause problems for experienced DVRs.
Take primary firing positions	YES	YES	NO	NO	3/4-Because firing positions cannot be fortified otherwise marked, identifying exact positions is more difficult than real world task; may cause problems for experienced DVRs.
Monitor displays	YES	YES	YES	YES	

Activity 3. ACQUIRE TARGET(S)	Provide Comment if Response is NO				Comments
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Same?	(4) Positive Trans/Cor?	
Part 3.1. Search for Target(s)					
Option 3.1.1. Search open batch--day					
SIMNET does not simulate open-batch conditions.					
Option 3.1.2. Search closed batch--day					
If moving, follow wingman concept/ react to formation changes	YES	YES	NO	NO	3/4-Because SIMNET tanks are identical with no distinguishing features, this element is more difficult than real-world task; may cause problem for experienced POGs.
Search fender to fender	YES	YES	YES	YES	
Execute search techniques	YES	YES	YES	YES	
Option 3.1.3. Search at night					
SIMNET does not simulate night viewing conditions.					

Activity 3. ACQUIRE TARGET(S) (cont'd)	Provide Comment If Response is NO				
	(1) Perform/ Practice?	(2) Every Element?	(3) S-R Loop?	(4) Positive Trans/Cor?	Comments
Part 3.2. Detect/Locate/Identify Target(s)					
Detect target(s)/signature(s)/ obstacle(s)	YES	NO	NO	YES	2-No target signature other than dust and smoke from vehicles. 3-Obstacles have little effect on task component.
Locate target(s)	YES	YES	YES	YES	
Identify target(s) making the following determinations:					
. IFFN	YES	YES	NO	NO	3/4-Easier than actual task due to color distinction (friend = brown/threat = green); expected transfer is nil.
. nomenclature	YES	YES	NO	NO	3/4-Easier than actual task due to the limited array of threat targets (TTT, BMP); expected transfer is nil.
If target detected, announce (ORDER REPORT, <TARGET>, <LOCATION>	YES	YES	YES	YES	
Evaluate cover and concealment	YES	YES	NO	NO	3/4-Cover and concealment are difficult to determine/evaluate; may cause problems for experienced SME.
Part 3.3. Evaluate Situation					
No driver actions specified					

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Provide Comment if Response is NO (1) Perform/ Practice?	(2) Every Element?	(3) S-E Item?	(4) Positive Train/Eval?	Comments
Option 4.1. Engage steady target from the offense using position memory					
Monitor TC and platoon leader commands	YES	YES	YES	YES	
If TC announces HALT, stop smoothly	YES	YES	YES	YES	
If TC does not announce HALT, maintain steady platform	YES	YES	NO	NO	3/4-"Smoothed out" terrain and lack of crew jostling makes this task relatively easy; expected transfer is all.
If antitank fire is encountered, seek cover and concealment or execute action drill	YES	YES	YES	YES	
Alert crew of obstacles	YES	YES	NO	NO	3/4-Obstacles have less severe impact on driving/crew than in real world; may lead to ignoring/forgetting this process.
Option 4.2. Engage steady target from the defense using position memory					
Set TACTICAL IDLE switch to ON position	YES	YES	YES	YES	
Set transmission control to N	YES	YES	YES	YES	
Release parking brake	YES	YES	NO	YES	3-Parking brake release handle is represented by a toggle switch.
Depress service brake	YES	YES	YES	YES	
Move to hull defilade position	YES	YES	NO	NO	3/4-True hull defilade position cannot be confirmed by GNR due to lack of telescope; may learn bad habits.
Set transmission control to N	YES	YES	YES	YES	
Depress/hold service brake	YES	YES	YES	YES	
Option 4.3. GNR correct identify announced target					
No driver actions specified					
Option 4.4. Engage target using TIS					
SIMNET does not simulate thermal optics viewing conditions.					

Activity 5. ADJUST FIRE	Provide Comment If Response is NO (1) Perform/ Practical?	(2) Every Element?	(3) S-B Same?	(4) Positive Trans/Cor?	Comments
Return to deflade or each alternate position	YES	YES	NO	NO	3-Deflade and alternate positions are difficult to identify; may be difficult for experienced DVRs.

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX

SIMNET does not simulate coax engagements.

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN

Perform DVR's actions as described a precision gunnery (Option 4.1 or 4.2)

If first target is not destroyed, perform DVR's actions as described in fire adjustment (Activity 5)

Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)

Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMUL-TANEOUS MAIN GUN ENGAGEMENTS)

SIMNET does not simulate cal .50 engagements.

	Provide Comment if Response is NO				
	(1)	(2)	(3)	(4)	
Activity 9. ENGAGE TARGET USING REWARDED GUNNERY TECHNIQUES	Perform/ Practice?	Every Element?	S-R Same?	Positive Trans/Car?	Comments
Options 9.1-9.9					
Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)					
Option 9.10/9.11. Engage target given stabilization system/turret power failure					
Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)					
Stop smoothly	YES	YES	YES	YES	
Resume driving	YES	YES	YES	YES	
Activity 10. ENGAGE TARGET FROM THE TC POSITION					
Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)					
Activity 11. ASSESS RESULTS OF ENGAGEMENT					
Respond to TC driving commands	YES	YES	YES	YES	

APPENDIX H

SUMMARY OF INSTRUCTIONAL FEATURES IDENTIFIED IN RESEARCH LITERATURE

APPENDIX H

SUMMARY OF INSTRUCTIONAL FEATURES IDENTIFIED IN RESEARCH LITERATURE

Instructional Features	Functional Definition	Training Purpose(s)	References
Total System Freeze	Stops all parts of a training scenario.	Permits part-task training by segmentation of lengthy tasks; basic simulator control feature.	1, 2, 3, 4, 5, 6, 7
Malfunction Control	Inserts simulated malfunctions within training scenario.	Permits training on emergency procedures and under degraded conditions.	1, 2, 3, 4, 5, 6, 7
Simulator Record/Replay	Records and replays actions and inputs that occurred during performance.	Provides performance feedback information.	1, 2, 3, 4, 5, 6, 7
Automated Simulator Demonstrations	Presents prerecorded manuever.	Provides a model of performance.	1, 2, 3, 4, 5, 6, 7
Initial Conditions	Presets initial values of environmental and vehicle parameters.	Saves instructor setup time; basic simulator control features.	1, 2, 3, 4, 6, 7
Hardcopy/Printout	Produces paper copy of performance data.	Provides performance feedback information; documents performance of students and system.	1, 2, 3, 4, 5, 7
Automated Performance Measurement	Records and processes quantitative student performance information for interpretation/diagnosis by instructor.	Provides performance feedback information; is prerequisite for other features related to performance measurement.	2, 3, 4, 5, 6, 7
Briefing Utilities	Presents information related to upcoming exercise; may include information on past performance.	Provides preview of upcoming exercise; provides "delayed" performance feedback information.	2, 3, 4, 5, 6, 7
Scenario Control	Configures and controls simulated events according to a specific training scenario.[b]	Saves instructor setup time; basic simulator control feature.	2, 3, 4, 5, 6, 7
Parameter Freeze	Freezes any aspect of flight system.[c]	Permits part-task training by fractionation of time-shared tasks.	1, 2, 4, 5, 7
Tutorial	Presents information concerning training objective or capabilities of simulator.	Provides basic/remedial instruction or on-line "helps."	2, 3, 5, 6, 7
Remote Instructor/Operator (I/O) Station	Displays current student performance information to the instructor.	Permits on-line monitoring of student performance.	1, 2, 3, 6, 7
Automated Adaptive Training	Adjusts the exercise degree of difficulty according to the student level of performance.	Provides adaptive instruction.	2, 4, 5, 6, 7

Instructional Features	Functional Definition	Training Purpose(s)	References
Automated Controllers	Presents information from external source (e.g., flight controller, higher HQ) as required.	Provides training on tactical tasks where such information is required.	2, 4, 6, 7
Automated Performance Alerts	Provides auditory or visual alert when performance tolerances have been exceeded.	Provides on-line performance feedback for tasks that lack intrinsic feedback.	2, 4, 6, 7
Closed Circuit Television	Monitors and records student behaviors.	Permits on-line monitoring of student behavior that would otherwise be unobservable; provides performance feedback on those behaviors.	4, 6, 7
Computer-Managed Instruction	Automates instructional management functions.	Offloads instructor tasks; permits "instructorless" training.	2, 6, 7
Automated Cuing and Coaching	Presents appropriate coaching message if performance tolerances are exceeded.[d]	Offloads instructor tasks: permits "instructorless" training.	2, 6, 7
Computer-Controlled Adversaries	Simulates actions of adversaries.	Permits training of tactical tasks where adversaries are required.	2, 6, 7
Graphic and Text Readouts of Controller Information	Provides real-time information about simulated aircraft/vehicle's situation; analogous to flight controller information.	Provides instructor information about situation that could not be inferred from other sources.	2, 6
Flight System Freeze	Freezes flight system while leaving all other systems operational.[e]	Permits part-task training by fractionation of tasks having procedural component.	5, 7
Remote Graphics Replay	Provides a post-mission graphic and dynamic recreation of training exercise.	Provides performance feedback where student must view performance in context of entire situation.	3, 7
Data Storage and Analysis	Stores, analyzes, and retrieves archival data on individual students, group of students, or the simulator itself.	Provides "delayed" performance feedback to student and program evaluation data for the entire system.	3, 7
Position Freeze	Fixes latitude and longitude while (flight) simulator continues to "fly" (nowhere).	Reorients students who are temporally overwhelmed by task.	5, 7
Procedures Monitoring	Monitors and records discrete responses of students.	Monitors student performance on and provides performance feedback for nomal and emergency procedures.	3, 7

Instructional Features	Functional Definition	Training Purpose(s)	References
Real-Time Simulation Variables Control	Inserts, removes, and otherwise alters simulation variables while simulator is in operation.	Permits spontaneous changes to training scenario; used in informal training situations.	3, 7
Automated Checkride	Administers and scores an evaluation on a predetermined series of testing events.	Automates performance evaluation where a high degree of standardization is required.	4, 7
Reposition	Places aircraft/vehicle at any point in space that is relevant to training scenario.[e]	Permits repetitive training of complex tasks.	3, 7
Automated Copilot/Crewmember	Simulates reactions of a copilot or other crewmember.	Permits training in crew interactions in the absence of crewmembers.	1, 7
Environmental	Varies environment conditions that presumably affect task difficulty.[f]	Permits training under degraded environmental conditions.	5
Reset	Returns aircraft/vehicle to a stored set of initial conditions and parameters.[g]	Facilitates repetitive training.	5
Crash/Kill Override	Continues instruction without interruption following a "crash" or "kill."	Facilitates training where the probability of a crash or kill is high.	5
Motion	Provides motion feedback.[h]	Provides training on tasks where students must learn to recognize/use motion cues.	5

[a]The numbers refer to the following references:

(1) Caro, P.W., Pohlman, L.D., & Isley, R.N. (1979). Development of simulator instructional feature design guides (TR 79-12). Pensacola, FL: Seville Research Corporation.

(2) General Electric (1983). Training device requirements analysis report, Institutional Conduct of Fire Trainer (I-COFT), Volume II: Appendices (Contract No. N61339-83-C-0038). Daytona Beach, FL: Author.

(3) Logicon, Inc. (1985). Instructional support feature guidelines (AF Contract No. F33615-84-C-0054). San Diego: Author.

(4) Hughes, R.G. (1979). Advanced training features: Bridging the gap between in-flight and simulator-based models of flying training (AFHRL Tech. Rep. 79-52). Brooks AFB, TX: Air Force Human Resources Laboratory.

(5) Pozella, D.J. (1983). Aircrew training devices: Utility and utilization of advanced instructional features (Phase I--Tactical air command) (AFHRL Tech. Rep. 83-22). Williams AFB, TX: Air Force Human Resources Laboratory.

(6) Semple, C.A., Cotton, J.C., & Sullivan, D.J. (1981). Aircrew training devices: Instructional support features (AFHRL-TR-80-58). Brooks AFB, TX: Air Force Human Resources Laboratory.

(7) Sticha, P. J., Blacksten, H. R., Knerr, C. M., Morrison, J. E., & Cross, K. D. (1986). Optimization of simulation-based training systems, Volume II: Summary of the state of the art (HumRRO Final Report 86-13). Alexandria, VA: Human Resources Research Organization.

[b]The Initial Conditions feature is sometimes viewed as a subfeature of Scenario Control (Logicon, 1985).

[c]Parameter Freeze is sometimes used synonomously with Flight System Freeze but is actually more general than the latter feature.

[d]Automated Cuing/Coaching is similar to Performance Alerts feature but includes information to the student on the correct course of action.

[e]Reposition prevents the student or instructor from having to take time to "fly" to a particular point.

[f]Environmental simulation is usually regarded as a fidelity rather than an instructional feature.

[g]Reset is sometimes considered as a subfeature of Initial Conditions feature.

[h]Motion simulation is usually regarded as a fidelity rather than an instructional feature.

APPENDIX I

EVALUATION OF PERFORMANCE TESTING CAPABILITIES OR ARMOR TRAINING DEVICES

APPENDIX I EVALUATION OF PERFORMANCE TESTING CAPABILITIES OR ARMOR TRAINING DEVICES

CONTENTS

APPENDIX I - 1
CODING SCHEME USED FOR EVALUATING TESTING CAPABILITIES

Table I - 1

Ratings used for element level descriptions of device testing capabilities

Column Heading	Symbol and interpretation
Measure Required	K - Knowledge assessment B - Behavior assessment O - Outcome assessment , - Used to join optional assessment modes (e.g. K,B = use knowledge or behavior assessment). K&B - Knowledge and behavior both required for diagnostic assessment. (O) - Outcome assessment can be used for proficiency assessment, but has limited diagnostic value.
Element Represented	Y - Performance of the element is expected to mirror performance on the actual equipment. (Y) - Performance of the element is sufficiently different from the actual equipment to reduce expected validity. Partial - Some portion of the performance requirements are not represented. Degraded - degraded stimulus conditions are expected to alter perceptual requirements for the element. N - Element can not be performed sufficiently to score performance.
Automatic Recording Mode	B - Behavior is recorded or scored O - Outcome of the element is recorded or scored T - Elapsed time to element performance is recorded [Note: behaviors or outcomes of elements that are remotely displayed at the time of execution, but not captured for later review are not counted in this column]
Automatic Recording Feedback	Display - Occurrence of the behavior or evaluation of the outcome is printed or displayed on a monitor. Replay - Occurrence of the behavior or representation of the outcome of the element can be watched on a video replay of the performance.
Automatic Recording Storage	L - Behavior or outcome records are "permanent" in the sense that they are not automatically erased/lost when the exercise or training session is over. S - Behavior or outcome records are displayed at the end of the exercise and then erased/lost.
Instructor Scoring	K - Instructor can observe performance or a remote display of performance and score knowledge. B - Instructor can observe performance or a remote display of performance and score behavior. O - Instructor can observe performance or a remote display of performance and score outcome.
Element Testable -	Y - Element can be scored either automatically or by an instructor. (Y) - Element can be scored, but reduced validity is expected. N - Element can not be scored.

Table I - 2

Ratings used for activity level descriptions of device testing capabilities

Column Heading	Symbol and Interpretation
Domain Testable	Y - Elements are sufficiently represented to expect valid information. (Y) - Elements representation is somewhat degraded and information may have marginal validity. N - Element representation is sufficiently degraded to expect little test validity.
Composite Meaningful	Gives a short description of any activity level scores provided. Blank - No composite score is computed for the domain.
Composite Storage	Gives a short description of activity level scores storage for long or short term access.
Selection/Repetition	Describes device capabilities for selecting exercises, e.g. programming a particular sequence of engagements.
Device Inconsistencies	Notes any characteristics that vary among devices and could affect performance scores.

APPENDIX I - 2
TESTING CAPABILITIES OF VIGS ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	N	-	-	-	-	

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Enter gunner station	K,B,O	N					N	
Operate domelight	K,B,O	N					N	
Operate intercom	K,B,O	N					N	
Install coax	K,B,O	N					N	
Adjust seats	K,B,O	N					N	
Adjust browpads	K,B,O	N					N	
Adjust chestrest	K,B,O	N					N	
Power up station	K,B,O	N					N	
Perform GPS function check	K,B,O	N					N	
Adjust GPS	K,B,O	N					N	
Perform computer self-test	K,B,O	N					N	
Perform computer data check	K,B,O	N					N	
Perform TIS check	K,B,O	N					N	
Perform GAS adjust	K,B,O	N					N	
Check power control handles	K,B,O	N					N	
Check manual elevation/traverse cranks	K,B,O	N					N	
Perform lead system check	K,B,O	N					N	
Perform firing circuits check	K,B,O	N					N	
Perform crosswind sensor check	K,B,O	N					N	
Perform hydraulic pressure check	K,B,O	N					N	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Boresight main gun	K&B,(O)	N					N	
Zero coax	K&B,(O)	N					N	
Report weapon status[1]	K,B	Y	N				N	
Index battlecarry ammo on AMMO SEL switch	K,B,O	Y	N				N	
Introduce battlecarry range into CCP	K,B,O	N					N	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.1. Prepare for offense	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Receive TC briefing	K	N					N	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.2. Prepare for defense	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Inspect terrain through GPS/TIS	K(K)	N					N	
Check GAS clearance	K,B,O	N					N	
Learn TRPs	K	N					N	

[1]Outcome is TC knowing correct information.

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	N					
Part 3.1. - Search	N					
Option 3.1.1. Open hatch - day	N					

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Closed hatch - day	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Select 3X GPS/TIS magnification	K,B,O	N					N	
Search on gun axis using GPS	K,B,O	Y	N			B	Y	
Alternate using GPS with TIS	K,(B,O)	N					N	
Execute search techniques to acquire targets	K	N					N	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Night	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Search on gun axis using TIS	K	N					N	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Part 3.2. Detection/Location/ ID/Reporting	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s) obstacle(s)[2]	K(K)	N					N	
Locate target(s)	K(K)	N					N	

[2]There are enough different patterns of cues to look for that detection is more complex than simple observation.

Activity 3. ACQUIRE TARGET(S) (cont'd)	Measure Required	Element Represented	Automatic Mode Feedback	Recording Storage	Instructor Scoring	Element Testable	Comments
Identify target(s) making the following determinations:							
• IFFN							
• Nomenclature	0(1)	0				0	
If target detected, announce GUNNER REPORT, <TARGET> <LOCATION>	1,0	0				0	
Confirm target	1,(0,0)	0				0	
Estimate range (approximate in order to evaluate LRF return)	R	Y	0			0	

. . . . . .

Part 3. Evaluate situation

[No gunner actions]

	Remote Testable	Composite Meaningful	Storage	Selective Repetitive	Device Inconsistencies	Comments
Activity 4. ENGAGE STABLE TARGETS WITH THE MAIN GUN	Partial	Time and tracking	No	Yes		
Option 4.1. Precision engagement - moving (offense)	0					Does not stimulate gun tank moving

	Remote Testable	Composite Meaningful	Storage	Selective Repetitive	Device Inconsistencies	Comments
Option 4.2. Precision engagement - stationary (defense)	Y	Time and tracking	No	Yes		Score may not be consistent with target difficulty

	Measure Required	Element Represented	Automatic Mode	Automatic Recording Feedback	Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: IN • GUN SELECT: MAIN • AMMO SELECT as announced	S,D, O	Partial	Ammo	Display		Degrade	0	
Sight through GPS	S,D,O	Y	0			0	Y	
Grasp pole switches	S,D,O	Y	0			0	Y	
Look through GAS to determine when gun clears deflade	S,D,O	0	-				0	No GAS
Announce DRIVER STOP	S,O	Y	0				0	No driver or look movement
Look through GPS	S,D,O	Y	0				0	Redundant step - with missing GAS
Announce IDENTIFIED	S,O	Y	0			0	Y	
Switch GPS to IHT	S,D,O	0	-				0	
Lay on center mass of target	D(O)	Y	0			0	Y	Observe aiming point on monitor
Begin tracking moving targets	D(O)	Y	0			0	Y	Observe aiming point on monitor
Depress lase button(s)	D(O)	Y	1			0	Y	Observe aiming point on monitor
Evaluate range display	S,O	Y	0				0	
Check ready-to-fire and fault symbols	S,O	0	-				0	
Make control lay	D(O)	Y	0			0	Y	Observe aiming point on monitor
Listen for UP	S,O	Y	0			0	Y	
Listen for FIRE	S,O	Y	0			0	Y	
Announce ON THE WAY	D(O)	Y	0			0	Y	
Squeeze trigger(s)	D(O)	(Y)	0.1	Deflection and elevation error of round	No	0	Y	Observe aiming point on monitor Gunner must continue tracking after firing for a bit
Continue tracking	D(O)	Y	0			0	Y	

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)

	Domain Testable	Composite Meaningful	Storage	Selection Repetitive	Device Inconsistencies	Comments
Option 4.3. Gunner cannot identify announced target	N	-				
Case 4.3.A.: GNR fails to identify target(s)	N	-				

	Measure Required	Element Represented	Automatic Mode	Recording Feedback	Storage	Instructor Scoring	Element Testable	Comments
Announces CANNOT IDENTIFY or does not respond	N(0)	N					N	

	Domain Testable	Composite Meaningful	Storage	Selection Repetitive	Device Inconsistencies	Comments
Case 4.3.B.: GNR identifies different target	N	-				

	Measure Required	Element Represented	Automatic Mode	Recording Feedback	Storage	Instructor Scoring	Element Testable	Comments
Announces IDENTIFY <DIFFERENT TARGET>	N(0)	N					N	

	Domain Testable	Composite Meaningful	Storage	Selection Repetitive	Device Inconsistencies	Comments
Option 4.4. Use TIS	Y	Time and tracking	N	Yes		

	Measure Required	Element Represented	Automatic Mode	Recording Feedback	Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: IR • GNR SELECT: MAIN • AMMO SELECT as announced • THERMAL MODE: GN • FLTR/CLEAR/SHTR: SHTR • THERMAL MAGNIFICATION: 3X to 10X • POLARITY SWITCH: WHITE or BLACK HOT, as desired • SENSITIVITY, CONTRAST, and FOCUS for best image	E,D,O	Partial	N			D	Y	
Sight through GPS	E,D,O	N	N				N	Quality of view depends on specific videodisc

	Domain Testable	Composite Meaningful	Storage	Selection Repetitive	Device Inconsistencies	Comments
Continue engaging targets using precision gunnery (Option 4.1 or 4.2)	Y	Time and tracking				

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	Partial	Time and tracking	No	Depends on outcome of first round		

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Recover sight picture	K,B	No	N				N	
Observe/announce strike of every round	K	Degraded	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.1. Reengage	Y	N				

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announce REENGAGING	K,B	Y	N			B	Y	
Release/reengage palm switches	K,B	Y	N			B	Y	
Lay center of mass	B(O)	Y	N			O	Y	Observe aiming point on monitor
Begin tracking moving target	B(O)	Y	N			O	Y	Observe aiming point on monitor
Depress lase button(s)	B(O)	Y	N			O	Y	Observe aiming point on monitor
Evaluate range	K,O	Y	N				N	
Check ready-to-fire and fault symbols	K,O	N	-				N	
Listen for UP	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	N			B	Y	
Squeeze trigger(s)	B(O)	Y	T,O	Deflection and elevation error of rounds		O	Y	Observe aiming point on monitor
Continue tracking	B(O)	Y	N			O	Y	Gunner must continue tracking after firing for a hit

Activity 5. ADJUST FIRE (con't)	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.2. Standard adjustment (degraded mode)	N					There are no degrade mode exercises

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.3. TC adjustment	N					There is no TC. There is no mil scale on the monitor so instructor cannot act as TC

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	
Check/positions switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LST RTN • GPS: 3X • GUN SELECT: COAX	K,B,O	Partial		Display			Partial	
Grasp palm switches	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	N			B	Y	
Switch GPS to 10X	K,B,O	N					N	
Lay center of mass	B(O)	Y	N			O	Y	Observe aiming point on monitor
Depress lase button(s)	B(O)	Y	N			O	Y	Observe aiming point on monitor
Evaluate range display	K,O	Y	N				N	
Listen for FIRE	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	N			B	Y	
Fire 20-30 round burst (5-6 tracers) to destroy/ suppress point/area targets[3]	B(O)	Point targets only	T,O	Deflection and elevation error of rounds		O	Y	Observe movment of aiming point
Adjust fire[1]	B(O)	Y	N			O	Y	

[3]Outcome is tracers in target area.

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Y	Time and Tracking	No	Yes		Own tank stationary. Instructor must complete TC command
Engage first target using precision gunnery (Option 4.1 or 4.2)	Y	-				Option 4.2 only
If first target is not destroyed, adjust fire as described in Activity 5	Y	-				
Engage second target using precision gunnery (Option 4.1 or 4.2)	Y	-				Option 4.2 only; Instructor can give TC command to shift fire

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	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)	N					There is no TC station

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	N	-				Battlesight is only technique presented
Option 9.1. Engage targets using battlesight gunnery	Y	Time tracking	N	Yes	-	Stationary tank only

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: * FIRE CONTROL MODE: NORMAL * LRF: SAFE * GPS: 3X * GUN SELECT: MAIN * AMMO SELECT: battlecarry ammo	K,B,O	Partial				(O)	Y	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	Y	-				Option 4.2 only
Option 9.2. Engage target given ineffective LRF	N					Not presented
Option 9.3. Engage target given multiple returns from LRF	N					Not presented
Option 9.4. Engage target given no range display (loss of symbology)	N					Not presented
Option 9.5. Engage target given crosswind failure	N					Not presented
Option 9.6. Engage target given cant sensor failure	N					Not presented

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.7. Lead angle sensor failure	N					Not presented
Option 9.8. GPS failure (day channel)	N					Not presented
Option 9.9. Engage target given GPS/TIS failure	N					Not presented
Option 9.10. Engage target using GAS	N					Not presented
Option 9.11. Engage target given stabilization system failure (emergency mode)	N					Not presented
Option 9.12. Engage target given turret power failure (manual mode)	N					Not presented

Activity 10. ENGAGE TARGET FROM TC POSITION

Testing this activity is not rated for the gunner.

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 11. ASSESS RESULTS OF ENGAGEMENT	N	-				

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Check/adjust MRS	K,B,O	No						
Index battlecarry ammo	K,B,O	No						
Announce <AMMO> INDEXED	K,B	No						

APPENDIX I - 3
TESTING CAPABILITIES OF TOPGUN ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	N	-				

	Measure Required	Element Represented	Automatic Mode	Recording Feedback	Recording Storage	Instructor Scoring	Element Testable	Comments
Enter gunner station	K,B,O						N	
Operate domelight	K,B,O						N	
Operate intercom	K,B,O						N	
Install coax	K,B,O						N	
Adjust seats	K,B,O						N	
Adjust broupads	K,B,O						N	
Adjust chestrest	K,B,O						N	
Power up station	K,B,O						N	
Perform GPS function check	K,B,O						N	
Adjust GPS	K,B,O						N	
Perform computer self-test	K,B,O						N	
Perform computer data check	K,B,O						N	
Perform TIS check	K,B,O						N	
Perform GAS adjust	K,B,O						N	
Check power control handles	K,B,O						N	
Check manual elevation/traverse cranks	K,B,O						N	
Perform load system check	K,B,O						N	
Perform firing circuits check	K,B,O						N	
Perform crosswind sensor check	K,B,O						N	
Perform hydraulic pressure check	K,B,O						N	

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Boresight main gun	K&B,(O)	N						
Zero coax	K&B,(O)	N						
Report weapon status[1]	K,B	N						No one to report to
Index battlecarry ammo on AMMO SEL switch	K,B,O	N						
Introduce battlecarry range into CCP	K,B,O	N						

Option 2.1. Prepare for offense	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
		N				

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Receive TC briefing	K	N						No TC

Option 2.2. Prepare for defense	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Inspect terrain through GPS/TIS	K(K)	N						
Check GAS clearance	K,B,O	N						
Learn TRPs	K	N						

[1]Outcome is TC knowing correct information.

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	N					
Part 3.1. - Search	N					Scenario on CKT, not viewed through eyepiece. Reduced test validity expected.
Option 3.1.1. Open hatch - day	N					Open hatch not simulated

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Closed hatch - day	(Y)					See comment Part 3.1 above

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Select 3X GPS/TIS magnification	K,B,O	(Y)	O				(Y)	
Search on gun axis using GPS	K,B,O	(Y)					(Y)	
Alternate using GPS with TIS	K,(B,O)	(Y)	O			B	(Y)	
Execute search techniques to acquire targets	K	(Y)					N	No observable behavior

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Night	N					See comment Part 3.1 above

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Search on gun axis using TIS	K	(Y)					N	No observable behavior

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Part 3.2. Detection/Location/ ID/Reporting	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s) obstacle(s)[2]	K(K)	Degraded						
Locate target(s)	K(K)	Y						

[2]There are enough different patterns of cues to look for that detection is more complex than simple observation.

Activity 3. ACQUIRE TARGET(S) (cont'd)	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Identify target(s) making the following determinations: • IFFN • Nomenclature	K(K)	N	N				N	
If target detected, announce GUNNER REPORT, <TARGET> <LOCATION>	K,B	N	N				N	
Confirm target	K,(B,O)	N	N				N	
Estimate range (approximate in order to evaluate LRF return)	K	Degraded	N				N	

Part 3. Evaluate situation

[No gunner actions]

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Partial	Points for Hits	L	Informal Training Mode	?	Stationary tank only
Option 4.1. Precision engagement - moving (offense)	N					Own tank moving is not represented
Option 4.2. Precision engagement - stationary (defense)	Y	Points for Hits	L	Informal Training Mode		

	Measure Required	Element Represented	Automatic Mode	Recording Feedback	Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT as announced	K,B, O	Partial				B	Y	
Sight through GPS	K,B,O	(Y)	O	Sight in Use	L		N	Score is presented on large CRT
Grasp palm switches	K,B,O	Y				B	Y	
Look through GAS to determine when gun clears defilade	K,B,O	N					N	
Announce DRIVER STOP	K,B	N					N	
Look through GPS	K,B,O	N					N	
Announce IDENTIFIED	K,B	Y				B	Y	
Switch GPS to 10X	K,B,O	Y	O	Sight in Use	L	B	Y	
Lay on center mass of target[3]	B,(O)	Y	O	Tracking Error	L	O	Y	Observe CRT
Begin tracking moving targets[3]	B,(O)	Y	O	Tracking Error	L	O	Y	Observe CRT
Depress lase button(s)[4]	B,(O)	Y	O	Range	L	O	Y	Observe CRT at ranging
Evaluate range display[5]	K,O	Degraded						
Check ready-to-fire and fault symbols[6]	K,O	Y				B	Y	
Make control lay[3]	B,(O)	Y	O	Tracking Error	L	O	Y	Observe CRT
Listen for UP[7]	K,O	Y				B	Y	
Listen for FIRE[4]	K,O	(Y)				B	(Y)	FIRE may be announced before gunner says IDENTIFIED
Announce ON THE WAY	K,B	Y				B	Y	

[3]For this element and similar elements throughout the entire domain, the relevant outcome is the sight picture.

[4]For element and similar elements throughout the entire domain, the relevant outcome is the sight picture at the time of lasing/firing.

[5]For this element and similar elements throughtout the domain, the relevant outcome is implementing activities 9.2 or 9.3 or relasing.

[6]For this and similar elements throughout the entire domain, the outcome is firing only if the ready-to-fire signal is visible.

[7]For this element and similar elements throughout the entire domain, the relevant outcome is firing only after UP and FIRE are announced.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Squeeze trigger(s)	B,(O)	Y	O,T	Time Miss Distance	L	O	Y	Observe CRT
Continue tracking	B,(O)	Y	O	Tracking Error	L	O	Y	Observe CRT

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.3. Gunner cannot identify announced target	N					No TC to assist
Case 4.3.A.: GNR fails to identify target(s)	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Announces CANNOT IDENTIFY or does not respond	K(B)	N						No TC

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Case 4.3.B.: GNR identifies different target	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Announces IDENTIFY <DIFFERENT TARGET>	K(B)	N						No TC

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.4. Use TIS	Y	Points for Hits				

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: * FIRE CONTROL MODE: NORMAL * LRF: ARM LAST RTN * GPS: 3X * GUN SELECT: MAIN * AMMO SELECT as announced * THERMAL MODE: ON * FLTR/CLEAR/SHTR: SHTR * THERMAL MAGNIFICATION: 3X TO 10X * POLARITY SWITCH: WHITE or BLACK HOT, as desired * SENSITIVITY, CONTRAST, and FOCUS for best image	K,B, O	Partial						
Sight through GPS	K,B,O	N	O	Sight in Use	L		N	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Continue engaging targets using precision gunnery (Option 4.1 or 4.2)	Y	Points for Hits	L			

Testing Capabilities of TOPGUN on Gunner Activities

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	Partial	Points for Hits	L	NO, Depend-on 1st Rd. Miss		

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Recover sight picture	K,B	Degraded						
Observe/announce strike of every round	K	Degraded						

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.1. Reengage						

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Announce REENGAGING	K,B	(Y)						
Release/reengage palm switches	K,B	Y						
Lay on center mass of target	B,(O)	Y	O	Error Tracking	L	O	Y	Observe CRT
Begin tracking moving targets	B,(O)	Y	O	Error	L	O	Y	Observe CRT
Depress lase button(s)	B,(O)	Y	O	Range	L	O	Y	Observe CRT at ranging
Evaluate range display	K,O	Degraded						
Check ready-to-fire and fault symbols	K,O	Y		Tracking		B	Y	
Listen for UP	K,O	Y				B	Y	
Announce ON THE WAY	K,B	Y		Time		B	Y	
Squeeze trigger(s)[8]	B,(O)	Y	O,T	Miss Distance Tracking	L	O	Y	Observe CRT
Continue tracking	B,(O)	Y	O	Error	L	O	Y	Observe CRT

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.2. Standard adjustment (degraded mode)	N					No degraded mode

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.3. TC adjustment	N					No TC

[8] TOPGUN software looks for BOT solution if first round in a dispersion round created by the software "probability factor." Being contrary to doctrine, this will reduce test validity.

Testing Capabilities of TOPGUN on Gunner Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	N					No coax simulation

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Y	Points for Hits	L	Informal Training Mode		
Engage first target using precision gunnery (Option 4.1 or 4.2)	Y	Points for Hits				
If first target is not destroyed, adjust fire as described in Activity 5	Y					
Engage second target using precision gunnery (Option 4.1 or 4.2)	Y	Points for Hits				

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)	N					TC station not simulated

Testing Capabilities of TOPGUN on Gunner Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	N					GAS only technique presented
Options 9.1 to 9.9, 9.11 and 9.12	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Option 9.10. Engage target using GAS	(Y)	Points for Hits	L	Informal Training Mode				
Set/check switches: * FIRE CONTROL MODE: NORMAL * LRF: SAFE * GUN SELECT: MAIN * AMMO SELECT: as announced	K,B,O	Partial				B	N	
Sight through GAS	K,B,O	(Y)	O	Sight in Use	L	B	N	
Grasp palm switches	K,B,O	Y				B	Y	
Announce IDENTIFIED	K,B	Y				B	Y	
Lay announced range line on target	B(O)	(Y)	O	Tracking Error	L	O	(Y)	Range is not announced, but appear on CRT data area. Use of range line can be observed on CRT.
Lead moving target as follows: . 2.5 mils for sabot . 5 mils for HEAT[9]	KBB(O)	Y	O	Tracking Error	L		Y	Range is not announced, but appear on CRT data area. Use of range line can be observed on CRT.
Listen for FIRE	K,O	Y					Y	FIRE may be announced before gunner says IDENTIFIED
Announce ON THE WAY	K,B	Y					Y	
Squeeze trigger(s)[10]	B(O)	Y	O	Miss Distance	L		Y	Observe CRT
Continue tracking	B(O)	Y	O	Tracking Error	L		Y	Observe CRT

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 10. ENGAGE TARGET FROM TC POSITION						

Testing this activity is not rated for the gunner.

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 11. ASSESS RESULTS OF ENGAGEMENT	N					

[9] Outcome is corrected sight picture.

[10] Outcome is corrected sight picture at time of firing.

APPENDIX I - 4
TESTING CAPABILITIES OF UCOFT ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	N	-	-	-	-	Many missing elements

	Measure Required	Element Represented	Automatic Mode	Automatic Feedback	Automatic Storage	Instructor Scoring	Element Testable	Comments
Enter gunner station	K,B,O	N					N	
Operate domelight	K,B,O	Y	N			B,O	Y	
Operate intercom	K,B,O	N					N	
Install coax	K,B,O	N					N	
Adjust seats	K,B,O	Y	N			B	Y	
Adjust browpads	K,B,O	Y	N			B	Y	
Adjust chestrest	K,B,O	Y	N			B	Y	
Power up station	K,B,O	N					N	
Perform GPS function check	K,B,O	N					N	
Adjust GPS	K,B,O	N					N	
Perform computer self-test	K,B,O	Y	N					
Perform computer data check	K,B,O	Y	N					
Perform TIS check	K,B,O	Y	N					
Perform GAS adjust	K,B,O	Y	N					
Check power control handles	K,B,O	Y	N			B	Y	
Check manual elevation/traverse cranks	K,B,O	Y	N			B	Y	
Perform load system check	K,B,O	Y	N			B	Y	
Perform firing circuits check	K,B,O	N					N	
Perform crosswind sensor check	K,B,O	N					N	
Perform hydraulic pressure check	K,B,O	N					N	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	N					Inconsistent and missing elements

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Boresight main gun	K&B,(O)	N					N	
Zero coax	K&B,(O)	N					N	
Report weapon status[1]	K,B	Y	N			B	Y	
Index battlecarry ammo on AMMO SEL switch	K,B,O	Y	N			B,O	Y	
Introduce battlecarry range into CCP	K,B,O	Y	N			B,O	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.1. Prepare for offense	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Receive TC briefing	K	Degraded	N				N	TC briefing is not required by U-COFT

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.2. Prepare for defense	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Inspect terrain through GPS/TIS	K(K)	Degraded	N				N	No observable behavior
Check GAS clearance	K,B,O	Y	N			B	Y	
Learn TRPs	K	N					N	Sketch/TRPs not drawn

[1]Outcome is TC hearing correct information.

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	N					Conditions are too degraded for adequate/valid testing
Part 3.1. - Search	N					
Option 3.1.1. Open hatch - day	N					UCOFT does not simulate open-hatch

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Closed hatch - day	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Select 3X GPS/TIS magnification	K,B,O	Y	N			B,O	Y	
Search on gun axis using GPS	K,B,O	Y	N			B	Y	Stimuli simplified
Alternate using GPS with TIS	K,(B,O)	Y	N			B	Y	Cues do not change; may penalize a UCOFT experienced gunner who no longer switches
Execute search techniques to acquire targets	K	Y	N				N	Cannot observe searching

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Night	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Search on gun axis using TIS	K	Degraded	N					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Part 3.2. Detection/Location/ ID/Reporting	Y					Simulation may reduce validity

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s) obstacle(s)[2]	K(K)	Degraded	N					No observable behavior or outcome
Locate target(s)	K(K)	Degraded	N					No observable behavior or outcome
Identify target(s) making the following determinations:								
· IFFN								
· Nomenclature	K(K)	Degraded	N					No observable behavior or outcome
If target detected, announce GUNNER REPORT, <TARGET> <LOCATION>	K,B	Y	N					No observable behavior or outcome
Confirm target	K,(B,O)	Y	N					No observable behavior or outcome
Estimate range (approximate in order to evaluate LRF return)	K	Degraded	N				N	

[2]There are enough different patterns of cues to look for that detection is more complex than simple observation.

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S) (cont'd)						
Part 3. Evaluate situation						
[No gunner actions]						

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Y	Complex[3]	L	Limited		
Option 4.1. Precision engagement - moving (offense)	Y	Complex	L	Limited		

	Measure Required	Element Represented	Automatic Mode	Recording Feedback	Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT as announced	K,B,(O)	Y	N			B,O	Y	No penalty for setting Gun Select or LRF early Switch settings can be observed at console
Sight through GPS	K,B,O	Y	N			B	Y	
Grasp palm switches	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	Y			B	Y	Fed in by instructor
Switch GPS to 10X	K,B,O	Y	N			B,O	Y	
Lay on center mass of target[4]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Begin tracking moving targets[4]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Listen for driver alerts	K	N	N					
Depress lase button(s)[5]	B,(O)	Y	O	Replay	S	O	Y	Correctness of range return judged at console
Evaluate range display	K,O	Degraded	N			B,O	(Y)	Observable behavior only if range judged incorrect
Check ready-to-fire and fault symbols[6]	K,O	Y	N			B,O	(Y)	Observable behavior only if fault symbol present
Make control lay[4]	B,(O)	Y	N			O	Y	Correctness of sight picture judged at console
Listen for UP[7]	K,O	Y	N			O	Y	
Listen for FIRE[6]	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	Y			B	Y	
Squeeze trigger(s)[5]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console, Az and El reticle error at console is contaminated by ranging, switch settings and round to round dispersion
Continue tracking[4]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console

[3] See Chapter 6 for a description of UCOFT scoring.

[4] For this element and similar elements throughout the entire domain, the relevant outcome is the sight picture.

[5] For element and similar elements throughout the entire domain, the relevant outcome is the sight picture at the time of lasing/firing.

[6] For this and similar elements throughout the entire domain, the outcome is firing only if the ready-to-fire signal is visible.

[7] For this element and similar elements throughout the entire domain, the relevant outcome is firing only after UP and FIRE are announced.

Activity 4. ENGAGE STABLE TARGETS WITH THE MAIN GUN (cont'd)

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.2. Precision engagement - stationary (defense)	Y	Complex	L	Limited		

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: * FIRE CONTROL MODE: NORMAL * LRF: ARM LAST RTN * GPS: 1X * GUN SELECT: MAIN * AMMO SELECT as announced	K,B,O	Y	N			B,O	Y	No penalty for setting Gun Select or LRF early. Switch settings can be observed at console
Sight through GPS	K,B,O	Y	N			B	Y	
Grasp palm switches	K,B,O	Y	N			B	Y	
Look through GAS to determine when gun clears deflade	K,B,O	Y	N			N	N	Difficult to tell if GNR actually looking
Announce DRIVER STOP	K,B	Y	N			N	N	Can time announcement rather than look
Look through GPS	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	T			B	Y	Fed in by instructor
Switch GPS to 10X	K,B,O	Y	N			B,O	Y	
Lay on center mass of target	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Begin tracking moving targets	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Depress laser button(s)	B,(O)	Y	O	Replay	S	O	Y	Correctness of range return judged at console
Evaluate range display	K,O	Degraded	N			B,O	(Y)	Observable behavior only if range judged incorrect
Check ready-to-fire and fault symbols	K,O	Y	N			B,O	(Y)	Observable behavior only if fault symbol present
Make control lay	B,(O)	Y	N			O	Y	Correctness of sight picture judged at console
Listen for UP	K,O	Y	N			O	Y	
Listen for FIRE	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Squeeze trigger(s)	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Continue tracking	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Option 4.3. Gunner cannot identify announced target	Y	-	-	N				Occurrence determined by GNR GNR must make one of three responses
Case 4.3.A.: GNR fails to identify target(s)	Y	N						
	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announces CANNOT IDENTIFY or does not respond	K(S)	Y	N			S	Y	
	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies			Comments
Case 4.3.B.: GNR identifies different target	(Y)	Y						
	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announces IDENTIFY <DIFFERENT TARGET>	K(S)	Y	N			S	Y	May require error by TC to evoke this response
	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies			Comments
Option 4.4. Use TIS	N							View sufficiently degraded to question adequacy for testing
	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT as announced • THERMAL MODE: ON • FLTR/CLEAR/SMTR: SMTR • THERMAL MAGNIFICATION: 3X to 10X • POLARITY SWITCH: WHITE or BLACK HOT, as desired • SENSITIVITY, CONTRAST, and FOCUS for best image	K,S, O	Y	N				Y	
Sight through GPS	K,S,O	View Degraded	N			S	Y	
	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies			Comments
Continue engaging targets using precision gunnery (Option 4.1 or 4.2)	N							View sufficiently degraded to question adequacy for testing

Testing Capabilities of UCOFT on Gunner Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	Degraded					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Recover sight picture	K,B	Degraded	N					
Observe/announce strike of every round	K	Degraded	N					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.1. Reengage	Y			N		Occurrence depends on missing first round

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announce REENGAGING	K,B	Y	N			B	Y	
Release/reengage palm switches	K,B	Y	N			B	Y	
Lay on center mass of target	B,(^)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Begin tracking moving targets	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Listen for driver alerts	K	N	N					
Depress lase button(s)	B,(O)	Y	O	Replay	S	O	Y	Correctness of range return judged at console
Evaluate range display	K,O	Degraded	N			B,O	(Y)	Observable behavior only if range judged incorrect
Check ready-to-fire and fault symbols	K,O	Y	N			B,O	(Y)	Observable behavior only if fault symbol present
Make control lay	B,(O)	Y	N			O	Y	Correctness of sight picture judged at console
Listen for UP	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Squeeze trigger(s)	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Continue tracking	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console

Activity 5. ADJUST FIRE (con't)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.2. Standard adjustment (degraded mode)	Y			N		Occurrence depends on first round miss and degraded mode

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Observe/announce deflection and range error	K(B)	Degraded	N			B	Y	Instructor must observe deflection and range error at console and judge GNR's response
Release/reengage palm switches	K,B	Y	N			B	Y	May be difficult to observe
Adjust 1 mil deflection[8]	K&B(O)	Y	O	Replay	S	O	Y	Observed at console
Adjust 200 meters range[8]	K&B(O)	Y	O	Replay	S	O	Y	Observed at console
Begin tracking moving target	B(O)	Y	O	Replay	S	O	Y	Observed at console
Listen for UP	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Squeeze trigger(s)	B(O)		O	Replay		B	Y	Observed at console
Continue tracking	B(O)		O	Replay		O	Y	Observed at console

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.3. TC adjustment	Y			N		

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Release/reengage palm switches	K,B,O	Y	N			B	Y	May be difficult to observe
Apply TC correction[8]	K&B(O)	Y	N			O	Y	Observed at console
Listen for UP	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Squeeze trigger(s)	B(O)		O	Replay		O	Y	Observed at console
Continue tracking	B(O)		O	Replay		O	Y	Observed at console

[8]Outcome is adjusted sight picture.

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Domain Testable	Composite Meaningful	Storage	Selection Repetition		Device Inconsistencies		Comments
	Y		L	Limited				
	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	No penalty for setting switches early. Switch setting can be observed at console
Check/positions switches: * FIRE CONTROL MODE: NORMAL * LRF: ARM LST RTN * GPS: 3X * GUN SELECT: COAX	K,B,O	Y	N			O	Y	
Grasp palm switches	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	N			B	Y	
Switch GPS to 10X	K,B,O	Y	T	Display		B	Y	
Lay on center mass of target	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Depress lase button(s)	B,(O)	Y	O	Replay	S	O	Y	Correctness of range return judged at console
Evaluate range display	K,O	Degraded	N			B,O	(Y)	Observable behavior only if range judged incorrect
Listen for FIRE	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Fire 20-30 round burst (5-6 tracers) to destroy/ suppress point/area targets[9]	B(O)	Degraded	O	Replay	S	O	Y	Observe at console
Adjust fire[12]	B(O)	Replace	O	Replay	S	O	Y	Observe at console

[9]Outcome is tracers in target area.

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Y	Complex	L	Limited		
Engage first target using precision gunnery (Option 4.1 or 4.2)						See 4.1/4.2
If first target is not destroyed, adjust fire as described in Activity 5						See 5
Engage second target using precision gunnery (Option 4.1 or 4.2)						See 4.1/4.2

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)						
Option 8.1. Simultaneous targets	Y	Complex	L	Limited		
Engage main gun target using precision gunnery (Option 4.1 or 4.2)	Y					See 4.1/4.2
Adjust fire using gunner's standard adjustment (Option 5.2)	Y					See 5.2

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announce TARGET--CEASE FIRE	K(B)	Y	N			B	Y	Judge appropriateness from target hit displayed at console

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 8.2. Cal .50 targets	Y	N		Limited		

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Aid in adjusting TC's weapon	K(B)	Y	N			B	Y	Judge corrections from console

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGETS USING REPLACE GUNNERY TECHNIQUES	(Y)					Partial coverage degraded conditions
Option 9.1. Engage targets using battlesight gunnery	Y	Complex	L	Limited		

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: * FIRE CONTROL MODE: NORMAL * LRF: SAFE * GPS: 3X * GUN SELECT: MAIN * AMMO SELECT: battlecarry ammo	K,B,O	Y	N					No penalty for setting Gun Select early Switch setting can be judged from console

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	Y					See 4.1/4.2
Option 9.2. Engage target given ineffective LRF	Y					
Case 9.2.A. Use battlesight gunnery	Y					See 9.1
Engage target using battlesight gunnery (Option 9.1)						
Case 9.2.B. TC indexes range						
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announce IDENTIFIED	K(B)							

Activity 9. ENGAGE TARGETS USING REPLACE GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.2.C. TC indexed range	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Open CCP door	K,P,O	Y	N			B	Y	
Press RANGE button	K,J,O	Y	N			B	Y	
Enter <RANGE>	K,B,O	Y	N			B,O	Y	
Press ENTER button	K,B,O	Y	N			B	Y	
Close CCP door	K,B,O	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	Y					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.2.D. GNR manually applies range	Y					See 9.10
Engage target using GAS (Option 9.10)						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.3. Engage target given multiple returns from LRF	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Depress lase button(s)	B(O)	Y	N			B,O	Y	Range appears at console
If multiple return symbol appears in GPS, announce RANGE <IN METERS>	K,B,O	Y	N			B	Y	
Switch LRF setting in accordance with TC instructions	K,B,O	Y	N			B,O	Y	Setting appears at console

Activity 9. ENGAGE TARGETS USING REPLACE GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.3.A. Gunner releases						

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Relay on target	B(O)	Y	N			O	Y	
Depress lase button(s)	B(O)	Y	B	Not Prepared	Used in SM Score	O	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Continue with engaging main target using precision gunnery (Option 4.1 or 4.2)						
Case 9.3.B. TC corrects range						
Continue with engaging main target using precision gunnery (Option 4.1 or 4.2)						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.4. Engage target given no range display (loss of symbology)	(Y)	-	-	By special instruction		There are no exercises for this condition, but it can be simulated by turning SYMBOL knob all the way down
Case 9.4.A. Little or no time	Y					See 4.1/4.2
Engage target using precision gunnery (Option 4.1 or 4.2)						
Case 9.4.B. Time permitting	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Open CCP door	K,B,O	Y	N			B	Y	
Press RANGE button	K,B,O	Y	N			B	Y	
Announce range	B,O	Y	N			B	Y	

Activity 9. ENGAGE TARGETS USING REPLACE GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.5. Engage target given crosswind failure	(Y)	-		By special instruction		There are no crosswind sensor failure engagements

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Open CCP door	K,B,O	Y	N			B	Y	
Press CROSSWIND button	K,B,O	Y	N			B	Y	
Press "0" key	K,B,O	Y	N			B	Y	
Press ENTER button	K,B,O	Y	N			B	Y	
Close CCP door	K,B,O	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2)	(Y)	-				See 4.1/4.2

Option 9.6. Engage target given cant sensor failure	Y			By special instruction		There are no cant sensor failure engagements

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Open CCP door	K,B,O	Y	N			B	Y	
Press CANT button	K,B,O	Y	N			B	Y	
Press "0"	K,B,O	Y	N			B	Y	
Press ENTER button	K,B,O	Y	N			B	Y	
Close CCP door	K,B,O	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery--stationary (Option 4.2)	(Y)	-				No cant required See 4.2

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
If tank is not on level ground, compensate by aiming 1 mil high/1 mil opposite direction of cant per 1000 meters in range to target[10]	K&B(O)	Y	N			O	Y	Adjusting for "cant" will result in a miss

[10]Outcome is corrected sight picture.

Activity 9. ENGAGE TARGETS USING REPLACE GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.7. Lead angle sensor failure	N					Lead angle failure is not simulated separately from STAB OUT

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Open CCP door	K,B,O	Y	N			B	Y	
Press LEAD button	K,B,O	Y	N			B	Y	
Press "0" key	K,B,O	Y	N			B	Y	
Press ENTER button	K,B,O	Y	N			B	Y	
Close CCP door	K,B,O	Y	N			B	Y	
Engage target using precision gunnery (Option 4.2) but apply lead to moving target as follows: . 2.5 mils for sabot . 5 mils for HEAT[11]	K,B,O	Y	N			O	Y	Observe from console

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.8. GPS failure (day channel)	N	Not specific to option				GPS failure is not simulated separately from TIS failure
Engage target using TIS (Option 4.4)						
Option 9.9. Engage target given GPS/TIS failure	Y	Not specific to option				
Case 9.9.A. Engage target given GPS/TIS failure	Y	Incorrect				See 9.10
Engage targets using GAS gunnery (Option 9.10)						
Case 9.9.B. Use GAS battlesight techniques	Y	Complex				See 9.1
Engage target using battlesight gunnery (Option 9.1) but with GAS instead of GPS						

[11] Outcome is corrected sight picture.

Activity 9. ENGAGE TARGETS USING REPLACE GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.10. Engage target using GAS	Y	Incorrect	S	Limited		Correct lay does not result in a hit

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: * FIRE CONTROL MODE: NORMAL . LRF: ARM LAST RTN * GPS: 3X * GUN SELECT: MAIN * AMMO SELECT as announced	K,B,(O)	Y	N			B,O	Y	Gun Select or LRF early Switch settings can be observed at console
Sight through GAS	K,B,O		N					
Grasp palm switches	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	T			B	Y	Fed in by instructor
Lay announced range line on target	B(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
If target is moving, apply lead as follows: . 2.5 mils for sabot . 5 mils for HEAT[12]	B(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
Listen for FIRE[6]	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Squeeze trigger(s)[5]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Continue tracking[4]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.11. Engage target given stabilization system failure (emergency mode)	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: * FIRE CONTROL MODE: NORMAL . LRF: ARM LAST RTN * GPS: 3X * GUN SELECT: MAIN * AMMO SELECT as announced	K,B,(O)	Y	N			B,O	Y	Gun Select or LRF early Switch settings can be observed at console
Sight through GPS	K,B,O	Y	N			B	Y	

[12] Outcome is corrected sight picture.

Activity 9. ENGAGE TARGETS USING REPLACE GUNNERY TECHNIQUES (cont'd)	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Grasp palm switches	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	T			B	Y	Fed in by instructor
If target is moving, apply lead as follows: . 2.5 mils for sabot . 5 mils for HEAT[13]	K&B(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
Listen for FIRE[6]	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Squeeze trigger(s)[5]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console
Continue tracking[4]	B,(O)	Y	O	Replay	S	O	Y	Correctness of sight picture judged at console

Option 9.12. Engage target given turret power failure (manual mode)	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: ' FIRE CONTROL MODE: NORMAL ' LRF: ARM LAST RTN ' GPS: 3X ' GUN SELECT: MAIN ' AMMO SELECT as announced	K,B,(O)	Y	N			B,O	Y	Gun Select or LRF early Switch settings can be observed at console
Sight through GAS	K,B,O		N					
Traverse/elevate with manual controls	B(O)	Y	N			B,O	Y	Outcome is changing at console
Announce IDENTIFIED	K,B		N					
Lay announced range line on target[14]	K&B(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
If target is moving, apply lead as follows: . 2.5 mils for sabot . 5 mils for HEAT[15]	K&B(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
Listen for FIRE[6]	K,O	Y	N			O	Y	
Announce ON THE WAY	K,B	Y	T			B	Y	
Press elevation knob firing trigger[16]	B(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
If gun fails to fire, vigorously turn blasting machine handle 3-4 times[15]	B(O)	Y	O	Replay	S	O	Y	Judge sight picture at console

[13] Outcome is corrected sight picture.

[14] Outcome is range line on target.

[15] Outcome is corrected sight picture.

[16] Outcome is sight picture at time of firing.

Activity 10. ENGAGE TARGET FROM TC POSITION

Testing this activity is not rated for the gunner.

Case 10.1. Gunner cannot identify target:

(See Activity 4.3)

Case 10.2 Three-man crew

No gunner

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 11. ASSESS RESULTS OF ENGAGEMENT	N					Limited by TC conditions

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Check/adjust MRS	K,B,O	Y	N					
Index battlecarry ammo	K,B,O	Y	N			B,O	Y	
Announce <AMMO> INDEXED	K,B	Y	N			B	Y	

APPENDIX I - 5
TESTING CAPABILITIES OF SIMNET ON GUNNER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite[1] Meaningful	Composite[1] Storage	Selection Repetition	Device Inconsistencies	Comments
	N					Too many missing elements

	Measure Required	Element Represented	Automatic Recording[2] Mode	Automatic Recording[2] Feedback	Automatic Recording[2] Storage	Instructor Scoring[3]	Element Testable	Comments
Enter gunner station	K,B,O	N					N	
Operate domelight	K,B,O	(Y)	N			B	Y	
Operate intercom	K,B,O	(Y)	N			B	Y	
Install coax	K,B,O	N					N	
Adjust seats	K,B,O	N					N	
Adjust browpads	K,B,O	N					N	
Adjust chestrest	K,B,O	N					N	
Power up station	K,B,O	Partial				(B)	N	
Perform GPS function check	K,B,O	Partial				(B)	N	
Adjust GPS	K,B,O	N					N	
Perform computer self-test	K,B,O	N					N	
Perform computer data check	K,B,O	N					N	
Perform TIS check	K,B,O	N					N	
Perform GAS adjust	K,B,O	N					N	
Check power control handles	K,B,O	N					N	
Check manual elevation/traverse cranks	K,B,O	N					N	
Perform lead system check	K,B,O	N					N	
Perform firing circuits check	K,B,O	N					N	
Perform crosswind sensor check	K,B,O	N					N	
Perform hydraulic pressure check	K,B,O	N					N	

[1] SIMNET provides no composite scores, therefore these two columns are left blank for the entire domain.

[2] SIMNET has no automatic scoring capabilities. However, there is a real-time remote plan-down display with memory capture for replay. Therefore, possibilities for an instructor scoring from the plan-down display are described.

[3] Ratings in this column assume instructor is acting as TC. This allows use of GPSE to observe sight picture. Otherwise, testing would require at least two observers: one inside crew compartment to observe behaviors and another outside using optional monitor to evaluate sight picture. While feasible, the use of two observers is not very practical.

Testing Capabilities of SIMNET on Gunner Activities

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Boresight main gun	K&B,(O)	N					N	
Zero coax	K&B,(O)	N					N	
Report weapon status[4]	K,B	Y	N			B	Y	
Index battlecarry ammo on AMMO SEL switch	K,B,O	Y	N			B	Y	
Introduce battlecarry range into CCP	K,B,O	N					N	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.1. Prepare for offense	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Receive TC briefing	K	Y	N			-	N	No observable behavior

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.2. Prepare for defense	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Inspect terrain through GPS/TIS	K(K)	Degraded	N			N	N	No TIS; No observable behavior
Check GAS clearance	K,B,O	N						
Learn TRPs	K	Y	N			N	N	

[4]Outcome is TC knowing correct information.

Testing Capabilities of SIMNET on Gunner Activities

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	N					Missing and degraded elements
Part 3.1. - Search	N					
Option 3.1.1. Open hatch - day	N					

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Closed hatch - day	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Select 3X GPS/TIS magnification	K,B,O	Y	N			B	Y	
Search on gun axis using GPS	K,B,O	Y	N			B	Y	
Alternate using GPS with TIS	K,(B,O)	N					N	
Execute search techniques to acquire targets	K	Y	N				N	No observable behavior

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Night	N					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Search on gun axis using TIS	K	N	N				N	No TIS

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Part 3.2. Detection/Location/ ID/Reporting	(Y)					Simulation may reduce validity

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s) obstacle(s)[5]	K(K)	Degraded	N				N	No observable behavior or outcome
Locate target(s)	K(K)	Y	N				N	No observable behavior or outcome

[5]There are enough different patterns of cues to look for that detection is more complex than simple observation.

Testing Capabilities of SIMNET on Gunner Activities

Activity 3. ACQUIRE TARGET(S) (cont'd)	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Identify target(s) making the following determinations:								
• IFFN								No observable behavior
• Nomenclature	K(K)	Degraded	N				N	or outcome
If target detected, announce GUNNER REPORT, <TARGET> <LOCATION>	K,B	Y	N			B	Y	
Confirm target	K,(B,O)	Y	N				N	No observable behavior or outcome
Estimate range (approximate in order to evaluate LRF return)	K	Degraded	N				N	

Part 3. Evaluate situation

[No gunner actions]

Testing Capabilities of SIMNET on Gunner Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	(Y)					
Option 4.1. Precision engagement - moving (offense)	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: • FIRE CONTROL MODE: NORMAL • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT as announced	K&B,(O)	Y	N			B	Y	
Sight through GPS	K,B,O	Y	N			B	Y	
Grasp palm switches	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	N			B	Y	
Switch GPS to 10X	K,B,O	Y	N			B	Y	
Lay on center mass of target[6]	B,(O)	Y	N			O	Y	
Begin tracking moving targets[1]	B,(O)	Y	N			O	Y	
Listen for driver alerts	K	Y	N				N	No observable behavior
Depress lase button(s)[7]	B,(O)	Y	N			O	Y	
Evaluate range display[8]	K,O	Degraded	N			B	Y	
Check ready-to-fire and fault symbols[9]	K,O	Y	N			B	Y	
Make control lay[1]	B,(O)	Y	N			O	Y	
Listen for UP[10]	K,O	Y	N			B	Y	
Listen for FIRE[4]	K,O	Y	N			B	Y	
Announce ON THE WAY	K,B	Y	N			B	Y	
Squeeze trigger(s)[2]	B,(O)	Y	O	Target hit	Y	O	Y	
Continue tracking[1]	B,(O)	Y	N			O	Y	

[6]For this element and similar elements throughout the entire domain, the relevant outcome is the sight picture.

[7]For element and similar elements throughout the entire domain, the relevant outcome is the sight picture at the time of lasing/firing.

[8]For this element and similar elements throughtout the domain, the relevant outcome is implementing activities 9.2 or 9.3 or relasing.

[9]For this and similar elements throughout the entire domain, the outcome is firing only if the ready-to-fire signal is visible.

[10]For this element and similar elements throughout the entire domain, the relevant outcome is firing only after UP and FIRE are announced.

Testing Capabilities of SIMNET on Gunner Activities

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.2. Precision engagement - stationary (defense)	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: ' FIRE CONTROL MODE: NORMAL ' LRF: ARM LAST RTN ' GPS: 3X ' GUN SELECT: MAIN ' AMMO SELECT as announced	K,B, O	Y	N			B	Y	
Sight through GPS	K,B,O	Y	N			B	Y	
Grasp palm switches	K,B,O	Y	N			B	Y	
Look through GAS to determine when gun clears deflade	K,B,O	N	-			-	N	
Announce DRIVER STOP	K,B	Y	N			B	Y	
Look through GPS	K,B,O	Y	N			B	Y	
Announce IDENTIFIED	K,B	Y	N			B	Y	
Switch GPS to 10X	K,B,O	Y	N			B	Y	
Lay on center mass of target	B(O)	Y	N			O	Y	
Begin tracking moving targets	B(O)	Y	N			O	Y	
Depress lase button(s)	B(O)	Y	N			O	Y	
Evaluate range display	K,O	Degraded	N			B	Y	
Check ready-to-fire and fault symbols	K,O	Y	N			B	Y	
Make control lay	B(O)	Y	N			O	Y	
Listen for UP	K,O	Y	N			B	Y	
Listen for FIRE	K,O	Y	N			B	Y	
Announce ON THE WAY	B(O)	Y	N			B	Y	
Squeeze trigger(s)	B(O)	Y	Y	Target Hit		O	Y	
Continue tracking	B(O)	Y	N			O	Y	

Testing Capabilities of SIMNET on Gunner Activities

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.3. Gunner cannot identify announced target	(Y)					
Case 4.3.A.: GNR fails to identify target(s)	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announces CANNOT IDENTIFY or does not respond	K(B)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 4.3.B.: GNR identifies different target	Y					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Announces IDENTIFY <DIFFERENT TARGET>	K(B)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.4. Use TIS	N					No TIS

Testing Capabilities of SIMNET on Gunner Activities

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	Partial					Degraded mode not represented

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Recover sight picture	K,B	N					N	
Observe/announce strike of every round	K	Y				B	Y	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.1. Reengage	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Announce REENGAGING	K,B	Y	N			B	Y	
Release/reengage palm switches	K,B	Y	N			B	Y	
Lay center of mass	B(O)	Y	N			O	Y	
Begin tracking moving target	B(O)	Y	N			O	Y	
Depress lase button(s)	B(O)	Y	N			O	Y	
Evaluate range display	K,O	Degraded	N			B	Y	
Check ready-to-fire and fault symbols	K,O	Y	N			B	Y	
Listen for UP	K,O	Y	N			B	Y	
Announce ON THE WAY	K,B	Y	N			B	Y	
Squeeze trigger(s)	B(O)	Y	N			O	Y	
Continue tracking	B(O)	Y	N			O	Y	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.2. Standard adjustment (degraded mode)	N					Degrade mode not presented

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.3. TC adjustment	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Release/reengage palm switches	K,B,O	Y	N			B	Y	
Apply TC correction[1]	K&B(O)	Y	N			O	Y	
Listen for UP	K,O	Y	N			B	Y	
Announce ON THE WAY	K,B	Y	N			B	Y	
Squeeze trigger(s)	B(O)	Y	N			O	Y	
Continue tracking	B(O)	Y	N			O	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	N					SIMNET does not simulate coax

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	(Y)					
Engage first target using precision gunnery (Option 4.1 or 4.2)	Y					
If first target is not destroyed, adjust fire as described in Activity 5	Y					
Engage second target using precision gunnery (Option 4.1 or 4.2)	Y					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS	N					SIMNET does not simulate cal .50

Testing Capabilities of SIMNET on Gunner Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	N					Only battlesight and multiple return available
Option 9.1. Engage targets using battlesight gunnery	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set/check switches: * FIRE CONTROL MODE: NORMAL * LRF: SAFE * GPS: 3X * GUN SELECT: MAIN * AMMO SELECT: battlecarry ammo	K,B,O	Y				B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2) but without lasing to target	Y					
Option 9.2. Engage target given ineffective LRF	N					Not presented
Option 9.3. Engage target given multiple returns from LRF	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Depress lase button(s)	B(O)	Y				B	Y	
If multiple return symbol appears in GPS, announce RANGE <IN METERS>	K,B,O	Y				B	Y	
Switch LRF setting in accordance with TC instructions	K,B,O	Y				B	Y	

Testing Capabilities of SIMNET on Gunner Activities

Activity 9. ENGAGE TARGET USING DEGRADED GUNNERY TECHNIQUES	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.3.A. Gunner relases						

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Relay on target	B(O)	Y				O	Y	
Depress lase button(s)	B(O)	Y				O	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Continue with engaging main target using precision gunnery (Option 4.1 or 4.2)	Y					
Case 9.3.B. TC corrects range	Y					
Continue with engaging main target using precision gunnery (Option 4.1 or 4.2)						
Option 9.4. Engage target given no range display (loss of symbology)	N					Not presented
Option 9.5. Engage target given crosswind failure	N					Not presented
Option 9.6. Engage target given cant sensor failure	N					Not presented
Option 9.7. Lead angle sensor failure	N					Not presented
Option 9.8. GPS failure (day channel)	N					No TIS
Option 9.9. Engage target given GPS/TIS failure	N					No TIS
Option 9.10. Engage target using GAS	N					No GAS
Option 9.11. Engage target given stabilization system failure (emergency mode)	N					Not presented
Option 9.12. Engage target given turret power failure (manual mode)	N					Not presented

Activity 10. ENGAGE TARGET FROM TC POSITION

Testing this activity is not rated for the gunner.

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 11. ASSESS RESULTS OF ENGAGEMENT	(Y)					

	Measure Required	Element Represented	Automatic Recording Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Check/adjust MRS	K,B,O	N					N	
Index battlecarry ammo	K,B,O	Y				B	Y	
Announce <AMMO> INDEXED	K,B	Y				B	Y	

APPENDIX I - 6
TESTING CAPABILITIES OF UCOFT ON TANK COMMANDER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	N	-				Many missing elements

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Enter station	K,B,O	N					N	
Power up CWS/turret	K,B,O	Y	N				Y	
Operate domelight	K,B,O	Y				B,O	Y	
Operate intercom	K,B,O	N	N				N	
Adjust seat[1]	K,B,O	Y	N			B,O	Y	
Adjust hatch	K,B,O	N					N	
Adjust platform	K,B,O	N					N	
Install TC's weapon	K,B,O	N					N	
Adjust kneeguard	K,B,O	N					N	
Adjust GPSE headrest/lens	K,B,O	N					N	
Check manual range controls	K,B,O	Y	N			B,O	Y	Observe range changes at console
Check power control handle	K,B,O	Y	N			B,O	Y	Observe motion at console
Check CWS in power/manual modes	K,B,O	Y	N			B,O	Y	

[1]Adjustment outcomes must be judged with reference to individual.

Testing Capabilities of UCOFT on Tank Commander Activities

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	N					UCOFT does not allow time nor give sufficient cues to test this existing activity

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Supervise/assist boresight	K,B&O	N						
Boresight TC's weapon	K&B,(O)	N						
Zero TC's weapon	K&B,(O)	N						
Select/announce battlecarry AMMO, RANGE	K,(B)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.1. Prepare for offense	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Receive offensive mission/ formation/movement/commo	K	Degraded	N					Pre-engagement information not analogous to OPORD
Analyze terrain	K(K)	N						Scene degraded; no maps
Check map overlay	K(K)	N						
Brief crew	K,B,O	N						Not required by UCOFT; not sufficient information to brief crew
Control driver, if necessary to maintain position in pit formation and to exploit cover and concealment	K,(B)	N						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 2.2. Prepare for defense	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue driver commands to move with platoon to occupy battle position[2]	K,(B)	N						
Receive defensive mission/ position commo	K	N						
Prepare primary/alternate/ supplementary positions	K,(B)	N						
Analyze terrain	K(K)	N						Scene degraded; no maps
Prepare tank sketch card	K,(B,O)	N						

[2]Movement per se is primarily under driver's control. TC initiates movement and gives corrections.

Testing Capabilities of UCOFT on Tank Commander Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	N					Missing and degraded elements
Part 3.1. - Search for Target(s)	N					
Option 3.1.1. Search open hatch - day	N					Open hatch not simulated

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Search closed hatch - day	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Search 360°	K,B,O	N					N	Must traverse to search; target all in front sector
Perform air guard duties	K	N					N	
Execute search techniques	K	N					N	Cannot oberve search techniques

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.3. Search at night	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Search 360°	K,B,O	N					N	
Use off-center vision	K	N					N	

Activity 3. ACQUIRE TARGET(S) (cont'd)

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Part 3.2. Detect/Locate/Identify Target(s)	(Y)	N				Simulation may reduce validity

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s)/ obstacle(s)[3]	K(K)	Degraded	N				N	No observable behavior
Locate target(s)	K(K)	Degraded	N				N	No observable behavior
Identify target(s) by · IFFN · Nomenclature	K(K)	Degraded	N				N	No observable behavior
Note number of target	K,O	Y	N			K	N	Would have to freeze exercise and ask TC what he saw
Classify multiple targets as most dangerous/dangerous/ least dangerous[4]	K,(O)	Y	O	Error Recorded for Incorrect Engagement		K	N	Evaluate fire command
Confirm acquisition report	K,(B,O)	Y	N			K	N	No observable behavior
Estimate range to select weapon(s) and to evaluate LRF return	K	Degraded	N			K	N	Evaluate fire command

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Part 3.3. Evaluate situation	Degraded	Mixed with other actions	II	Limited		Simulation may reduce validity

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Decide whether or not to engage contingent on:[5] · Plt mission · Platoon fire plan · Plt ldr command	K,(O)	N					N	All targets are engaged
Select the appropriate weapon/ ammunition and the firing mode (precision/degraded) contingent on:[6] · Target range · Type of target (hard/soft, point/area) · Tank status (ammo, malfunctions)	K,(O)	Y	O	Ammo choice		O	Y	Evaluate of fire command
Determine crewman (GNR, TC, LDR) and the type of fire command (single, multiple, or simultaneous) contingent on: · Number of targets · Target classification[7]	K,(O)	Y	N			O	Y	Evaluate of fire command

[3]There are enough different patterns of cues to look for that detection is more complex than simple observation.

[4]Outcome is sequence of target engagement selected by TC.

[5]Oucome is initiation of fire command.

[6]Outcome is ammunition annouced in fire command.

[7]Outcome is alert element of fire command.

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Y	Complex	Partial	Limited		
Option 4.1. Engage single target from the offense using precision gunnery	Y	Complex	Partial	Limited		

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue contact report: CONTACT <DIRECTION> <TARGET>	K,B	Y	N				Y	Not required by UCOFT
Decide whether to engage target while moving or from a short halt	K(K)	Y	N				Y	Can "stop" tank only in degraded mode exercises
If engaging from a short halt, issue driver command: DRIVER STOP	K,B	Y	N				Y	
Relay any action drill command	K,B,O	N					N	
Issue fire command: GUNNER <AMMO> <TARGET>[8]	K,(B)	Y	B	Ammo Recorded		B	Y	
Lay gun (simultaneous with fire command)	K,B,O	Y	N			B,O	Y	Score by viewing motion on console
Release override	K,B,O	Y				O	Y	
Sight through GPSE	K,B,O	Y				O	Y	Score at console
Evaluate range display[9]	K,O	Y				O	Y	Occurrence depends on gunner
Listen for UP[10]	K	Y				B	Y	
Announce FIRE, or FIRE, FIRE <ALTERNATE AMMO>	K,B	Y					Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.2. Engage single target from the defense using precision gunnery	Y	Complex	Partial	Limited		

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue contact report: CONTACT <DIRECTION> <TARGET>	K,B	Y	N				Y	
Issue fire command: GUNNER <AMMO> <TARGET>[11]	K,(B)	Y	N				Y	
Announce DRIVER MOVE OUT, GUNNER TAKE OVER	K,B	Y	N				Y	
Lay gun (simultaneous with fire command)	K,B,O	Y	N				Y	
Release override	K,B,O	Y	N				Y	

[8] Assumes decisions were made in Part 3.3. Outcome is crew responding. May use reduced command.

[9] If range appears incorrect, observable outcomes are indexing range or commanding gunner to relase.

[10] Outcome is announcing FIRE only after hearing up.

[11] Assumes decisions were made in Part 3.3. Outcome is crew responding. May use reduced command.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Sight through GPSE	K,B,O	Y	N			O	Y	Score at console
Evaluate range display	K,O	Y	N			O	Y	Occurrence depends on gunner
Listen for UP	K,O	Y	N			O	Y	
Announce FIRE, or FIRE,FIRE <ALTERNATE AMMO>	K,B	Y	N			O	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.3. Gunner cannot identify announced target	Y					
Case 4.3.A.: Gunner fails to identify target(s)	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Direct gunner onto target using one of the following techniques: • Verbal command: TRAVERSE <LEFT or RIGHT>, STEADY, ON • TRPs • Announce WATCH MY TRACERS and use .50 caliber tracers to point to target	K&B							

OR

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Announce FROM MY POSITION and proceed with TC engagement (see Activity 10)	Y					
Case 4.3.B. Gunner identifies incorrect target(s)						

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If GNR is correct, issue a correction to the fire command	K,(B,O)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
If GNR identifies the wrong target, treat as Case 4.3.A. and proceed	Y					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.4. Engage target using TIS	Y					

Engage targets using precision gunnery (Option 4.1 or 4.2)[12]

[12]When element references another part of the domain, classifications for referenced section apply.

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	Y	?				

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Recover sight picture	K,B	Degraded	N					
Observe strike of round	K	Degraded	N					
If TARGET was observed, determine whether or not target was destroyed	K(K)	N	O					

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.1. Use reengage technique	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Evaluate range display	K,O	Y	N			O	Y	Occurrence depends on gunner
Announce FIRE	K,B	Y	N			B	Y	

Option 5.2. Use standard adjustment (degraded mode)

No TC actions specified

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.3. Use TC adjustment	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Issue subsequent fire command to adjust fire .5-3 mils in deflection and .5-2 mils (100-400 meters) in range	K&B	Y	N			B	Y	Determine appropriate correction and score from console
If target is destroyed or exposure too long, command CEASE FIRE	K,(B)	Y	Y	Exposure time recorded	S	B	Y	
If in defensive posture, command DRIVER, BACK UP	K,(B,O)	Y	O		S	B	Y	Excessive exposure leads to own tank being hit

Testing Capabilities of UCOFT on Tank Commander Activities

Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	Y	Complex	Partial	Limited		

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER COAX <TARGET>[13]	K,B	Y	Time and Ammo	Displayed	S	B	Y	Ammo keyed in by I/O
Lay gun (simultaneous with fire command)	K,B,O	Y	N			O	Y	Observe sight picture at console
Release override	K,B,O	Y	N				Y	
Evaluate range display	K,O	Y	N			O	Y	Occurrence depends on gunner
Announce FIRE	K,B	Y	N					
Monitor/evaluate engagement	K	Y	N				N	
Command CEASE FIRE	K,(B)	Y	N			B	Y	

Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	(Y)					Severe time limits reduce testing utility

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER <AMMO> <NUMBER> <TARGETS>, <RIGHT/LEFT> <TARGET> FIRST	K,B	Y	B	Target Order Scored	S	B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage first target using precision gunnery (Option 4.1 or 4.2)	Y	Complex				
If first target is not destroyed, adjust fire (Activity 5)	Y	Complex				

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If first target is destroyed, announce <NEXT> TARGET	K,(B)	Y	N					Severe time limits may prevent crew from getting this far
[Continue until all targets are destroyed]								
Announce CEASE FIRE	K,(B)	Y	N					

[13] Assumes decisions were made in Part 3.3. Outcome is crew responding.

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)	Y	Complex	Partial	Limited		
Option 8.1. Simultaneous targets	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER <AMMO> <TARGET>, FIRE AND ADJUST[14]	K,B	Y	N			B	Y	

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	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 8.2. Cal .50 targets	Y	Complex	Partial	Limited		

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Announce: CALIBER .50[14]	K,B	Y	N			B	Y	
Charge TC's weapon	K,B,O	N					N	Osbserve at console
Lay weapon for deflection	B,(O)	Y	N			O	Y	Outline is range line selected in next stp
Estimate range to target	K	Degraded	N				N	Observe at console
Lay CWS sight range line on target	B,(O)	Y	N			O	Y	Observe at console
Fire bursts of 10-15 rounds	B,(O)	Y	N			O	Y	Observe at console
Adjust fire if needed	B,(O)	Y	N			O	Y	Observe at console
If target is destroyed, announce TC COMPLETE	K,(B)	Y	N			B	Y	

[14]Assumes decisions were made in Part 3.3. Outcome is crew responding.

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES						
Option 9.1. Engage targets using battlesight gunnery	(Y)	Not specific to technique				Battlesight dependent on TC ability to estimate range. UCOFT range estimation may not be correlated with real world

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER BATTLESIGHT <TARGET>[15]	K,B	Y	N					
Depress MANUAL RANGE BATTLE SGT button	K,B,O	Y	N					
Estimate range to target	K	Y	N				N	
If target outside of ± 200 meters of battlesight range, enter range change using MAN RNG B/S ADD DROP toggle switch	K,(B,O)	Y	N			B	Y	Score use of toggle switch
Check range readout in GPSE	K,(B,O)	Y	N				N	No observable behavior

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2) but without evaluating LRF display	Y	Complex	Partial	Limited		

Option 9.2. Engage targets given ineffective LRF	(Y)					Battlesight dependent on TC ability to estimate range. UCOFT range estimation may not be correlated with real world

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If LRF fails to function or is rendered ineffective due to environmental conditions or battlefield obscurants, TC has the choice of using one of the following techniques:[16]	K(K)	Y	N			B	Y	Test whether TC initiates appropriate technique

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.2.A. Use battlesight gunnery	Y	Complex	Partial	Limited		
Engage target using battlesight gunnery (Option 9.1)						

[15]Assumes decisions were made in Part 3.3. Outcome is crew responding.

[16]Appropriate behaviors are the TC commands to begin on of the alternative techniques.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)

Case 9.2.B. TC indexes range — Y | ?

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER <AMMO> TARGET	K,B	Y	N			B	Y	
Estimate range to target	K	Y	N				N	
Index range using MAN RNG B/S ADD/DROP toggle switch	K,B,O	Y	N			B,O	Y	B-Use toggle switches? O-Correct range entered?

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.2.C. GNR indexes range						

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Estimate range to target	K	Y	N				N	
Issue fire command: GUNNER <AMMO> INDEX <RANGE>	K,B	Y	N			B	Y	Is appropriate range announced?

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.2.D. GNR manually applies range						
Engage target using GAS (Option 9.10)						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.3. Engage targets given multiple returns from LRF	(Y)					Battlesight dependent on TC ability to estimate range. UCOFT range estimated may not be correlated with real world.

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Estimate range	K	Y	N				N	
Evaluate range display	K,O	Y	N			O	Y	
If range appears incorrect, may instruct GNR to switch LRF setting from ARM LAST RTN to ARM 1ST RTN or v.v.	K,(B,O)	Y	N			B	Y	
If multiple return symbol appears in GPSE and displayed range is outside ± 200 m of estimated range, choose one of the following actions:[17]	K(K)	Y	N			B	Y	Does TC initiate an appropriate technique?

[17]Appropriate behaviors are the TC commands to begin one of the alternative techniques.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.3.A. Gunner releases	Y	-	-	-	-	

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Announce RELASE	K,B	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.3.B. TC corrects range						

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Correct range using MAN RNG B/S ADD/DROP toggle switch	K,B,O	Y	N			B,O	Y	B-Use toggle switch? O-Correct range entered?
If displayed range is within ± 200 m of estimated range, announce FIRE	K,(B,O)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.4. Engage targets given no range display (loss of symbology)	(Y)	-	-	By special instruction		There are no exercises for this condition, but it can be simulated by turning symbol knob all the way down

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
TC choose one of the following options:[18]	K(K)		N					Observe whether TC initiates one of the options

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.4.A. Little or no time	Y	-				
Engage target using precision gunnery (Option 4.1 or 4.2) but without evaluating range	Y					
Case 9.4.B. Time permitting	Y	-				

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Have gunner report range from CCP	K,(B)	Y	N				Y	
Evaluate range	K,O	Y	N				Y	Observable only if range judged incorrect

[18] Appropriate behaviors are the TC commands to begin one of the alternative techniques.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.5. Engage target given crosswind sensor failure	Degraded			By special instruction		No crosswind sensor failure exercise

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If computer self-test indicates crosswind sensor failure, have the gunner cancel crosswind input	K,(B)	N					N	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2)	Y	-				

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.6. Engage target given cant sensor failure	Degraded	-	-	By special instruction		No cant sensor failure exercises

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If computer self-test indicates cant sensor failure, have the GNR cancel cant input	K,(B)	N					N	
Announce DRIVER STOP	K,B	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery--stationary (Option 4.2)	Y	-	-			

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Monitor GNR's cant correction	K	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.7. Engage target given lead angle sensor failure	N	-		By special instruction		Lead angle failure is not simulated independent of STAB failure

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If computer self-test indicates lead angle sensor failure, have the GNR cancel lead angle input	K,(B)	N						
Announce DRIVER STOP	K,B	Y	N					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery--stationary (Option 4.2)	Y	-				

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Monitor GNR's lead	K	Y	N					

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.8. Engage target given GPS failure (day channel)	N					No GPS failure independent of TIS failure

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If no GPS image, have GNR switch to thermal channel	K,(B)	N						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage targets using TIS (Option 4.4)	-					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.9. Engage target given GPS/TIS failure	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If both GPS and TIS fail, the TC choose one of the following engagement techniques:[19]	K(K)	N	N			B	Y	Observe whether TC initiate inappropriate technique

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.9.A. Use GAS with precision techniques	Y	Not specific to technique				
Engage target using GAS gunnery (Option 9.10)						
Case 9.9.B. Use GAS with battle-sight techniques	Y	Not specific to technique				
Engage target using battlesight gunnery (Option 9.1)						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.10. Engage target using GAS gunnery[20]	Y	Complex	Partial	Limited		

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Estimate range to target	K	N					N	Range is given
Issue fire command: GUNNER <AMMO> <TARGET> <RANGE>	K,B	Y	N			B	Y	
Lay gun (simultaneous with fire command)	K,B,O	Y	N			O	Y	Observe at console
Release override	K,B,O	Y	N				Y	
Announce FIRE	K,B	Y	N			B	Y	

[19] Appropriate behaviors are the TC commands to begin one of the alternative techniques.

[20] Assumes decision to use GAS was made in Part 3.3. Outcome is crew responding.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.11. Engage target given stabilization system failure (in emergency mode)	Y	Complex	Partial	Limited		

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER <AMMO> <TARGET>[21]	K,B	Y	N			B	Y	
Announce DRIVER STOP	K,B	Y	N			B	Y	
Lay gun (simultaneous with fire command)	K,B,O	Y	N			O	Y	Score at console
Release override	K,B,O	Y	N			B		
Announce FIRE	K,B	Y	N			B		
Announce DRIVER, MOVE OUT	K,B	Y	N			B		

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.12. Engage target given turret power failure	Y	Complex				

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Announce DRIVER STOP	K,B	Y	N			B	Y	
Issue fire command: GUNNER <AMMO> <TARGET> <DIRECTION> <RANGE>[22]	K,B	Y	N			B	Y	
Announce FIRE	K,B	Y	N			B	Y	
Announce DRIVER MOVE OUT	K,B	Y	N			B	Y	

[21]Assumes decisions made in Part 3.3. Outcome is crew responding.

[22]Assumes decisions made in Part 3.3. Outcome is crew responding.

Testing Capabilities of UCOFT on Tank Commander Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 10. ENGAGE TARGETS FROM THE TC POSITION (Also Three Man Crew Engagements)	Y					
Issue one of the following fire commands:						
Case 10.A. Gunner cannot identify target	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
FROM MY POSITION	K,B	Y	Time	Time	S			Fed in by I/O

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 10.B. Three-man crew (no GNR)	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
LOAD <AMMO>	K,B	Y	N					
Set/check switches: • FIRE CONTROL MODE: NORMAL • TIS: STBY/ON • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT as selected	K&B,(O)	Y	N			O,B	Y	
Estimate range to target	K	Y	N				Y	
Sight through GPSE	K,B,O	Y	N			B	Y	
Lay on center mass of target[23]	B,(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
Depress lase button[24]	B,(O)	Y	O	Replay	S	B	Y	Judge return at console
Evaluate range display	K,O	Degraded	N			(B)	Y	Observable only if range judged incorrect
Make control lay[1]	B,(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
Announce ON THE WAY	K,B	Y	T	Time	S	B	Y	Fed in by I/O
Squeeze trigger[25]	B,(O)	Y	O	Replay	S	O	Y	Judge sight picture at console
Announce CEASE FIRE	K,(B)	Y	O			B	Y	

[23] Sight picture is the relevant outcome.

[24] Relevant outcomes are sight picture and correct range.

[25] Relevant outcome is sight picture at the time of firing.

Testing Capabilities of UCOFT on Tank Commander Activities

Activity 11. ASSESS RESULTS OF ENGAGEMENT	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	Degraded	N	-	-	-	

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Assess battle damage/ casualties	K(K)	N						
Determine if and how crew should be reorganized to fight in a three-man configuration	K	N						
Issue SPOTREP	KAB	Y	N					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 11.A. Tank is stationary	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Determine whether to move to primary, alternate, or supplementary firing positions	K(K)	N						
Issue driver commands	K,B	N						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 11.B. Tank is moving	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Determine changes to route	K(K)	N						
Issue driver commands	K,B	N						
Determine appropriate ammo for anticipated targets	K(K)	Y	N				N	
Announce PREPARE BATTLECARRY <AMMO> or RELOAD <AMMO>	K,(B)	Y	N			B	Y	
Enter battlecarry range using the MANUAL BATTLE SGT ADD/DROP toggle switch	K,B,O	Y	N			B	Y	

APPENDIX I - 7
TESTING CAPABILITIES OF SIMNET ON TANK COMMANDER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite[1] Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	N					Too many missing elements

	Measure Required	Element Represented	Automatic Recording[2] Mode	Feedback	Storage	Instructor Scoring[3]	Element Testable	Comments
Enter station	K,B,O	N					N	
Power up CWS/turret	K,B,O	N					N	
Operate domelight	K,B,O	(Y)					N	
Operate intercom	K,B,O	(Y)					N	
Adjust seat	K,B,O	N					N	
Adjust hatch	K,B,O	N					N	
Adjust platform	K,B,O	N					N	
Install TC's weapon	K,B,O	N					N	
Adjust kneeguard	K,B,O	N					N	
Adjust GPSE headrest/lens	K,B,O	N					N	
Check manual range controls	K,B,O	Y				B	"	
Check power control handle	K,B,O	Y				B	Y	
Check CWS in power/manual modes	K,B,O	Power only				B	Y	

[1] SIMNET provides no composite scores, therefore these two columns are left blank for the entire domain.

[2] SIMNET has no automatic scoring capabilities. However, there is a real-time remote plan-down display with memory capture for replay. Therefore, possibilities for an instructor scoring from the plan-down display are described.

[3] In this column, possibilities for an instructor scoring from inside the SIMNET crew compartment are described.

Testing Capabilities of SIMNET on Tank Commander Activities

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	Partial					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Supervise/assist boresight	K,B&O	N						
Boresight TC's weapon	K&B,(O)	N						
Zero TC's weapon	K&B,(O)	N						
Select/announce battlecarry AMMO, RANGE	K,(B)		N			B	Y	

Option 2.1. Prepare for offense	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	Partial					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Receive offensive mission/ formation/movement/commo	K	Y	N				N	No observable behavior
Analyze terrain	K(K)	Degraded	N				N	No observable behavior
Check map overlay	K(K)	Y	N				N	No observable behavior
Brief crew	K,B,O	Y	N			B	Y	
Control driver, if necessary to maintain position in plt formation and to exploit cover and concealment	K,(B)	Y	N			B	Y	

Option 2.2. Prepare for defense	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
	Partial					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Issue driver commands to move with platoon to occupy battle position[4]	K,(B)	Y				B,O	Y	
Receive defensive mission/ position commo	K	Y					N	No observable behavior
Prepare primary/alternate/ supplementary positions	K,(B)	N					N	
Analyze terrain	K(K)	Y					N	No observable behavior
Prepare tank sketch card	K,(B,O)	Y				O	Y	

[4]Movement per se is primarily under driver's control. TC initiates movement and gives corrections.

Testing Capabilities of SIMNET on Tank Commander Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	Partial					Missing elements and degraded simulation
Part 3.1. - Search for Target(s)	N					Degraded simulation
Option 3.1.1. Search open hatch - day						Open hatch not simulated

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.2. Search closed hatch - day	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Search 360°	K,B,O	Degraded	N			B	Y	Must traverse to search
Perform air guard duties	K	Y	N				N	No air targets
Execute search techniques	K	Y					N	No observable behavior

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.3. Search at night	N					Night not simulated

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Search 360°	K,B,O							
Use off-center vision	K							

Activity 3. ACQUIRE TARGET(S) (cont'd)

Part 3.2. Detect/Locate/Identify Target(s)	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	Y					Simulation may reduce validity

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s)/ obstacle(s)[5]	K(K)	Degraded	N				N	No observable behavior
Locate target(s)	K(K)	Y	N				N	No observable behavior
Identify target(s) by · IFFN · Nomenclature	K(K)	Degraded	N				N	No observable behavior
Note number of target	K,O	Y	N				N	No observable behavior
Classify multiple targets as most dangerous/dangerous/ least dangerous[6]	K,(O)	Y	N			B	Y	Evaluate fire command
Confirm acquisition report	K,(B,O)	Y	N				N	No observable behavior
Estimate range to select weapon(s) and to evaluate LRF return	K	Degraded	N				N	Evaluate fire command

Part 3.3. Evaluate situation	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Decide whether or not to engage contingent on:[7] · Plt mission · Platoon fire plan · Plt ldr command	K,(O)	Y	N			B	Y	Simulation may reduce validity
Select the appropriate weapon/ ammunition and the firing mode (precision/degraded) contingent on:[8] · Target range · Type of target (hard/soft, point/area) · Tank status (ammo, malfunctions)	K,(O)	Y	N			B	Y	Evaluate fire command; not all allowable response possible on SIMNET
Determine crewman (GNR, TC, LDR) and the type of fire command (single, multiple, or simultaneous) contingent on: · Number of targets · Target classification[9]	K,(O)	Y	N			B	Y	Evaluate fire command; not all allowable response possible on SIMNET

[5]There are enough different patterns of cues to look for that detection is more complex than simple observation.

[6]Outcome is sequence of target engagement selected by TC.

[7]Oucome is initiation of fire command.

[8]Outcome is ammunition annouced in fire command.

[9]Outcome is alert element of fire command.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	Y					Except TIS which primarily affects gunner
Option 4.1. Engage single target from the offense using precision gunnery	Y					
	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue contact report: CONTACT <DIRECTION> <TARGET>	K,B	Y	N			B	Y	
Decide whether to engage target while moving or from a short halt	K(K)	Y	N			B	(Y)	No degraded mode on SIMNET so this option may never be taken
If engaging from a short halt, issue driver command: DRIVER STOP	K,B	Y	N			B	(Y)	No degraded mode on SIMNET so this option may never be taken
Relay any action drill command	K,B,O	Y	N			B	Y	
Issue fire command: GUNNER <AMMO> <TARGET>[10]	K,(B)	Y	N			B	Y	
Lay gun (simultaneous with fire command)	K,B,O	Y	N			B	Y	
Release override	K,B,O	Y	N			B	Y	
Sight through GPSE	K,B,O	Y	N			B	Y	
Evaluate range display[11]	K,O	Y	N			B	Y	
Listen for UP[12]	K	Y	N			B	Y	
Announce FIRE, or FIRE, FIRE <ALTERNATE AMMO>	K,B	Y	N			B	Y	

Option 4.2. Engage single target from the defense using precision gunnery	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	Y					
	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue contact report: CONTACT <DIRECTION> <TARGET>	K,B	Y	N			B	Y	
Issue fire command: GUNNER <AMMO> <TARGET>[13]	K,(B)	Y	N			B	Y	
Announce DRIVER MOVE OUT, GUNNER TAKE OVER	K,B	Y	N			B	Y	
Lay gun (simultaneous with fire command)	K,B,O	Y	N			B	Y	
Release override	K,B,O	Y	N			B	Y	

[10] Assumes decisions were made in Part 3.3. Outcome is crew responding. May use reduced command.

[11] If range appears incorrect, observable outcomes are indexing range or commanding gunner to relase.

[12] Outcome is announcing FIRE only after hearing up.

[13] Assumes decisions were made in Part 3.3. Outcome is crew responding. May use reduced command.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Sight through GPSE	K,B,O	Y	N			B	Y	
Evaluate range display	K,O	Y	N			B	Y	
Listen for UP	K,O	Y	N			B	Y	
Announce FIRE, or FIRE,FIRE <ALTERNATE AMMO>	K,B	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.3. Gunner cannot identify announced target	Y					
Case 4.3.A.: Gunner fails to identify target(s)	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Direct gunner onto target using one of the following techniques: • Verbal command: TRAVERSE <LEFT or RIGHT>, STEADY, ON • TRPs • Announce WATCH MY TRACERS and use .50 caliber tracers to point to target	K&B	(Y)	N			B	Y	
OR								
Announce FROM MY POSITION and proceed with TC engagement (see Activity 10)	Y							

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 4.3.B. Gunner identifies incorrect target(s)	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If GNR is correct, issue a correction to the fire command	K,(B,O)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
If GNR identifies the wrong target, treat as Case 4.3.A. and proceed	Y					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.4. Engage target using TIS	N					No TIS

Engage targets using precision gunnery (Option 4.1 or 4.2)[14]

[14]When element references another part of the domain, classifications for referenced section apply.

Testing Capabilities of SIMNET on Tank Commander Activities

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback Storage		Instructor Scoring	Element Testable	Comments
Recover sight picture	K,B	Y	N				N	
Observe strike of round	K	Y	N				N	No observable behavior
If TARGET was observed, determine whether or not target was destroyed	K(K)	Degraded	N				N	SIMNET uses coded graphics

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.1. Use reengage technique	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback Storage		Instructor Scoring	Element Testable	Comments
Evaluate range display	K,O	Y	N			O	Y	
Announce FIRE	K,B	Y	N			B	Y	

Option 5.2. Use standard adjustment (degraded mode)

No TC actions specified

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 5.3. Use TC adjustment	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback Storage		Instructor Scoring	Element Testable	Comments
Issue subsequent fire command to adjust fire .5-3 mils in deflection and .5-2 mils (100-400 meters) in range	K&B	Y	N			B	Y	
If target is destroyed or exposure too long, command CEASE FIRE	K,(B)	Y				B	Y	
If in defensive posture, command DRIVER, BACK UP	K,(K,O)	Y				B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	N					No coax simulation

---

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER <AMMO> <NUMBER> <TARGETS>, <RIGHT/LEFT> <TARGET> FIRST	K,B	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage first target using precision gunnery (Option 4.1 or 4.2)	Y					
If first target is not destroyed, adjust fire (Activity 5)	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
If first target is destroyed, announce <NEXT> TARGET	K,(B)	Y	N			B	Y	
[Continue until all targets are destroyed]								
Announce CEASE FIRE	K,(B)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)	N					No cal .50 simulation

Testing Capabilities of SIMNET on Tank Commander Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES						
Option 9.1. Engage targets using battlesight gunnery	(Y)					Battlesight dependent of TC ability to estimate range. SIMNET range estimation may not be correlated with real world

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Issue fire command: GUNNER BATTLESIGHT <TARGET>[15]	K,B	Y	N				Y	
Depress MANUAL RANGE BATTLE SGT button	K,B,O	Y	N				Y	
Estimate range to target	K	Degraded	N				Y	
If target outside of ± 200 meters of battlesight range, enter range change using MAN RNG B/S ADD DROP toggle switch	K,(B,O)	Y	N			B	Y	Score use of toggle switch
Check range readout in GPSE	K,(B,O)	Y	N				N	No observable behavior

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Engage target using precision gunnery (Option 4.1 or 4.2) but without evaluating LRF display	Y					
Option 9.2. Engage targets given ineffective LRF	N					Not s'mulated
Option 9.3. Engage targets given multiple returns from LRF	(Y)					Battlesight dependent of TC ability to estimate range. SIMNET range estimation may not be correlated with real world

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Estimate range	K	Degraded	N				N	No observable behavior
Evaluate range display	K,O	Y	N			B	Y	
If range appears incorrect, may instruct GNR to switch LRF setting from ARM LAST RTN to ARM 1ST RTN or v.v.	K,(B,O)	Y	N			B	Y	
If multiple return symbol appears in GPSE and displayed range is outside ± 200 m of estimated range, choose one of the following actions:[16]	K(K)		N			B	Y	

[15]Assumes decisions were made in Part 3.3. Outcome is crew responding.

[16]Appropriate behaviors are the TC commands to begin one of the alternative techniques.

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.3.A. Gunner releases	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Announce RELASE	K,B	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Case 9.3.B. TC corrects range						

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Correct range using MAN RNG B/S ADD/DROP toggle switch	K,B,O	Y	N			B	Y	
If displayed range is within ± 200 m of estimated range, announce FIRE	K,(B,O)	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.4. Engage targets given no range display (loss of symbology)	N					Not simulated
Option 9.5. Engage target given crosswind sensor failure	N					Not simulated
Option 9.6. Engage target given cant sensor failure						Not simulated
Option 9.7. Engage target given lead angle sensor failure						Not simulated
Option 9.8. Engage target given GPS failure (day channel)						Not simulated
Option 9.9. Engage target given GPS/TIS failure						Not simulated

Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.10. Engage target using GAS gunnery[17]	N					Not simulated

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.11. Engage target given stabilization system failure (in emergency mode)	N					Not simulated

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 9.12. Engage target given turret power failure	N					Not simulated

[17]Assumes decision to use GAS was made in Part 3.3. Outcome is crew responding.

Testing Capabilities of SIMNET on Tank Commander Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 10. ENGAGE TARGETS FROM THE TC POSITION (Also Three Man Crew Engagements)	Y					Tracking skills are assessed only by target hit
Issue one of the following fire commands:						
Case 10.A. Gunner cannot identify target	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
FROM MY POSITION	K,B	Y	N			B	Y	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Case 10.B. Three-man crew (no GNR)	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
LOAD <AMMO>	K,B	Y				B	Y	
Set/check switches: • FIRE CONTROL MODE: NORMAL • TIS: STBY/ON • LRF: ARM LAST RTN • GPS: 3X • GUN SELECT: MAIN • AMMO SELECT as selected	K&B,(O)	Y	N			B	Y	
Estimate range to target	K	Degraded	N				N	
Sight through GPSE	K,B,O	Y	N			B	Y	
Lay on center mass of target[18]	B,(O)	Y	N				Y	Not observable by instructor in compartment
Depress lase button[19]	B,(O)	Y	N			B	Y	
Evaluate range display	K,O	Y	N				N	Not observable by instructor in compartment
Make control lay[1]	B,(O)	Y	N				N	Not observable by instructor in compartment
Announce ON THE WAY	K,B	Y	N			B	Y	
Squeeze trigger[20]	B,(O)	Y	O	Target hit			Y	
Announce CEASE FIRE	K,(B)	Y	N			B	Y	

[18] Sight picture is the relevant outcome.

[19] Relevant outcomes are sight picture and correct range.

[20] Relevant outcome is sight picture at the time of firing.

Testing Capabilities of SIMNET on Tank Commander Activities

	Domain Testable	Composite Meaningful	Selection Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 11. ASSESS RESULTS OF ENGAGEMENT	Y					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Assess battle damage/ casualties	K(K)	N						
Determine if and how crew should be reorganized to fight in a three-man configuration	K	N						
Issue SPOTREP	K&B	Y						

	Domain Testable	Composite Meaningful	Selection Storage	Selection Repetition	Device Inconsistencies	Comments
Case 11.A. Tank is stationary						

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Determine whether to move to primary, alternate, or supplementary firing positions	K(K)	Y					Y	No observable behavior
Issue driver commands	K,B	Y				B	Y	

	Domain Testable	Composite Meaningful	Selection Storage	Selection Repetition	Device Inconsistencies	Comments
Case 11.B. Tank is moving						

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Determine changes to route	K(K)	Y					N	No observable behavior
Issue driver commands	K,B	Y				B	Y	
Determine appropriate ammo for anticipated targets	K(K)	Y				B	Y	
Announce PREPARE BATTLECARRY <AMMO> or RELOAD <AMMO>	K,(B)	Y				B	Y	
Enter battlecarry range using the MANUAL BATTLE SGT ADD/DROP toggle switch	K,B,O	Y				B	Y	

APPENDIX I - 8
TESTING CAPABILITIES OF SIMNET ON LOADER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite[1] Meaningful	Composite[1] Storage	Selection Repetition	Device Inconsistencies	Comments
	N					

	Measure Required	Element Represented	Automatic Recording[2] Mode	Automatic Recording[2] Feedback	Automatic Recording[2] Storage	Instructor Scoring[3]	Element Testable	Comments
Erect crosswind sensor	K,B,O	N					N	
Install LDR's machinegun	K,B,O	N					N	
Enter LDR's station	K,B,O	N					N	
Operate domelight	K,B,O	(Y)					N	
Power up LDR's station	K,B,O	N					N	
Operate intercom	K,B,O	(Y)	N				N	
Adjust LDR's seat/platform	K,B,O	N					N	
Adjust LDR's hatch	K,B,O	N					N	
Install/check LDR's night vision viewer	K,B,O	N					N	
Position LDR's guards for firing	K,B,O	N					N	
Operate LDR's panel	K,B,O	N					N	
Operate turret traverse lock	K,B,O	N					N	
Operate ready ammunition door in auto/manual modes	K,B,O	N					N	
Operate semi-ready ammunition door	K,B,O	N					N	
Operate hull ammunition door	K,B,O	N					N	
Stow 105mm ammunition	K,B,O	N					N	
Operate main gun breechblock	K,B,O	N					N	
Check replenisher	K,B,O	N					N	

[1]SIMNET provides no composite scores, therefore these two columns are left blank for the entire domain.

[2]SIMNET has no automatic scoring capabilities. However, there is a real-time remote plan-down display with memory capture for replay. Therefore, possibilities for an instructor scoring from the plan-down display are described.

[3]In this column, possibilities for an instructor scoring from inside the SIMNET crew compartment are described.

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Clear/load coaxial machinegun	K,B,O	N	N				N	
Fill ready rack	K,B,O	N	N				N	
Report ammo status	K,B	Y	N			B	Y	Listen for report
Load battlecarry ammo	K,B,O	K only	N				N	See footnote Option 4.1

Option 2.1. Prepare for offense	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Receive TC briefing	K	Y	N				N	No observable behavior

Option 2.2. Prepare for defense	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Inspect terrain to flank/rear	K(K)					B	(Y)	Observable behavior is when the loader looks; cannot judge inspection

Testing Capabilities of SIMNET on Loader Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	N					Missing and degraded elements
Part 3.1. Search for Target(s)	N					
Option 3.1.1. Search open hatch - day	N					No open hatch simulation
Option 3.1.2. Search closed hatch - day	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Search right front counter-clockwise to right rear	K	Y	N			(B)	Y	Can observe whether loader looks is require area
Execute search techniques	K	Y	N				N	No observable behavior

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.3. Search at night	N					No night simulation

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Part 3.2. Detect/Locate/ Identify Target(s)	(Y)					Simulation may reduce validity

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s)/ obstacle(s)	K,(K)	Degraded	N				N	No observable behavior
Locate target(s)	K,(K)	Y	N				N	No observable behavior
Identify target(s) making the following determinations:								
· IFFN								
· nomenclature	K,(K)	Degraded	N				Y	No observable behavior
If target detected, announce LOADER REPORT (TARGET) (LOCATION)	K,B	Y	N			B	Y	Listen for report

Part 3.3. Evaluate Situation

No TDR actions specified

Testing Capabilities of SIMNET on Loader Activities

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	N					See footnote
Option 4.1. Engage single target from the offense using precision gunnery	N					See footnote

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments
Drop down into turret	K,B,O	N						
Check turret ring	B,O	N						
Set GUN/TURRET DRIVE switch in EL UNCPL position	K,B,O	Y	N			B	Y	
Case 4.1.A. Announced round is not loaded								
Move ejection guard to SAFE	K,B,O	K[4]	N				N	
Ensure SAFE light is lit	K,B,O	K	N				N	
Open breech	K,B,O	K	N				N	
Remove incorrect round from chamber, if necessary	K,(B,O)	K	N				N	
Open ammo doors	K,B,O	K	N				N	
Stow unwanted round, if necessary	K,B,O	K	N				N	
Remove correct round from stowage	K,B,O	K	N				N	
Load desired round	K,B,O	K	N				N	
[Continue with Case B:]								
Case 4.1.B. Announced round loaded								
Move ejection guard to FIRE	K,B,O	K	N				N	
Clear recoil path	K,B,O	K	N				N	
Announce UP	K,B,O	Y	N			B	Y	
Open ammo doors	K,B,O	K	N				N	

[4]Each of the elements marked with a "K" in this column are represented in SIMNET by a toggle switch or push button which is flipped or pressed to simulate executing the element. The "K" rating signifies that only the knowledge of the procedure is represented, not the actual behavior. Testing behavior, outcomes or time under these conditions is unwarranted. In addition, loading in SIMNET requires knowledge of how the various behaviors are represented by SIMNET, as well as knowledge of the procedure itself. Therefore testing knowledge of the loading procedure is contaminated.

Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN (cont'd)

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.2. Engage single target from the defense using precision gunnery	N					See footnote

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Drop down into turret	K,B,O	N					N	
Check turret ring	B,O	N					N	
Set GUN/TURRET DRIVE switch in EL UNCPL position	K,B,O	Y	N			B	Y	
Case 4.1.A. Announced round is not loaded								
Move ejection guard to SAFE	K,B,O	K[5]	N				N	
Ensure SAFE light is lit	K,B,O	Y	N				N	
Open breech	K,B,O	K	N				N	
Remove incorrect round from chamber, if necessary	K,(B,O)	K	N				N	
Open ammo doors	K,B,O	K	N				N	
Stow unwanted round, if necessary	K,B,O	K	N				N	
Remove correct round from stowage	K,B,O	K	N				N	
Load desired round	K,B,O	K	N				N	
[Continue with Case B:]								
Case 4.1.B. Announced round loaded								
Move ejection guard to FIRE	K,B,O	K	N				N	
Clear recoil path	K,B,O	K	N				N	
Announce UP	K,B,O	Y	N			B	Y	
Open ammo doors	K,B,O	K	N				N	

[5]Each of the elements marked with a "K" in this column are represented in SIMNET by a toggle switch or push button which is flipped or pressed to simulate executing the element. The "K" rating signifies that only the knowledge of the procedure is represented, not the actual behavior. Testing behavior, outcomes or time under these conditions is unwarranted. In addition, loading in SIMNET requires knowledge of how the various behaviors are represented by SIMNET, as well as knowledge of the procedure itself. Therefore testing knowledge of the loading procedure is contaminated.

Activity 4. ENGAGE SINGLE
TARGETS WITH THE
MAIN GUN (cont'd)

Option 4.3. GNR cannot identify announced target

No LDR actions specified

- -

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.4. Engage targets using TIS	N					

Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)

==

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Feedback	Storage	Instructor Scoring	Element Testable	Comments	
Set GUN/TURRET DRIVE switch in EL UNCPL position	K,B,O	Y	N			B	Y		

	Domain Testable	Composite Meaningful	Storage	Selection Repetition	Device Inconsistencies	Comments
Load announced round (Case A, Option 4.1)	N					

- -

Option 5.1. Use reengage technique

No LDR actions specified

- -

Option 5.2. Use standard adjustment

No LDR actions specified

- -

Option 5.3. Use TC adjustment

No LDR actions specified

- -

Testing Capabilities of SIMNET on Loader Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	N					No coax simulation

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	N					
Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	N					
If first target is not destroyed, perform LDR's actions as described in Activity 5	N					
Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)	N					

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)	N					No coax simulation

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGETS USING DEGRADED GUNNERY TECHNIQUES	N					
Option 9.1 and 9.3	N					
Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)						

Remaining options are not represented by SIMNET

Testing Capabilities of SIMNET on Loader Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 10. ENGAGE TARGET FROM THE TC POSITION	N					
Perform LDR's actions as described in precision gunnery (Option 4.1 or 4.2)						

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 11. ASSESS RESULTS OF ENGAGEMENT	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Check replenisher reservoir	K,B,O	N					N	
Remove spent casings	K,B,O	N					N	

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Load announced round as described in precision gunnery (Option 4.1 or 4.2)	N					

	Measure Required	Element Represented	Automatic Scoring Mode	Automatic Scoring Feedback	Automatic Scoring Storage	Instructor Scoring	Element Testable	Comments
Announce loading status	K,B					B	Y	

APPENDIX I - 9
TESTING CAPABILITIES OF SIMNET ON DRIVER ACTIVITIES

Activity 1. PREPARE STATIONS FOR OPERATION	Domain Testable	Composite[1] Meaningful	Composite[1] Storage	Selection Repetition	Device Inconsistencies	Comments
	N					Too many missing elements

	Measure Required	Element Represented	Automatic Recording[2] Mode	Automatic Recording[2] Feedback	Automatic Recording[2] Storage	Instructor Scoring[3]	Element Testable	Comments
Enter DVR's station	K,B,O	N					N	
Power up hull systems	K,B,O	Degraded	N				N	
Operate domelight	K,B,O	(Y)	N				N	
Check turret seal	K,B,O	N					N	
Operate intercom	K,B,O	(Y)	N				N	
Adjust seat/periscopes	K,B,O	N					N	
Adjust hatch	K,B,O	N					N	
Adjust steer/throttle control	K,B,O	N					N	
Operate drain valves	K,B,O	N					N	
Start engine	K,B,O	N					N	
Make after-start checks	K,B,O	N					N	

[1] SIMNET provides no composite scores, therefore these two columns are left blank for the entire domain.

[2] SIMNET has no automatic scoring capabilities. However, there is a real-time remote plan-down display with memory capture for replay. Therefore, possibilities for an instructor scoring from the plan-down display are described.

[3] The driver compartment is completely enclosed with no room for an observer. Therefore, the possibilities for instructor scoring are from the remote plan-down display or observation of tank movement from another adjacent simulator. In either case, listening to radio/intercom communications is assumed.

Testing Capabilities of SIMNET on Driver Activities

Activity 2. PERFORM PREPARE-TO-FIRE CHECKS	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	(Y)					Terrain simulation may reduce test validity

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Check fuel tanks	K	Y	N			N	N	
Report fuel status	K,B	Y	N			N	Y	Listen for report

Option 2.1. Prepare for offense	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	(Y)					Terrain simulation may reduce test validity

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Receive TC briefing	K	Y	N				Y	No observable behavior
Select routes in accordance with mission and formation	K&B,(O)	Y	O			O	Y	Observe tank movement

Option 2.2. Prepare for defense	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
	(Y)					Terrain simulation may reduce test validity

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Drive to battle position	K&B,(O)	Y	O			O	Y	Observe tank movement
Rehearse movement between primary and alternate firing positions	K&B,(O)	Y	O			O	Y	Observe tank movement
Take primary firing positions	K&B,(O)	Y	O			O	Y	Observe tank movement
Monitor displays	K,B	Y	N			B	Y	Observe driver report of warnings/actions

Testing Capabilities of SIMNET on Driver Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 3. ACQUIRE TARGET(S)	N					Misssing and degraded elements
Part 3.1. Search for Target(s)	N					
Option 3.1.1. Search open hatch --day	N					SIMNET does not simulate open hatch
Option 3.1.2. Search closed hatch--day	N					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
If moving, follow wingman concept/ react to formation changes	K&B,(O)	Y	N			O	Y	Observe tank movement
Search fender to fender	K	Y	N				N	No air target
Execute search techniques	K	Y	N				N	No observable behavior

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 3.1.3. Search at night	N					Night not simulated
Part 3.2. Detect/Locate/Identify Target(s)	Y					Simulationn may reduce validity

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Detect target(s)/signature(s)/ obstacle(s)	K,(K)	Degraded	N				N	No observable behavior
Locate target(s)	K,(K)	Y	N				N	No observable behavior
Identify target(s) making the following determinations: . IFFN . nomenclature	K,(K)	Degraded	N				N	No observable behavior
If target detected, announce LOADER REPORT, <TARGET>, <LOCATION>	K	Y	N			B	Y	Listen for report
Evaluate cover and concealment	K,(K)	Y	N				N	No observable behavior

Part 3.3. Evaluate Situation

No driver actions specified

Testing Capabilities of SIMNET on Driver Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 4. ENGAGE SINGLE TARGETS WITH THE MAIN GUN	Movement only					Cannot observe driver's behaviors
Option 4.1. Engage single target from the offense using precision gunnery	(Y)					Terrain simulation may reduce validity

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Monitor TC and platoon leader commands	K	Y	N				N	No observable behavior
If TC announces HALT, stop smoothly	K&B,(O)	Y	N			O	Y	Observe tank movment
If TC does not announce HALT, maintain steady platform	K&B,(O)	Y	N			O	Y	Observe tank movement
If antitank fire is encountered, seek cover and concealment or execute action drill	K&B,(O)	Y	N			O	Y	Observe tank movement
Alert crew of obstacles	K,B	Y				B	Y	Listen for reports

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.2. Engage single target from the defense using precision gunnery	Movement only					Cannot observe driver's behaviors

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Set TACTICAL IDLE switch to ON position	K,B,O	Y	N					
Set transmission control to D	K,B,O	Y	N					
Release parking brake	K,B,O	Y	N					
Depress service brake	K,B,O	Y	N					
Move to hull defilade position	K,B,O	Y	O			O		Observe tank movement
Set transmission control to R	K,B,O	Y	N					
Depress/hold service brake	K,B,O	Y	N					

Option 4.3. GNR cannot identify announced target

No driver actions specified

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Option 4.4. Engage target using TIS	N					No TIS

Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)

Testing Capabilities of SIMNET on Driver Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 5. ADJUST FIRE	(Y)					Terrain simulation may reduce validity

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Return to defilade or seek alternate position	K&B,(O)	Y	O			O	Y	Observe tank movement

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	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 6. ENGAGE A SINGLE TARGET WITH THE COAX	N					No coax simulation

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	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 7. ENGAGE MULTIPLE TARGETS WITH THE MAIN GUN	Movement only					Cannot observer driver's behaviors. Terrain simulation may reduce validity
Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2	Movement only					Simulation may reduce validity
If first target is not destroyed, perform DVR's actions as described in fire adjustment (Activity 5)	Movment only					
Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2)	Movement only					

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Activity 8. ENGAGE TARGETS WITH THE CAL .50 (INCLUDING SIMULTANEOUS MAIN GUN ENGAGEMENTS)	N							No cal .50 simulation

Testing Capabilities of SIMNET on Driver Activities

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 9. ENGAGE TARGET USING DEGRADED GUNNERY TECHNIQUES	Movement only					Cannot observe driver's behaviors. Terrain simulation may reduce validity
Options 9.1 and 9.3	Movement only					

Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2

Remaining options are not simulated by SIMNET

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 10. ENGAGE TARGET FROM THE TC POSITION	Movement only					Cannot observe driver's behaviors. Terrain simulation may reduce simulation

Perform DVR's actions as described in precision gunnery (Option 4.1 or 4.2

	Domain Testable	Composite Meaningful	Composite Storage	Selection Repetition	Device Inconsistencies	Comments
Activity 11. ASSESS RESULTS OF ENGAGEMENT	Movement only					Cannot observe driver's behaviors. Terrain simulatin may reduce simulation

	Measure Required	Element Represented	Automatic Recording Mode	Automatic Recording Feedback	Automatic Recording Storage	Instructor Scoring	Element Testable	Comments
Respond to TC driving commands	K&B,(O)					O	Y	

APPENDIX J

TRAINING AND TESTING OBJECTIVES FOR INSTRUCTIONAL UNITS

APPENDIX J
TRAINING AND TESTING OBJECTIVES FOR INSTRUCTIONAL UNITS

Objective Number	Condition(s) Under Which Action is Performed	To-Be-Trained Action	Other Units In Which Action Is Trained[a]
Unit Number: 1			
Title: Conduct of Fire--Basic Skills and Knowledges			
Device/Medium: Classroom			
3:IIc	Acquired target(s)	TC issues fire command	/16
3:IIIf	Target range/type & FCS status	Select weapon/ammo and firing mode (precision/degraded)	/16
3:IIIg	Number of targets & Target classification	Determine crewman and fire command (sgl, mult, or sim)	/16
4:IIId	Relation of gun tube to target	Recall appropriate verbal command to guide GNR	/9
4:IIIf	GNR's control handle	Recall function and operation of lase buttons	/2
4:IIIh	LRF display	Interpret meaning of LRF symbol(s)	/14
5:IIIb	GNR control handles	Recall function and operation of palm switches	/2
Unit Number: 2			
Title: Precision Gunnery I--Gunner Duties			
Device/Medium: VIGS/TopGun			
4:I	Fully operational FCS & Single main gun target	Engage target using precision gunnery techniques	/9,19
4:IId	Moving target	GNR tracks target using control handles	/9
4:IIe	Reticle on target	GNR lases to target	/9
4:IIf	Return within/beyond 200m of estimated range	TC announces FIRE/GNR relases to target	/9,14
4:IIIc	GNR control handles & Target	Manipulate GNR control handles to set aiming point on target	/9
4:IIIe	Target track	Manipulate GNR's control handles to follow track	/9
4:IIIf	GNR's control handle	Recall function and operation of lase buttons	1/9
5:IIIb	GNR control handles	Recall function and operation of palm switches	1/13
Unit Number: 3			
Title: Secondary Functions I--PREOPS Procedures			
Device/Medium: Tank			
1:I	Secured tank	Prepare tank crew stations for operation	
1:IIa	Turret power OFF	TC prepares commander's station for operation	
1:IIb	Turret power ON	GNR prepares gunner's station for operation	
1:IIc	Turret power ON	LDR prepares loader's station for operation	
1:IId	Engine OFF	DVR prepares driver's station for operation	
1:IIIa	Task performed with aid of TM	Locate task procedure in TM	
1:IIIb	Task information in TM format	Answer questions concerning task	
4:IIa	Fire command	GNR sets/checks FCS/TIS switches for precision engagement	/9
4:IIIa	Engagement scenario	Identify appropriate setting for GNR station switches	/9
9.1:IIb	Battlesight fire command	GNR sets switches for battlesight engagement	/11
9.2:IVc	Computer control panel	Retrieve/store data in ballistic computer	/12
9.5:IIIa	Output from computer self-test	Determine status of fire control system	/12

(table continues)

Objective Number	Condition(s) Under Which Action is Performed	To-Be-Trained Action	Other Units In Which Action Is Trained[a]
Unit Number:	4		
Title:	Secondary Functions II--PREFIRE Procedures		
Device/Medium:	Tank/Field		
2:I	PREOPS completed	Prepare tank to fire in offensive or defensive mission	
2:IIa	Stations prepared for operation	TC/GNR boresight weapons	
2:IIb	Battlecarry announcement	Prepare battlecarry posture	
2:IIc	Offensive/defensive mission	Prepare for moving/stationary engagement	
2:IIIb	Likely threat targets/ranges	Select appropriate battlecarry ammunition and range	
2:IIIc	Movement technique	Recall appropriate position of tanks during movement	
2:IIId	Map or view of terrain	Identify sources of cover and concealment	
2:IIIe	Map or view of terrain	Identify primary, alternate, and supplementary positions	
2:IIIf	Map or view of terrain	Analyze terrain	
2:IIIg	Map or view of terrain	Prepare sketch range card	
Unit Number:	5		
Title:	Loader Duties		
Device/Medium:	Tank		
4:IIg	Fire command & Moving/stationary tank	LDR sets switch on EL UNCPL/POWERED & loads round	/19
4:IIIi	LDR's control panel	Recall function of GUN/TURRET DRIVE switch	/19
4:IIIj	AMMO element of fire command	Identify round by sight	
6:IIg	Fire command	LDR ensures switch is in POWERED & monitors ammo feed	
Unit Number:	6		
Unit Title:	Driver Duties		
Device/Medium:	Tank		
2:IVb	Operational tank & Trafficable terrain	Drive an M1 tank	
4:IIh	Fire command & Moving/stationary tank	DVR maintains steady platform/moves turret to hull-down	/19
6:IIh	Fire command & Moving tank	DVR maintains steady platform	/19
9.6:IIb	Moving tank	TC commands DRIVER STOP & DVR stops smoothly	/12
11:IIe	Orders to change route OR to move between firing positions	TC issues driver command & DVR responds	/15
Unit Number:	7		
Title:	Target Acquisition/Range Determination		
Device/Medium:	Field		
3:I	Detectable target(s)	Acquire target(s)	
3:IIa	Target(s) or signatures visible within sector	Detect target(s)	
3:IIb	Target(s) in sight	Provide acquisition report	
3:IIIa	Search responsibility within platoon	Identify crew search sectors	
3:IIIb	Search conditions	Identify appropriate search techniques	
3:IIIc	Target signature(s)	Identify target(s)	
3:IIId	Visible target(s) & Location method	Report target location IAW given method	
3:IIIe	Visible target(s)	Identify target as friend/foe/neutral and by nomenclature	
3:IVa	Visible target	Estimate range to target	
3:IVb	Target array	Classify target as most dangerous/dangerous/least dangerous	/16

(table continues)

Objective Number	Condition(s) Under Which Action is Performed	To-Be-Trained Action	Other Units In Which Action Is Trained[a]
Unit Number: 8			
Title: Precision Gunnery II--TC Duties			
Device/Medium: U-COFT			
4:IIb	Fire command	TC lays gun for direction	/9
4:IIIb	TC control handle	Operate TC control handle to control turret direction	/9
8:IIIa	CWS controls	Operate CWS controls to traverse, elevate, and fire cal .50	/17
9.1:IIa	Battlesight fire command	TC presses MANUAL RNG button & adjusts w/ ADD/DROP switch	/11
9.1:IIIb	TC station controls	Recall function & operation of manual range controls	/11
10:I	GNR cannot identify target OR GNR is absent	Engage target from the tank commander position	/19
10:IIa	Four-man crew/three-man crew	TC announces FROM MY POSITION/LOAD AMMO	
10:IIb	Target visible in GPSE	TC lays reticle on center of mass	
10:IIc	Moving target	TC tracks target using commander's control handle	
10:IId	Reticle on target	TC lases to target	
10:IIe	Return within/beyond 200m of estimated range	TC announces ON THE WAY/TC releases to target	
10:IIIb	TC control handles & Target	Manipulate TC control handles to set reticle on target	
10:IIIc	Target track	Manipulate TC's control handles to follow track	
10:IIId	TC's control handles	Recall function and operation of lase buttons	
Unit Number: 9			
Title: Precision Gunnery III--TC/Gunner Coordination			
Device/Medium: U-COFT			
4:I	Fully operational FCS & Single main gun target	Engage target using precision gunnery techniques	/19
4:IIa	Fire command	GNR sets/checks FCS/TIS switches for precision engagement	3/
4:IIb	Fire command	TC lays gun for direction	8/
4:IIc	Target visible/not visible in GPS or TIS	GNR announces IDENTIFIED/CANNOT IDENTIFY	
4:IId	Moving target	GNR tracks target using control handles	2/
4:IIe	Reticle on target	GNR lases to target	2/
4:IIf	Return within/beyond 200m of estimated range	TC announces FIRE/GNR releases to target	2/14
4:IIIa	Engagement scenario	Identify appropriate setting for GNR station switches	2,3/
4:IIIb	TC control handle	Operate TC control handle to control turret direction	8/
4:IIIc	GNR control handles & Target	Manipulate GNR control handles to set aiming point on target	2/
4:IIId	Relation of gun tube to target	Recall appropriate verbal command to guide GNR	1/
4:IIIe	Target track	Manipulate GNR's control handles to follow track	2/
4:IIIf	GNR's control handle	Recall function and operation of lase buttons	1,2/
Unit Number: 10			
Title: Coax Engagements			
Medium/Device: U-COFT/VIGS			
6:I	Fully operational FCS & Machine gun target(s)	Engage target with the coaxial machine gun	
6:IIa	Fire command	GNR sets/checks FCS/TIS switches for coax engagement	
6:IIf	Return within/beyond 200m of estimated range	TC announces FIRE & GNR fires bursts/GNR releases to target	

(table continues)

Objective Number	Condition(s) Under Which Action is Performed	To-Be-Trained Action	Other Units In Which Action Is Trained[a]
Unit Number:	11		
Title:	Degraded Mode Gunnery I--B/S, GAS, EMER, & MAN		
Device/Medium:	U-COFT		
9.1:I	[Surprise sit. OR Ineff. LRF] & Target w/in B/S range	Engage target using battlesight gunnery	
9.1:IIa	Battlesight fire command	TC presses MANUAL RNG button & adjusts w/ ADD/DROP switch	8/
9.1:IIb	Battlesight fire command	GNR sets switches for battlesight engagement	3/
9.1:IIc	Range indexed & Switches set	Continue as precision engagement without ranging to target	
9.1:IIIb	TC station controls	Recall function & operation of manual range controls	8/
9.7:IIc	Moving target	GNR leads target while tracking	
9.7:IIIc	Direction of target movement & Ammunition	Indicate appropriate aiming point to manually lead target	/12
9.10:I	GPS/TIS failure OR LRF failure	Engage target using GAS	
9.10:IIa	Acquired target	TC includes range element in FC & lays gun	
9.10:IIb	Fire command with range element	GNR sets/checks FCS switches for GAS engagement	
9.10:IIc	Target visible/not visible in GAS	GNR announces IDENTIFIED/CANNOT IDENTIFY	
9.10:IIe	Aiming point on target	TC announces FIRE & GNR fires at target	
9.10:IVa	Fire command & GAS reticle	Indicate appropriate aiming point on reticle	
9.11:I	Stabilization failure	Engage target in emergency mode	
9.11:IIa	Fire command	GNR sets FCS/TIS switches for emergency mode engagement	
9.11:I	Turret power failure	Engage target in manual mode	
9.12:IIa	Acquired target	TC includes range/direction elements in FC & lays gun	
9.12:IIe	Moving target	GNR tracks target using manual controls	
9.12:IIg	Failure to fire using elevation crank trigger	GNR turns blasting machine handle vigorously 3-4 times	
9.12:IIId	GNR's manual controls & Target	Operate manual controls to set aiming point on target	
9.12:IIIf	Target track	Manipulate manual controls to follow track	
Unit Number:	12		
Title:	Degraded Mode Gunnery II--System Failures		
Device/Medium:	Classroom/Hand-Held Tutor		
9.2:I	Ineffective LRF	Engage target using one of three techniques	
9.2:IIa	Target within battlesight range	Use battlesight gunnery	
9.2:IIb	GPS operative	Manually index range	
9.2:IIc	GPS inoperative	Use GAS	
9.2:IIIa	Fire command without/with INDEX <RANGE>	TC/GNR indexes range	
9.2:IVc	Computer control panel	Retrieve/store data in ballistic computer	3/
9.4:I	No range display	Engage target using one of two techniques	
9.4:IIa	Little or no time	Continue as precision engagement w/out evaluating range	
9.4:IIb	Time permitting	TC instructs GNR to announce range on CCP display	
9.4:IIc	Announced range	Evaluate announced return & Continue as precision engagement	
9.5:I	Crosswind sensor failure	Engage target	
9.5:IIa	Indication of crosswind sensor failure	GNR cancels crosswind input to ballistic computer	
9.5:IIb	Canceled crosswind sensor input	Continue as precision engagement	
9.5:IIIa	Output from computer self-test	Determine status of fire control system	3/
9.6:I	Cant sensor failure	Engage target	
9.6:IIa	Indication of cant sensor failure	GNR cancels cant sensor input to ballistic computer	
9.6:IIb	Moving tank	TC commands DRIVER STOP & DVR stops smoothly	6/
9.6:IIc	Tank on unlevel ground	GNR modifies aiming point	
9.6:IId	Modified aiming point	Continue as precision engagement	
9.6:IIIc	Direction of cant & Range to target	Determine appropriate compensation for cant	
9.7:I	Lead angle sensor failure	Engage target	
9.7:IIa	Indication of lead angle sensor failure	GNR cancels lead angle sensor input to ballistic computer	
9.7:IIc	Moving target	GNR leads target while tracking	11/
9.7:IId	Lead applied to moving target	Continue as precision engagement	
9.7:IIIc	Direction of target movement & Ammunition	Indicate appropriate aiming point to manually lead target	11/
9.8/9.9:I	GPS failure	Engage target using either TIS or GAS	
9.8:IIa	GPS failure	Use TIS	
9.9:IIb	GPS failure & TIS failure	Use GAS	
9.8:IIIa	Fire command	GNR sets switches for TIS viewing	
9.8:IIIb	TIS image	Continue as precision engagement	
9.9:IIc	Precision fire command	Engage target using precision gunnery	
9.9:IIId	Battlesight fire command	Engage target using battlesight gunnery	

(table continues)

Objective Number	Condition(s) Under Which Action is Performed	To-Be-Trained Action	Other Units In Which Action Is Trained[a]
Unit Number: 13			
Title: Adjustment of Fire			
Medium/Device: U-COFT			
5:I	Fully operational FCS/FCS in degraded mode	Apply reengagement/standard adjustment technique	
5:IIa	Target destroyed/not destroyed	TC announces cease fire/GNR announces observation	
5:IIb	No subsequent fire command OR TC announces REENGAGE	GNR reengages target	
5:IIc	No subsequent fire command/subsequent fire command	GNR applies standard adjustment/TC issues correction	
5:IIIa	Relation between round and target	Recall appropriate observation term	
5:IIIb	GNR control handles	Recall function and operation of palm switches	1,2/
5:IIIc	Observation OR TC correction	Indicate adjusted aiming point on reticle	
5:IIId	Observation	Issue subsequent fire command	
Unit Number: 14			
Title: Multiple Returns			
Medium/Device: U-COFT			
4:IIf	Return within/beyond 200m of estimated range	TC announces FIRE/GNR relases to target	2,9/
4:IIIh	LRF display	Interpret meaning of LRF symbol(s)	1/
9.3:I	Multiple returns from LRF	Engage target using one of two techniques	
9.3:IIa	Multiple return	TC commands RELASE & GNR relases to target	
9.3:IIb	Return from relase	Evaluate return & Continue as precision engagement	
9.3:IIc	Multiple return	TC indexes range	
Unit Number: 15			
Title: Assess Results of Engagement			
Medium/Device: Classroom			
11:I	Engagement concluded & Mission continues	Assess results of engagement	
11:IIa	Battle casualties	TC determines if/how crew should go to 3-man configuration	
11:IIb	Engagement concluded	TC issues SPOTREP	
11:IIc	> 5 rounds fired in engagement & Mission continues	GNR updates muzzle reference sensor	
11:IIe	Orders to change route OR to move between firing positions	TC issues driver command & DVR responds	6/
11:IIf	Engagement concluded	LDR checks replenisher reservoir & removes spent casings	
11:IIIa	Missing crewmember	Describe appropriate reassignment of tank crew duties	
11:IIIb		Recall elements of SPOTREP	
Unit Number: 16			
Title: Multiple Targets--Basic Knowledges			
Medium/Device: Classroom/EIDS			
3:IIc	Acquired target(s)	TC issues fire command	1/
3:IIIf	Target range/type & FCS status	Select weapon/ammo and firing mode (precision/degraded)	1/
3:IIIg	Number of targets & Target classification	Determine crewman and fire command (sgl, mult, or sim)	1/
3:IVb	Target array	Classify target as most dangerous/dangerous/least dangerous	7/
7:I	Multiple main gun targets	Engage multiple targets with the main gun	/18,19
7:IIa	Multiple fire command	Engage greatest threat using precision gunnery	/18
7:IIb	Target destroyed/not destroyed	Adjust fire/engage next target	/18
7:IIc	No targets remaining	TC announces CEASE FIRE	/18
8:I	Machinegun target & Main gun target	Engage simultaneous targets with the main gun and cal .50	/16
8:IIa	Simultaneous fire command	TC engages machinegun target with cal .50	/16
8:IIb	Machine gun target destroyed/not destroyed	TC announces TC COMPLETE/adjusts fire	/16

(table continues)

Objective Number	Condition(s) Under Which Action is Performed	To-Be-Trained Action	Other Units In Which Action Is Trained[a]
Unit Number: 17			
Title: Simultaneous Engagements--Practice			
Medium/Device: U-COFT			
8:I	Machinegun target & Main gun target	Engage simultaneous targets with the main gun and cal .50	16/
8:IIa	Simultaneous fire command	TC engages machinegun target with cal .50	16/
8:IIb	Machine gun target destroyed/not destroyed	TC announces TC COMPLETE/adjusts fire	16/
8:IIc	Simultaneous fire command	GNR engages main gun target using precision gunnery	
8:IId	Main gun target destroyed/not destroyed	GNR announces TARGET--CEASE FIRE/adjusts fire	
8:IIIa	CWS controls	Operate CWS controls to traverse, elevate, and fire cal .50	8/
Unit Number: 18			
Title: Multiple Engagements--Practice			
Medium/Device: U-COFT			
7:I	Multiple main gun targets	Engage multiple targets with the main gun	16/19
7:IIa	Multiple fire command	Engage greatest threat using precision gunnery	16/
7:IIb	Target destroyed/not destroyed	Adjust fire/engage next target	16/
7:IIc	No targets remaining	TC announces CEASE FIRE	16/
Unit Number: 19			
Title: Tactical Gunnery Exercise			
Medium/Device: SIMNET			
4:I	Fully operational FCS & Single main gun target	Engage target using precision gunnery techniques	2,9/
4:IIg	Fire command & Moving/stationary tank	LDR sets switch on EL UNCPL/POWERED & loads round	5/
4:IIh	Fire command & Moving/stationary tank	DVR maintains steady platform/moves turret- to hull-down	6/
4:IIIi	LDR's control panel	Recall function of GUN/TURRET DRIVE switch	5/
6:IIh	Fire command & Moving tank	DVR maintains steady platform	6/
7:I	Multiple main gun targets	Engage multiple targets with the main gun	16,18/
10:I	GNR cannot identify target OR GNR is absent	Engage target from the tank commander position	8/

[a] Numbers before the slash indicate previous units in which the objective is trained; numbers after the slash indicate subsequent units. No entry indicates that the objective is trained only in the instructional unit under which it is listed.