Research Report 1334

(12)

# DEVELOPMENT OF M1 (ABRAMS) TANK SUSTAINMENT TRAINING MATERIAL

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Allen Corporation of America



ARI FIELD UNIT AT FORT KNOX, KENTUCKY





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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this research was to: (1) design and develop M1 crew procedure guides for tasks performed before, during, and after tank operations; and (2) design, developed and evaluate low-cost sustainment training material for skill enhancement on various tank combat tasks. This report discusses the history of the research effort and the results of the field evaluations. Research findings indicate the media types utilized are viable and effective for sustainment training purposes.

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Combat Skill Development and Retention

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FOREWORD

The Army Research Institute - Fort Knox Field Unit has been working toward solution of training and performance problems that result from the Army's acquisition of sophisticated new weapon systems. The research has focused on the development and fielding of the M1 "Abrams" Tank. Problems in personnel selection and assignment, individual and crew training, and training and performance in units are being investigated.

The M1 "Abrams" Tank has sophisticated automotive and fire control systems that make it unique among armor weapon systems. Such features as turbine engine, digital computer, laser rangefinder, thermal imagery sight, and lead angle sensor simplify combat operations, but make preparing to fight more complicated. They also require that crewman be able to identify when these systems have failed and how to use backup systems. Differences in fire controls has meant that changes be made in the fire commands and responses that communicate information during combat engagements. These differences in performance requirements of the M1 have been addressed in this project within a more general goal of producing training materials that are appropriate for use in Army operational units.

This research report, "Development of M1 Abrams Tank Sustainment Training Materials," describes the development and tryout of materials designed to aid M1 crewmen in performance of the long complicated tasks required to prepare for operations and to teach them M1 fire commands, degraded mode gunnery, and laser rangefinder techniques. The sustainment training materials take the form of procedures guides, knowledge and workbooks, and practice exercises. Application of some of the methods described in this report have already been applied to other weapon systems.

The materials described in the report provide training on M1 unique tasks and skills and knowledges. The training approaches used are of importance because they aim at providing materials that can be used directly within the armor training environment by the principal trainer, the tank commander. Use of these materials and materials like them have potential for improving performance on new weapon systems such as the M1 tank.

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# PREFACE

This document reports on a research project in which procedure guides and skill sustainment training materials were developed for use by M1 tank crews.

The research was performed by Allen Corporation of America under subcontract to Systems Research Laboratories, Dayton, Ohio. Dr. James J. Vaughan served as the Allen Corporation Program Manager.

This research was supported by the U.S. Army Research Institute for the Behavioral and Social Sciences under Contract No. MDA903-81-C-0031, "XM1 Tank System Training and Aptitude Requirements." The project was monitored technically by Dr. Stephen L. Goldberg and Mr. Ronald E. Kraemer of the U.S. Army Research Institute. Their assistance and support in this research effort is greatly appreciated. The authors also wish to express gratitude to all personnel at the New Equipment Training Team, Fort Knox, Kentucky, and the Fort Hood, Texas M1 units who provided assistance and participated in this reaserch project.

DEVELOPMENT OF M1 ABRAMS TANK SUSTAINMENT TRAINING MATERIAL

## BRIEF

Requirement:

The purpose of this research was to (1) design and develop M1 crew procedure guides for tasks performed before, during, and after tank operations; and (2) design, develop and evaluate low cost sustainment training materials for skill enhancement on various tank combat tasks.

Procedure:

The M1 procedure guides were developed via analysis of task procedures and identification of all decisions made by the operator during task performance. Sustainment training materials developed were of two types -- scenarios and field exercises. These sustainment training materials were evaluated on two separate occasions at Fort Hood, Texas. Current M1 tank crewmembers participated in both of these evaluations. Data were collected relating to utility, acceptability and training effectiveness of the materials.

Findings:

The M1 crew procedure guides appear to be extremely effective job aids for the performance of operational tasks having many procedural steps. In addition, the scenario-style booklets proved to be both training- and cost-effective tools for the M1 community. Finally, the concept and format of the sustainment training materials were favorably accepted by the crewmen.

Utilization of Findings:

These low-cost media should be evaluated to assess effectivenesss in training (1) additional tasks within the M1 community, and (2) similar tasks in other communities, such as the M60A1, M60A3, M551, M109, M110, and so on.

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# SECTION I

# INTRODUCTION

Allen Corporation of America has completed work on an effort entitled "XM1 Tank System Training and Aptitude Requirements". This contract (MDA903-81-C-0031) was initiated by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) and funded by the Defense Supply Service, Washington, DC. The contract consisted of two overall objectives:

- Objective 1 - develop an XM1/M60A3 crewman aptitude measurement methodology, evaluate identified aptitude requirements, and provide an implementation program for use by command personnel in operational units.

- Objective 2 - design, develop, pilot test, and implement an XM1 tank crew sustainment training program for use at the platoon level in operational units.

Systems Research Laboratories (SRL) of Dayton, Ohio is presently completing activities encompassing Objective 1. This document, prepared by Allen Corporation, comprises the final report related to Objective 2.

## SCOPE OF WORK

Following the award of the contract, Allen Corporation prepared a research plan detailing the various activities to be performed during the effort. Specifically, Allen Corporation was responsible for:

1. Development of procedure guides and plans for use by the XM1 crew (tank commander (TC), gunner, loader, and driver).

2. Training analysis of selected tank crew tasks leading to the development of appropriate skill sustainment materials.

3. Development of individual skill sustainment materials and management plan for in-tank individual and crew use.

4. Evaluation and revision of individual skill sustainment materials.

## CONTENT OF THIS REPORT

This report has been designed to describe Allen Corporation activities during the performance of the above tasks. Further, it provides information on personnel and management conditions which affected the conduct of those activities. The report ends with research conclusions and recommendations. Specifically:

- Section II - Describes the process and activities used by Allen Corporation in the development of the M1 Procedures Guides and Sustainment Training Materials.

- Section III - Describes the materials evaluated, and procedures employed during the first field evaluation. In addition, results of that evaluation are presented.
- Section IV - Describes the second field evaluation in terms of the materials and procedures employed, and results obtained.
- Section V - Presents conclusions based on results of the field evaluations.
- Section VI - Presents recommendations for potential future research activities related to armor unit training.

## SECTION II

## OVERVIEW OF MATERIALS DEVELOPMENT

During the conduct of this effort, two categories of training materials were developed. The first were M1 crew procedure guides. The second were M1 crew skill sustainment materials. The general description of, and process for, the development of each of these products is described below.

### M1 CREW PROCEDURE GUIDES

The initial concept of the procedure guides was documents which would recite tank procedures and be packaged in a format suitable for ready use. In that sense, they would be similar to other existing checklists prepared for the Army armor community. However, the intent of the M1 crew procedure guides developed under this contract was for them to go into more detail than existing checklists, yet at the same time, remain easy to use by crewmembers.

Two goals were established for the procedure guides. These goals were as follows:

1. Provide to each crewmember a convenient, accurate, and comprehensive document which identifies his tasks, and task procedures, required for preparing the tank for combat, securing the tank, and performing various activities during operation. For example, the procedure guide would present to the gunner the procedures involved in zeroing the main gun. A portion of this procedure is illustrated in Figure 1.

2. Support initial training for new crewmembers. For example, rather than require the new crewmember to read a complex and lengthy statement of a procedure within the Operator's Technical Manual, the crewmember could instead use the procedure guides as simplified, although complete, versions of the Technical Manual.

The first effort in preparing the crew procedure guides was to identify those tasks which would be included. Although the M1 Operator's Technical Manual and various armor checklists were reviewed, the final set of tasks selected for inclusion in the guides were based upon crew requirements for setting up the tank for combat and securing the tank.

Many of the more complex tasks were not readily adaptable to the checklist format most commonly seen, which simply list steps of a task. This was due to the large number of decisions that the crewmember is required to make during task performance. For example, the task, zero the main gun, contains 16 potential decision points within the more than 100 procedural steps. To overcome this problem, an "algorithm" type checklist which would incorporate those decisions was developed. A set of algorithm characteristics (guidelines) was established prior to actual material development in order to ensure uniformity of preparation activities. These characteristics are as follows:

- Algorithms will present clear and concise procedures required for successful task performance.

**Prepare for Zero**

1. Gun. . . . . Boresight (page 41)
2. Crosswind sensor . Erect
3. CCP power. . . . . -ON-
4. AMMO TEMP. . . . . Enter data
5. BARO PRESS . . . . Enter data
6. AIR TEMP . . . . . Enter data
7. TUBE WEAR. . . . . Enter data
8. MAGNIFICATION lever. . . . . 10X
9. Day ballistic door . . . . . Open
10. Zero target. . . . Select
11. Gun. . . . . Front of tank
12. GUN SELECT . . . . -MAIN-
13. THERMAL MODE . . . STBY
14. FLT/CLEAR/SHTR . . CLEAR

*Fire for Zero*

15. Key cover. . . . . Open
16. AMMO SELECT. . . . -SELECT- ——— HEP/APERS/HEAT/SABOT in order
17. FIRE CONTROL MODE . . . . . -EMERGENCY-
18. AMMO SUBDES key. . Press/release
19. DOES DISPLAY READ CORRECT AMMO SUBDES? NO → 19a. Number key. . . . Input SUBDES
    19b. ENTER key . . . . Press/release
    → GO TO 18
    YES ↓
20. ENTER key. . . . . Press/release
21. Turret drift . . . Nulled out
22. ZERO key . . . . . Press/release

Figure 1. Portion of ZERO THE MAIN GUN Procedures Included In the M1 Gunner Procedure Guides

- Information included in the procedures will be restricted to only that which is necessary to perform the task.

- Language used in the procedure steps will be unambiguous and at a level appropriate for the users.

- Algorithms will make use of symbology when possible. Original symbology new to system operators will be defined prior to presentation in the procedure.

- Notes/cautions/warnings which impact task performance, safety, or system integrity will be identified at appropriate places within the procedures.

- All decision points occurring during task performance will be identified. At these decision points the user will be asked a question. Based upon the user's answer (formulated internally) the appropriate succeeding steps will be identified. This branching technique will require that:

  - all decision points points occuring in the procedure must be identified.

  - all possible alternative actions/procedures be identified and detailed.

- Each algorithm will be presented independently of others -- that is, each will begin on a separate page in the procedure guides.

- Each algorithm will possess obvious start and finish points.

- Duplication of any "common" sub-procedures will be avoided. For those sub-procedures found in a task, a separate algorithm will be developed for that sub-procedure. This will avoid unnecessarily lengthly and repetitive procedures.

- Necessary pictures or illustrations will be included in each procedure guide.

- Each procedure guide will contain a table of contents which will allow the user to rapidly locate the desired procedure (task).

- The physical dimensions of the procedure guides should be tailored to their intended use and environment. That is, procedure guide size should take into account space required and available for use, storage requirements, and frequency of anticipated or required use.

The resulting algorithms are very similar to Job Performance Aids in that they account for most (if not all) of the unique occurrences within a task. Depending upon the decision to be made, the user is directed to alternate procedures. With the algorithm technique in mind, a set of tasks for each crew position was established which would compose the crew procedure guides.

The first research activity involved in preparing the guides was to become familiar with each of the tasks identified for inclusion. This process began via a review of the M1 Operator's Technical Manual (TM 9-2350-255-10) and other available M1 training materials. With this task related knowledge, developers traveled to Fort Knox, Kentucky, for on-site tank inspection and familiarization. In addition, developers reviewed each of the tasks with Subject Matter Experts (SMEs). The purpose of this review was to identify those cues and responses involved in task performance and to check the accuracy of the Operator's Technical Manual vis-a-vis what was actually done on the tank.

Following this review, an initial algorithm was developed for each task. These initials algorithms were then taken to Fort Knox for further review by M1 SMEs. Based on the results of this second review, the algorithms were modified. The modifications were based upon:

- Input from SMEs, and
- Changes to the M1 Operator's Technical Manual. (Allen Corporation was provided with three updated versions of the Technical Manual during the course of procedure guides development. Each updated version required modification to the procedure guides.)

Four procedure guides booklets resulted from the effort -- one for each crewmember on the tank. A total of sixty-four tasks are presented across these booklets. In addition, before, during, and after operations preventive maintenance checks and services (PMCS) activities are identified in each crewmember's procedure guide booklet as appropriate. Each task within the booklets has separate pages devoted to it. Further, each set of procedures is annotated for warnings, cautions, lights that are activated/deactivated, and decisions which must be made during task performance. Tables 1 though 4 present listings of all tasks included in the Driver, Loader, Gunner, and Tank Commander Procedure Guides respectively. The final booklets were typed into an appropriate reduction format in order to allow each page to be inserted into plastic jackets of pocket-size ring binders. Although formal evaluations of the procedure guides were conducted, Allen Corporation was not involved in those evaluations. Thus, results of those evaluations are not presented in this document.

A sample of the finished M1 crew procedure guides, in the form delivered to ARI, is presented in Appendix A to this report.

## SUSTAINMENT TRAINING MATERIALS

The primary focus of the sustainment training materials development was on the maintenance of skills. Thus, an assumption was made that M1 crew personnel had well-developed skills related to various tank tasks. The purpose of the sustainment materials was to provide review and enrichment of those skills.

Approximately forty-five tasks across all four M1 crew positions were initially identified as potential candidates for which sustainment training materials could be developed. Many of these tasks, however, were the same as those that were eventually included within the crew procedure guides. As a result, the orignial list was reduced to fourteen in number. These fourteen

Table 1. Driver Procedure Guides

ACTIVITIES

Prepare Station
Enter Station
Power Up Hull Systems
Start Engine
After Start Checks
Secure Station
Shut Down Engine
Power Down Hull Systems
Exit Tank
Operate/Secure Gas Particulate Filter
Before Operations PMCS
During Operations PMCS
After Operations PMCS

Table 2. Loader Procedure Guides

ACTIVITIES

Prepare Station
Install Weapon
Enter Station
Power Up Station
Secure Station
Power Down Station
Remove the M240 Machinegun
Unload (Clear) Main Gun
Manually Extract a Main Gun Round
Clear the M240 Machinegun
Operate/Secure Gas Particulate Filter
Before Operations PMCS
After Operations PMCS

Table 3. Gunner Procedure Guides

ACTIVITIES

Prepare Station
Enter Station
Install Coaxial Machinegun
Power Up Station
Perform GPS Functional Check
Perform GPS Adjustments
Perform Computer Data Check
Perform TIS Checkout
Perform GAS Adjustments
Perform Computer Self Test
Test Fire Control System
Perform Lead System Check
Perform Firing Circuits Check
Perform Crosswind Circuits Check
Prepare to Fire Checks
Update Muzzle Reference Sensor
Manual Inputs to Automatic Fire Control Data
Manual Inputs to Fire Control Data
Zero Coaxial Machinegun
Boresight the Main Gun
Zero the Main Gun
Secure Station
Remove Coaxial Machinegun
Power Down Station
Clear Coaxial Machinegun
Operate/Secure Gas Particulate Filter
Before Operations PMCS
After Operations PMCS

Table 4. Tank Commander Procedure Guides

ACTIVITIES

Prepare Station

Enter Station

Power Up Station/Turret

Install Weapon - Cal .50

Install Weapon - M240

Prepare to Fire Checks

Boresight the Cal .50

Zero the Cal .50

Secure Station

Remove Weapon - Cal .50

Remove Weapon - M240

Secure Station and Turret

Power Down Station and Turret

Clear the Cal .50

Set Headspace and Timing - Cal .50

Clear the M240

Operate/Secure Gas Particulate Filter

Before Operations PMCS

Master Check-Off List - Before Operations PMCS

Master Check-Off List - During Operations PMCS

Master Check-Off List - After Operations PMCS

tasks, listed below, were selected as they were considered to be complex and thus, candidates for sustainment training.

- Issue Fire Commands
- Most Dangerous Threat Identification
- Range to Target
- Machinegun Fire Techniques
- Multiple Bar Return
- Degraded Gunnery Modes
- Select Routes
- Evades Missiles
- Identify Hull- and Turret-Down Positions
- Target Tracking (Automatic and Manual)
- Computer Self Test
- Computer Data Check
- Manual Data Inputs
- Manual Data Inputs to Automatic Functions

For the fourteen selected tasks, an array of potential techniques for training was developed. These techniques were considered innovative in nature, and ranged from simple paper and pencil activities to sophisticated approaches involving the use of microprocessors. The following is a brief description of each training technique, or media identified.

1. Line drawings/booklet - A booklet presenting a number of line drawings of various battlefield scenarios. Each scenario would be accompanied with a written problem to be solved. The correct answer to the problem would be found on a separate page within the booklet.

2. Photos/booklet - A booklet similar to (1) above, but presenting photos instead of line drawings. The photos would permit representation of visual components in actual scale and with correct relationships between objects.

3. Slides/viewer/booklet - Similar to (1) above except visual representations would be on a slide and would be placed in a hand-held viewer and held to the eyes for viewing. This media would permit control of the visual angle subtended as well as providing an increased simulation of depth. In essence, what is seen with this media would be a direct replica (in almost all respects) of the real world.

4. Slides/timed viewer/booklet - Similar to (3) above except employing a slide viewer with a timing apparatus. Thus, the time involved in completing a task could be controlled.

5. Motion picture/device/booklet - A portable device capable of depicting motion involving realistic battlefield scenarios. Problems and solutions could be presented via an accompanying booklet. The device would be held to the eyes enabling control of the visual angle subtended.

6. Flashcards/realistic pictorial - A set of flashcards presenting a pictorial scenario as well as a written problem. As in all flashcards, problem solutions would be presented on the back of the cards.

7. Flashcards/non-realistic pictorial - A set of flashcards presenting a non-realistic scenario. The scenario would be akin to a football play diagram which would include threat and friendly forces, environmental conditions, ranges, and other required cues as well as a written problem. The cards would focus on the development of strategies rather than visual perceptions.

8. Pictures/non-realistic overlays/booklet - A set of environmental pictures with transparent overlays presenting non-realistic scenarios akin to football play diagrams. The overlays would present threat and friendly forces, ranges, and so forth and would result in the development of strategies. The booklet would present problems and provide solutions.

9. Workbook - A written booklet presenting problems to be completed.

10. Mockup computer control panel (CCP) with microprocessor/coded acetate overlays - A device which would permit manipulation of a surface similar to that of the CCP. The coded acetate overlays would include written data inputs such as barometric pressure and ammunition temperature. Use of the device would permit personnel to repetitively run through various CCP tasks and receive feedback on their performance. Control of the device would be via the coded acetate overlays permitting various situations and problems to be developed.

Following identification and definition of the potential media types, a draft media model was developed to determine the optimal media type for each of the fourteen tasks. Figure 2 illustrates the "matching" of the various media types to each candidate task.

Upon review of the model, many of the media types were deemed too costly to develop under the existing contract. Therefore, it was decided that only the simpler paper and pencil techniques for training would be employed for this research effort. In addition, it was believed that the paper and pencil approach would be more suitable for use both within and without the tank. This review also limited the number of tasks to be trained to a total of five. These five tasks are:

1. Issue Fire Commands,

2. Degraded Mode Gunnery,

3. Dealing with Multiple Laser Returns,

4. Target Handoff, and

5. Target Tracking and Leading.

Figure 2. MEDIA SELECTION MODEL

Media Types*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Issue Fire Commands | | | | | | | | | | |
| - Target Detection | 2** | 2 | 1 | 1 | 1 | 2 | | | | |
| - Target Identification | 2 | 1 | 1 | 1 | 1 | 1 | | | | |
| - Most Dangerous Threat | 1 | 1 | 1 | 1 | 1 | 1 | | 2 | | |
| - Range to Target | | 2 | 1 | 1 | 2 | | | | | |
| - Ammo Select | 1 | 1 | 1 | 1 | | 1 | | 1 | | |
| - Battlesight or Precision | | | 1 | 1 | | | | | | |
| 2. Most Dangerous Threat | 1 | 1 | 1 | 1 | 1 | 1 | | 2 | | |
| 3. Range to Target | | 2 | 1 | 1 | 2 | | | | | |
| 4. Machine Gun Fire Techniques | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 5. Multiple Bar Return | | | 1 | 1 | | 2 | | 2 | | |
| 6. Degraded Modes | 2 | 2 | | | 1 | 2 | 1 | 2 | | |
| 7. Select Routes | 2 | 2 | 1 | 1 | | 1 | | | | |
| 8. Evade Missiles | | | | | | | 1 | 1 | | |
| 9. Identify Hull Defiliate Position | 2 | 2 | 1 | 1 | 1 | 1 | | | | |
| 10. Tracking (Auto and Manual) | | | | | 1 | | | | | |
| 11. Computer Self Test | | | | | | | | | 2 | 1 |
| 12. Computer Data Check | | | | | | | | | 2 | 1 |
| 13. Manual Data Input | | | | | | | | | 2 | 1 |
| 14. Manual Data Inputs to Automatic Functions | | | | | | | | | 2 | 1 |

*Media Types

1. Line Drawings/Booklet
2. Photos (B&W or Color)/Booklet
3. Slides/Viewer/Booklet
4. Slides/Timed Viewer/Booklet
5. Motion Picture Device Booklet
6. Flash Cards/Realistic Pictorial
7. Flash Cards/Non-realistic Pictorial
8. Pictures/Non-realistic Overlays/Booklet
9. Workbook
10. Mock-up CCP/Microprocessor/Coded Acetate Overlay

**Numerics located in matrix cells represent first and second best media choices.

Task 5 above, was identified as a candidate for sustainment training after review of the media model and final task selection.

The training approaches applied to these tasks were of two types. First are what were termed "scenarios". The tasks selected for training using the scenario approach include issue fire commands, degraded mode gunnery, and dealing with multiple laser returns. The second are what were termed "field exercises". Field exercises were developed to train the target handoff, and target tracking and leading tasks. Each of these training approaches is briefly described below.

Scenarios

The scenarios were designed as a new and unique way of presenting combat situations to the crewmembers. These situations are presented via a pictorial representation of the battlefield situations and a brief description of the battlefield situation. In addition, a description of the M1 tank system status and/or malfunction indications is included. Following the situation description is a problem which must be solved for the given situation. The crewmember must decide on the appropriate next action by choosing from an array of possible answers or constructing a unique answer. All of the above information is confined to a one page scenario. An explanation of the correct answer to the problem is presented on the following page. Figure 3 presents a typical degraded mode gunnery scenario.

The scenarios were evaluated during the two separate field evaluations. Because the content of the scenarios changed based on the lessons learned during the first evaluation, a detailed description of the scenario contents is reserved for Section III, Field Evaluation 1, and Section IV, Field Evaluation 2 of this report. It should be mentioned at this time that no initial learning material was presented during Field Evaluation 1. That is, the first training materials encountered by the crewmembers were the scenarios themselves. However, Field Evaluation 1 results indicated that many crewmembers lack the basic knowledge related to fire commands and degraded mode gunnery. Thus, for Field Evaluation 2, detailed knowledge booklets were developed and presented to the crewmen prior to their beginning the scenarios. These knowledge booklets, described in detail in Section IV, provided the crewmen with basic fire command and degraded mode gunnery skills needed to use the scenarios in a more meaningful manner. A sample of the knowledge and scenarios booklets, in the form used during Field Evaluation 2, is presented in Appendix B.

Field Exercises

Training materials for the target handoff and target tracking/leading tasks were presented in the form of field exercises. The exercises were designed to give the crewmembers actual hands-on practice for these tasks. For each task, the training materials describe how the exercise is to be set up and prepared. Each of the exercises' set up instructions are designed to be simple and capable of being performed by the crew without the assistance of additional trainers/personnel. The exercises are tailored for use on a small maneuvering area, approximately 300 feet by 600 feet. Once set up, detailed instructions for conducting the exercises are presented along with easy-to-use performance recording sheets. Finally, each exercise booklet presents alternative methods for conducting the exercise. These alternative methods provide guidance for a tank crew who either does not have access to a suitable

SCENARIO 37

THE SITUATION

- M1 is positioned next to an old building.
- You see a HIND-D chopper directly in front of you hovering about 100 meters above the ground.
- You are undetected.
- F in GPS and range shows flashing "0000".
- You run a self test and the laser is the only failure found.
- You cancel the RANGE input.

What is the next thing to do before you can engage the chopper?

Figure 3. Typical Degraded Mode Gunnery Scenario (Continued)

SCENARIO 37 ANSWER

The correct answer is: Estimate range to target.

When the laser fails you:

- Estimate range to target.
  - If target is in battlesight range, use GPS battlesight.
  - If target is beyond battlesight range, use GAS precision (estimated range).
- Engage the target and apply BOT.

The important thing to remember is that you must first estimate the range to the target. You then can decide if GPS battlesight or GAS with estimated range will be used to engage the target.

Figure 3. Typical Degraded Mode Gunnery Scenario (continued)

maneuvering (open) area or wishes to make the exercises more challenging and difficult.

Exercise material requirements, with the exception of the M1 tank, are such that they can be easily obtained, maintained, and stored by an individual tank crew or platoon. Materials required for the basic field exercises include:

- Six target illustrations drawn on posterboard-type material having the approximate dimensions of 2 by 2-1/2 feet,
- Five target frames approximately 4 feet high designed to "stand" the targets at predefined ranges,
- One target frame capable of being carried by a crewmember,
- Several small marker stakes, and
- One stopwatch and pen/pencil.

The size and shape of the target illustrations are such that they approximate realistic target characteristics at the appropriate ranges.

The nature of the exercises is such that they can be conducted with a minimum of preparation time. Thus, they are well suited as an "in-the-cracks" training aid. A sample of the field exercises, in their final form, is presented in Appendix C to this report.

Preparation and Evaluation

During the period of May 1981 through November 1981, the sustainment training materials were developed. Most of the subject matter expertise input was provided by the M1 New Equipment Training (NET) Team, Fort Knox, Kentucky. A sample of the sustainment training materials was prepared for use at Fort Hood, Texas during the month of November 1981. This initial evaluation of the sustainment materials was conducted by Allen Corporation personnel. Based upon the results of the evaluation, the sustainment training materials were revised and expanded.

The finished sustainment training materials were evaluated during February 1982. This evaluation, unlike the initial evaluation, was conducted directly by the tank commanders, with Allen Corporation personnel providing only support functions. Following the final evaluation, Allen Corporation modified each of the scenario booklets and exercises in respect to comments from M1 personnel at Fort Hood. In preparation for final printing, these modifications have been discussed with various Fort Knox SMEs in order to assure that the final sustainment materials possess content accuracy.

A detailed discussion of the procedures employed, and results obtained, from Field Evaluations 1 and 2 are presented in Section III and IV respectively.

## SECTION III

## FIELD EVALUATION 1

This field evaluation was conducted during November of 1981 and lasted one week. The evaluation took place at Fort Hood, Texas and utilized nine M1 tank crews. The purpose of the field evaluation was to: 1) assess acceptability of the sustainment training materials format, and 2) verify content accuracy of the materials.

### MATERIALS

Sustainment training materials evaluated during this pilot test included both the field exercises and samples of the scenarios. In addition, supporting materials were developed and employed. The contents of each of these materials is briefly described below.

#### Scenarios

The scenario samples evaluated during this pilot test included scenarios for both Issue Fire Commands and Degraded Mode Gunnery. For both of these categories, several series of scenarios were developed. Each series consisted of scenarios dealing with the same "subtopic". The following is a list of the series including the number of scenarios within each.

**Issue Fire Commands**

Series 1 - Proper Sequence of Fire Command Elements (4 scenarios)
Series 2 - Proper Weapon/Ammunition for Target (4 scenarios)
Series 3 - Identify Most Dangerous Target (10 scenarios)
Series 4 - Crew Engagement Responses (6 scenarios)
Series 5 - Combat Situations (17 scenarios)

**Degraded Mode Gunnery**

Series 1 - Before Operations Checks (9 scenarios)
Series 2 - Identify Degraded Modes (6 scenarios)
Series 3 - Respond to Degraded Modes (7 scenarios)
Series 4 - Identify and Respond to Degraded Modes (15 scenarios)

Each scenario series began with directions for using the series. The scenarios within each series contained those scenario characteristics described in Section II. Located at the back of each series were answer sheets on which the user could record his responses.

#### Field Exercises

Two field exercises were tested during this evaluation. These exercises were Target Handoff, and Target Tracking and Leading. The contents of the field exercise booklets were discussed in the preceeding section.

Supporting Materials

In addition to the sustainment training materials described above, supplementary data collection materials were developed for the field evaluation. These materials include:

- Pre- and post-tests for the fire command materials. The pre-test and post-test each consisted of three scenarios representative of the problems presented in the fire command scenario series. The crewmembers were required to construct an answer for the problems presented in the scenarios. Identical forms were not employed. However, the pre- and post-tests were designed to be equivalent in terms of content and difficulty.

- Pre- and post-tests for the degraded mode gunnery materials. The pre-test and post-test were identical forms. Each consisted of eight brief multiple choice test items. The test items were representative of the problems presented in the degraded mode gunnery scenarios.

- Experience questionnaire. The questionnaires were designed to obtain crewmen data such as length in service, present pay grade, previous M1 tank experience, and various other demographic information. Only one form of the questionnaire was developed.

- Fire command materials evaluation form. The evaluation form was developed to elicit crewmembers' perception of, and attitude toward, the fire command scenarios via numerous multiple choice questionnaire items.

- Degraded mode gunnery evaluation form. The evaluation form employed to identify the crewmembers' perception of, and attitude toward, the degraded mode gunnery scenarios was identical to the fire command materials evaluation form.

- Target handoff exercise evaluation form. This form consisted of free-response and multiple choice questionnaire items designed to identify the crewmembers' attitude toward the target handoff exercise.

- Target tracking and leading exercise evaluation form. This form, like that employed for the target handoff exercise, consisted of free-response and multiple choice questionnaire items designed to elicit the crewmembers' attitude toward the target tracking and leading exercise.

The manner in which each of these materials was employed is discussed in the following paragraphs.

PROCEDURES

As mentioned above, nine M1 tank crews participated in this evaluation. Each crew's level of participation was four hours. Thus a total of two crews evaluated the training materials and field exercises in one eight-hour day. Further, each crew's four-hour participation was divided into two two-hour sessions:

- Session 1 - Evaluation of scenarios.
- Session 2 - Evaluation of field exercises.

Since all crews participated in approximately the same manner, the following paragraphs present the field evaluation procedures for one "typical" crew.

Session 1

Session 1 began with an overview of the field evaluation presented by Allen Corporation personnel. The overview addressed such topics as purpose, duration and activities of the evaluation, and each crewmember's role in the evaluation. In addition, a brief description of the materials was presented.

Following the overview, each crewmember was administered an experience questionnaire. After the questionnaires were administered, the crew was divided into two groups of two people each. One group (Group 1) was assigned to work on the degraded mode gunnery scenario series while the second group (Group 2) was assigned to work on the fire command scenario series. Prior to beginning work on the scenarios, appropriate pre-tests (degraded mode gunnery or fire command) were administered to all crewmembers. Group 1 always consisted of the gunner and either the driver or loader. Group 2 always consisted of the tank commander and driver or loader, whichever was not in Group 1. The Allen Corporation representative was present at all times and was available to answer any questions regarding scenario instructions or content. The M1 crewmembers were asked to not only complete the appropriate series of scenarios, but also to identify any areas of questionable content accuracy. Upon completion of the scenario series, crewmembers were given a post-test appropriate to the specific group to which they were assigned. Due to evaluation time limitations, Group 1 did not evaluate the fire command material, nor did Group 2 evaluate any of the degraded mode gunnery material.

At the end of Session 1, the post-tests were collected and scenario evaluation forms were distributed for completion. Group 1 received the degraded mode gunnery evaluation form while Group 2 completed the fire command evaluation form. In most cases, both groups were able to complete all of their respective scenarios within the Session 1 time limitation. There were a few instances, however, where a crewmember was unable to complete all of his materials. Since the purpose of the evaluation was not to obtain detailed performance scores of individuals for each scenario series, no requirement was placed on the crewmember to spend extra time completing the materials. It was felt that all crewmembers who began working on the scenario series were able to complete enough material to allow them to evaluate the materials in a meaningful manner.

Session 2

Session 2, evaluation of the field exercises, required employing an M1 tank in a small maneuvering area. Thus, at the beginning of this session the crew would move the tank from the Fort Hood M1 motor pool to the maneuvering area located a short distance from the motor pool. The crew was then given the Target Handoff and Target Tracking and Leading Exercise booklets. Although the booklets contained instructions for setting up the exercises (building target frames, placing targets, etc.), Allen Corporation personnel

performed all exercise set-up activities prior to each crew's arrival in an effort to make the best use of time available.

After the crew reviewed the exercise booklets, the TC was instructed to take the lead in his crew's conduct of the exercises. The Allen Corporation representative remained either on or near the tank but did not intervene unless queried by the TC.

The crew began by first conducting the Target Handoff Exercise. Although this exercise constitutes only TC/gunner interaction, the TC attempted to have all of his crew (gunner, loader, and driver) take turns as the "gunner" as time permitted. The TC not only led this exercise, but was also responsible for recording each crewmember's performance during the exercise.

Upon completion of the Target Handoff Exercise, the TC would have the driver move the tank to the position required for the Target Tracking and Leading Exercise. Once again, the TC led this exercise (without any unnecessary interference from the Allen Corporation representative) and attempted to have each of his crewmembers take turns as the "gunner" as time permitted. The TC scored each crewmember's performance on this exercise as well.

When both the Target Handoff and Target Tracking and Leading exercises were completed, evaluation forms were administered. Those crewmembers (including the TC) who participated in the first exercise were each given a Target Handoff Exercise Evaluation form to complete. Those crewmembers who participated in the second exercise were each given a Target Tracking and Leading Exercise Evaluation form to complete. After all evaluation forms were filled out by the appropriate crewmembers, the crew returned the M1 to the motor pool, thus ending their role in the evaluation. The intention was to have all crewmembers participate in both exercises. There were some instances, however, when this was not possible. The reasons for these deviations are discussed below.

Special Conditions

During the course of Field Evaluation 1, several unexpected conditions were encountered which warrant mentioning at this time. These conditions include the testing environment, personnel availability, and equipment availability.

Testing Environment. Although not by design, the conditions under which the scenario evaluation took place varied from crew to crew, and were not under the control of the researchers. That is, there was no classroom, ready-room, etc., designated for use during the evaluation. As a result, some crews completed the scenarios standing by their tank, while other crews used the floor of a maintenance area or even the back of a truck. It was not until the last two days of the evaluation that a room above the maintenance area was made available for use by the crews. This room, however, was still much less than satisfactory for evaluation purposes as it did not contain chairs for the crewmembers, nor was it capable of being heated to a comfortable temperature. It is obvious that such conditions would detract from motivation and crew cooperation.

Personnel Availability. As mentioned previously, a total of nine M1 tank crews were scheduled to participate in the evaluation. However, it was not uncommon to find that one crewmember was absent or that one crewmember could participate for only some portion of that crew's evaluation. As a result, the

number of crewmembers (sample size) participating in the various evaluation activities was distributed unequally.

Equipment Availability. Crew access to M1 tanks was often hampered. Reasons for this non-availability of equipment included: not having keys to unlock the tank, not having permission to use the tank, not knowing which tank could be used, and not having keys to the motor pool gate which was the only tank exit from the motor pool area.

The purpose of mentioning these special conditions at this time is two-fold. First, it gives the reader a better understanding of what can be expected during a typical field evaluation. Secondly, it provides an explanation for the missing "data points" which the reader will encounter when reviewing the results of this field evaluation.

## RESULTS

The following is the presentation of Field Evaluation 1 results. The results cited are based upon several data/information sources. These sources include:

- Experience Questionnaires
- Fire command Pre- and Post-Tests
- Degraded Mode Gunnery Pre- and Post-Tests
- Crew Evaluations of the Fire Command Materials
- Crew Evaluations of the Degraded Mode Gunnery Materials
- Target Handoff Exercise
- Target Tracking and Leading Exercise
- Crew Evaluations of the Target Handoff Exercise
- Crew Evaluations of the Target Tracking and Leading Exercise
- Allen Corporation Personnel Observations

The results are presented in four primary topic areas. These areas include: (1) Subject Experience; (2) Fire command Scenarios; (3) Degraded Mode Gunnery Scenarios; and (4) Field Exercises.

### Subject Experience

The experience history of the crewmembers participating in Field Evaluation 1 is summarized in Table 5. As seen in that table, major differences in subject experience exist primarily between TCs and the other crewmembers. TCs were typically older than their tank crewmembers by an average of almost six years. In addition, their length in the service and experience on tanks other than the M1 was much greater than that of the drivers, loaders, or gunners. It was observed, however, that some experienced TCs were somewhat more resistant to change than other crewmembers. That is, some TCs disagreed with some fire command and degraded mode gunnery material content because, as they verbally indicated, it was not the way they did things on the "old" tanks. Further, Allen Corporation personnel observed that TCs, in general, were superior to their tank crewmembers in terms of communication skills and reading ability. A potential result of this subjective observation is that TCs may have been able to complete the training materials more easily and rapidly than were drivers, loaders, and gunners. (Note: Data presented in Table 5 resulted from different sample sizes. Some items, such as "Time on Other Tanks," did

Table 5. Field Evaluation 1 - Summary of Selected Experience Questionnaire Items

| | Average Age (Years) | Average Length In Service (Months) | Average Last Grade Completed | Average Total Time On M1 (Months) | Average Total Time On Other Tanks (Months) | Average Total Time On All Tanks (Months) |
|---|---|---|---|---|---|---|
| Driver | 21.0 (N=9) | 2.14 (N=9) | 11.8 (N=9) | 10.7 (N=8) | 11.3 (N=7) | 20.6 (N=8) |
| Loader | 21.6 (N=9) | 13.4 (N=8) | 12.2 (N=9) | 6.8 (N=7) | 5.4 (N=4) | 9.9 (N=7) |
| Gunner | 20.9 (N=8) | 32.7 (N=7) | 11.9 (N=8) | 10.4 (N=7) | 13.2 (N=6) | 12.3 (N=7) |
| Tank Commander | 27.1 (N=9) | 96.0 (N=9) | 12.8 (N=9) | 10.1 (N=8) | 42.6 (N=9) | 43.5 (N=9) |

not apply to some crewmembers. Other items, such as "Time on M1" were either misinterpreted or inappropriately answered by some crewmembers.)

Fire Command Scenarios

The objective data relating to the training effectiveness of the fire command materials were obtained via the fire command pre- and post-tests. As seen in Figure 4, performance on the post-test (across drivers, loaders, and TCs) was slightly lower than pre-test performance. Although this difference was not found to be statistically significant, it is felt to be a noteworthy result. There are several possible explanations for the decline in post-test performance. Three potential explanations are:

1) Pre-test and post-test forms were designed to be equivalent in difficulty and content. It is possible that this design intent was not met and that the post-test was actually more difficult than the pre-test.

2) Subjects did not possess the knowledge "required" to deal with the fire command scenarios. This lack of "required knowledge" may have resulted in confusion as opposed to learning.

3) Given the conditions under which the fire command materials were evaluated (discussed previously), subjects may have been experiencing fatigue or boredom by the time the post-test was administered.

It is interesting to note that decreased performance on the post-test was somewhat position specific. That is, performance decreases, although not statistically significant, were evidenced only with drivers and loaders. This is shown in Figure 5. TC post-test performance did not decline, but rather, remained relatively constant (and statistically insignificant). Overall, TCs performed much better on the pre- and post-tests than did drivers and loaders. This fact lends itself in support of Explanation 2 above -- that subjects did not possess sufficient basic fire command knowledge for learning to occur simply by practicing the scenarios.

Although drivers and loaders performed somewhat poorly on the fire commands pre- and post-tests, researchers observed that their attitude toward the scenarios remained favorable. Table D-1 (in Appendix D) presents a summary of driver, loader, and TC responses on the fire command scenarios evaluation form. Because the information presented in that table is relatively straightforward, a detailed disucussion of each question and associated crew responses is not deemed necessary. In summary, however, most of the respondents indicated that the scenarios were acceptable in terms of readability and completeness. Further, the crewmen generally found the scenarios interesting and felt that the material is very useful for practice. Although less than half of the crewmembers thought they had learned a lot by doing the scenarios, all participants indicated that they would use the scenarios if many were available.

Degraded Mode Gunnery Scenarios

In contrast to the performance data obtained from the fire command pre- and post-tests, average degraded mode gunnery post-test score (across drivers, loaders, and gunners) was higher than the average pre-test score (see Figure 6). These identical pre- and post-tests displayed a mean difference of

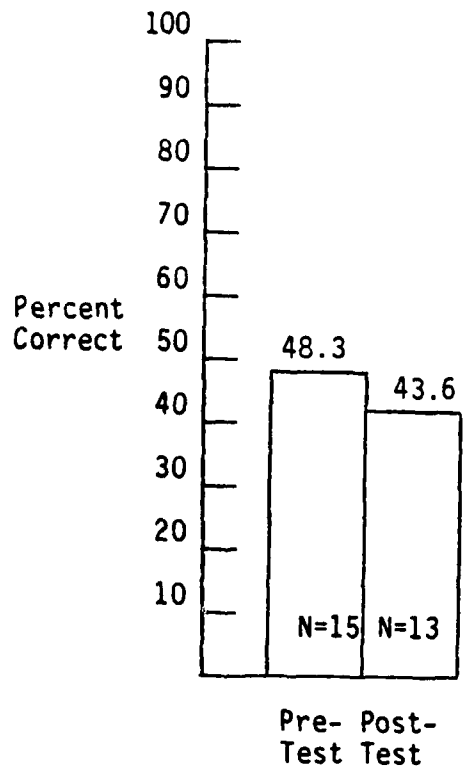



Figure 4

Evaluation 1: Results of Fire Command Pre- and Post-Tests.
Percent Correct Across Drivers, Loaders, and TCs.

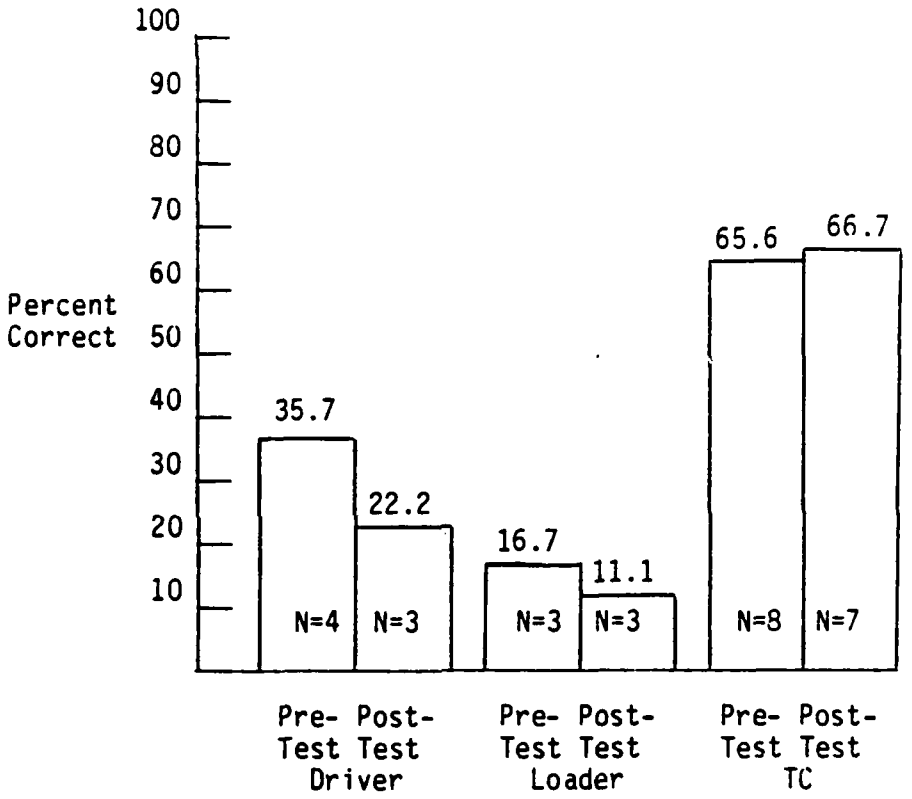



Figure 5

Evaluation 1: Results of Fire Command Pre- and Post-Tests. Percent Correct By Crew Position.

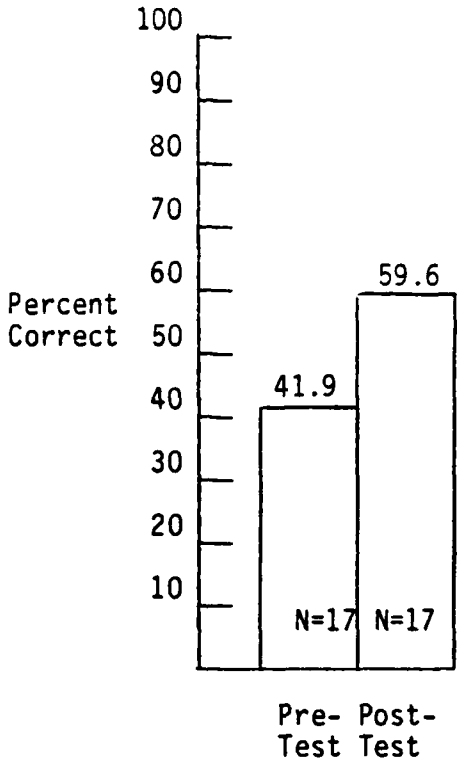



Figure 6

Evaluation 1: Results of Degraded Mode Gunnery Pre- and Post-Tests. Percent Correct Across Drivers, Loaders, and Gunners.

nearly 18 percent which is significant beyond the 0.01 level of significance ($t=3.038$, $df=32$). As seen in Figure 7, the higher post-test scores were not restricted to any one crew position, but rather were achieved by drivers, loaders, and gunners. Although average post-test scores were not significantly (statistically) higher than pre-test scores for any of these groups, average increases in test performance ranged from 15.6 percent for gunners to nearly 22 percent for drivers. These results, together with those presented in Figure 6, indicate that learning may have indeed occurred as a result of practicing the degraded mode gunnery scenarios.

As was the case with the fire command materials, participants responded favorably to the degraded mode gunnery scenarios. The results of the drivers, loaders, and gunners scenarios evaluation are summarized in Table D-2. That table indicates that although some respondents found the scenarios hard to do, nearly all felt that the scenarios would be a useful tool for practice and that they did learn as a result of practicing the scenarios. Not all crewmen responded quite so favorably, however. In particular, one gunner found the scenarios boring while one loader indicated that he learned nothing at all by doing the scenarios. These subjects are believed to be exceptions, however, and their reactions should not be used to describe general subject attitude.

Field Exercises

During the field exercises, crewmembers were observed to be genuinely motivated and eager to participate. Further, many of the drivers and loaders found that the exercises provided them with unique and pleasant experiences.

Target Handoff Exercise. A total of five drivers, six loaders, and five gunners participated as the "gunner" during the Target Handoff Exercise. Each participant performed sixteen target handoffs (trials). Data collected during this exercise are presented in Figures 8 and 9. Figure 8 shows that average target handoff time was relatively constant between crew positions. Figure 9, however, illustrates that gunners achieved somewhat higher levels of accuracy of laying on the target than did drivers or loaders. Further, it should be noted that complete target misses were very low for each of the crew positions. Only 2.6 percent of all targets handoffs resulted in target misses for drivers, compared with 2.1 percent for loaders. Across all 80 trails performed by gunners, no target misses were observed.

Statistical analyses were not performed using data from the Target Handoff Exercise. Reasons for not performing statistical tests are as follows:

- The crewmember in the loader's position was responsible for keeping time using a stopwatch. Although instructions were given as to timekeeping procedures, standardization between timekeepers cannot be assessed.

- The TC was responsible for scoring accuracy of laying on target. This scoring is somewhat subjective and can vary among TCs. Thus, scoring consistency by TCs is also questionable.

Again, the intent of evaluating this exercise was not to obtain detailed performance data. Rather, exercise utility and user acceptance were the primary issues of concern.

All crewmembers participating in this exercise indicated that the exercise is useful for practice and that by doing similar exercises, their target

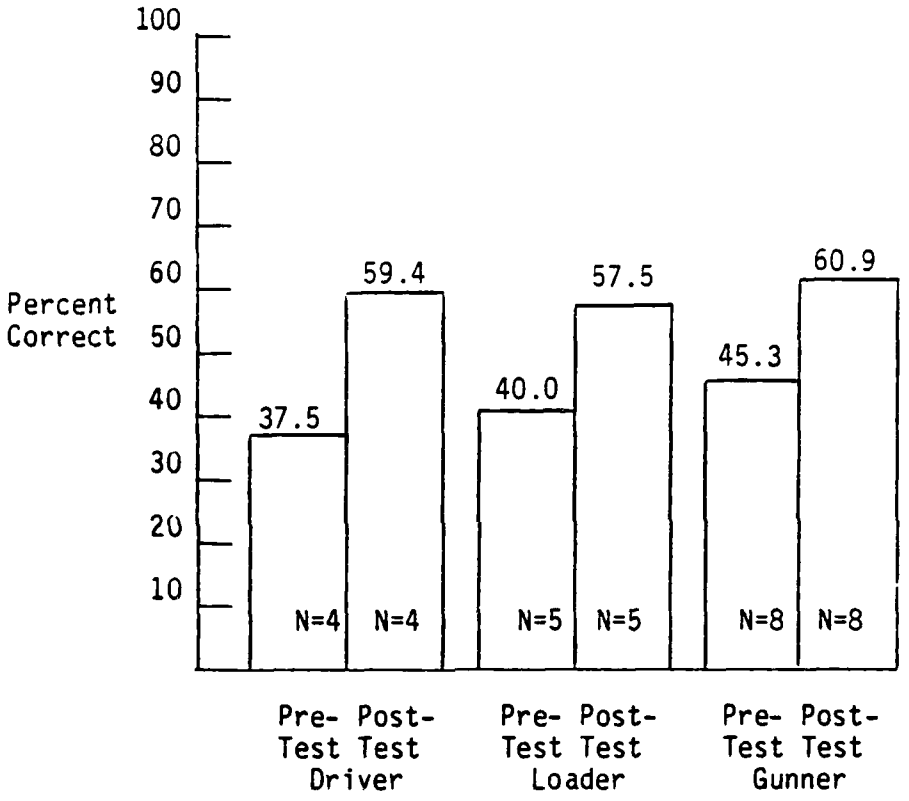



Figure 7

Evaluation 1: Results of Degraded Mode Gunnery Pre- and Post Tests. Percent Correct By Crew Position.

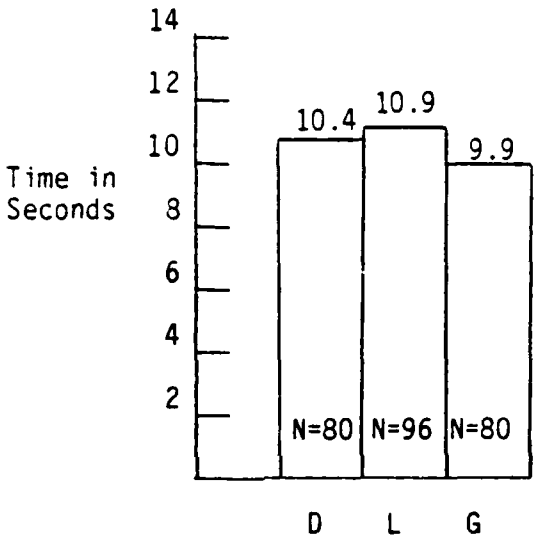



Figure 8

Evaluation 1: Average Target Handoff Time by Crew Position.

Targets located 1,000 yards (simulated) from M1 with 750 yards (simulated) between targets.
N = number of trials.
D = drivers, L = loaders, G = gunners.

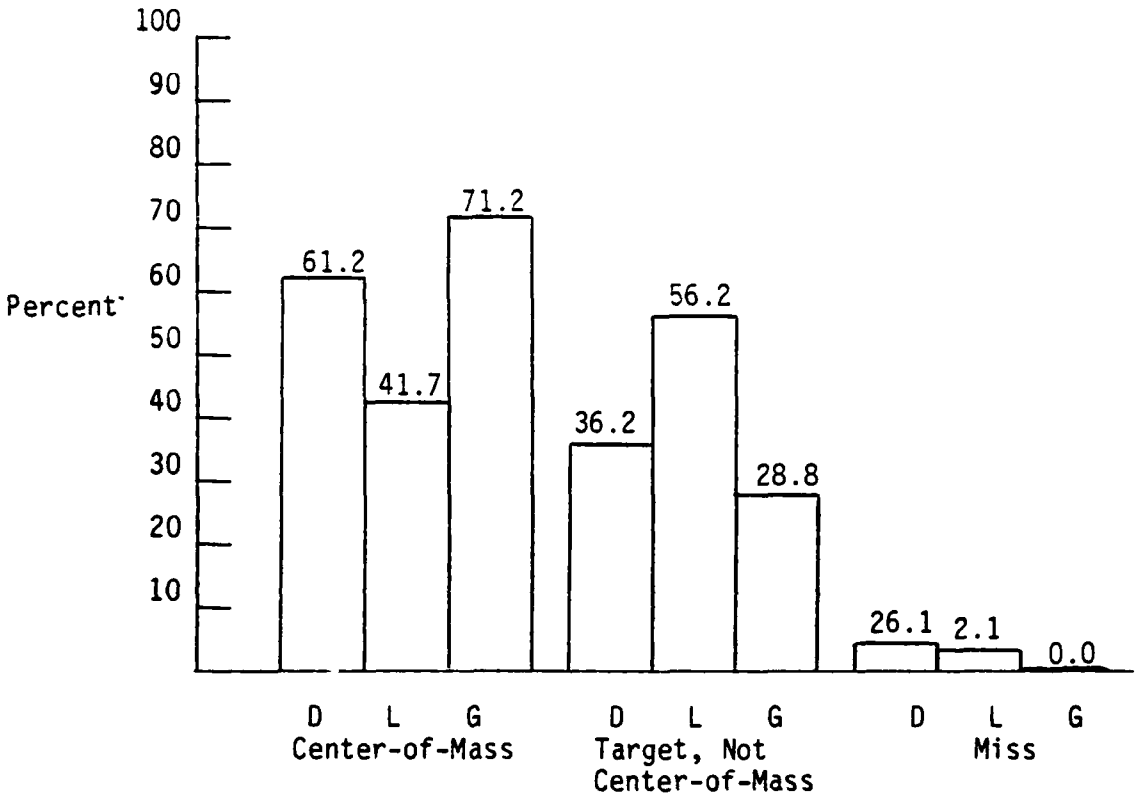



Figure 9

Evaluation 1: Accuracy, in Percent, of Laying Main Gun on Target During the Target Handoff Exercise.

Based on 80 trials across drivers (D), 96 trials across loaders (L), and 80 trials across gunners (G).

handoff skills would improve (see Table D-3). The Target Handoff Exercise evaluation summarized in Table D-3 shows that crewmembers found the exercise both interesting and easy to perform. In addition, most participants viewed the exercise as fairly realistic and indicated they would use this type of exercise if available in the future.

Target Tracking and Leading Exercise. A total of three drivers, four loaders, and four gunners participated as the "gunner" during the Target Tracking and Leading Exercise. Each participant was scored fifteen times when tracking the target at 1,000 yards (simulated) and 2,000 yards (simulated). In addition, participants were scored while leading the moving target at simulated ranges of 1,000 yards and 2,000 yards.

The results of the Target Tracking and Leading Exercise are presented in Figures 10 and 11. Target tracking accuracy (Figure 10) varied very little between drivers, loaders, and gunners for both the 1,000 yard and 2,000 yard simulated ranges. Figure 11 illustrates that target leading performance varied considerably between drivers, loaders, and gunners at the simulated range of 1,000 yards. However, at the simulated 2,000 yard target range, target leading performance remained relatively constant between crew positions. As with the target tracking data, no statistical tests were performed using the target leading performance scores. In this exercise, performance scoring was completed by the TC of each crew. Thus, a lack of standardization, in terms of scoring criteria, may have existed even though that criteria was described in the exercise instructions.

Crew evaluations of this exercise indicate that the crewmembers participating found the exercise useful for practice. Further, crewmen generally felt that by doing similar exercises, their target tracking and leading skills would improve (see Table D-4). The Target Tracking and Leading Exercise evaluation is summarized in Table D-4. As seen in that table, most crewmembers found the exercise interesting and useful. This exercise was, however, somewhat less well received than was the handoff exercise. The primary reason for this is the requirement for one crewmember to walk with the target during this exercise. This observation is reinforced by the crewmembers' responses to Question 13 of Table D-4.

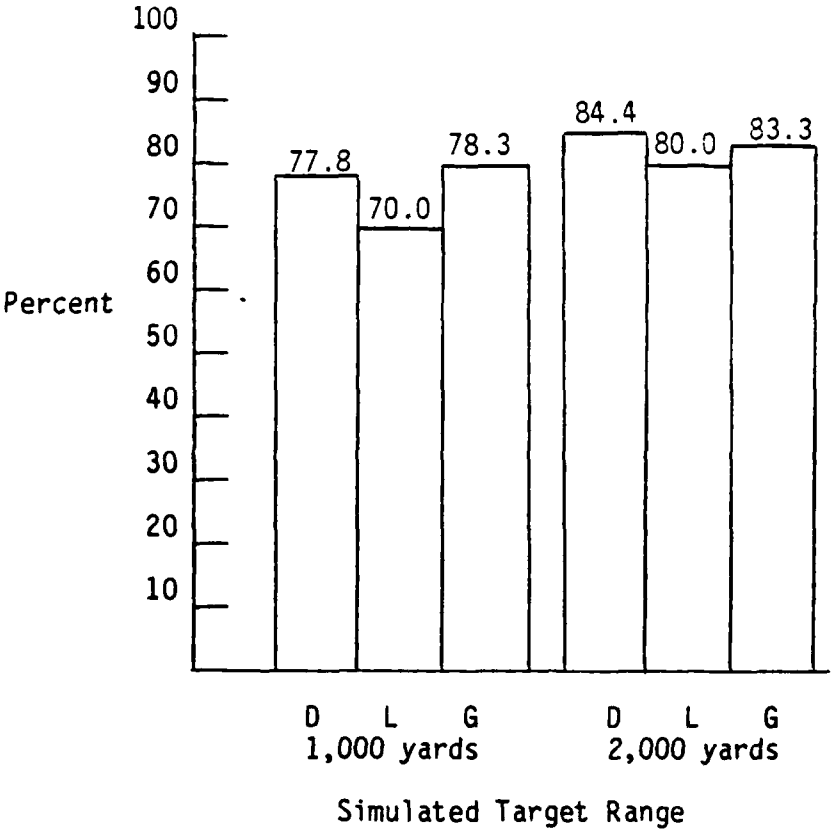



Figure 10

Evaluation 1: Percent of Trials Scored as "Hit" When Tracking the Moving Target.

Based on 45 trials across drivers (D), 60 trials across loaders (L), and 60 trials across gunners (G).

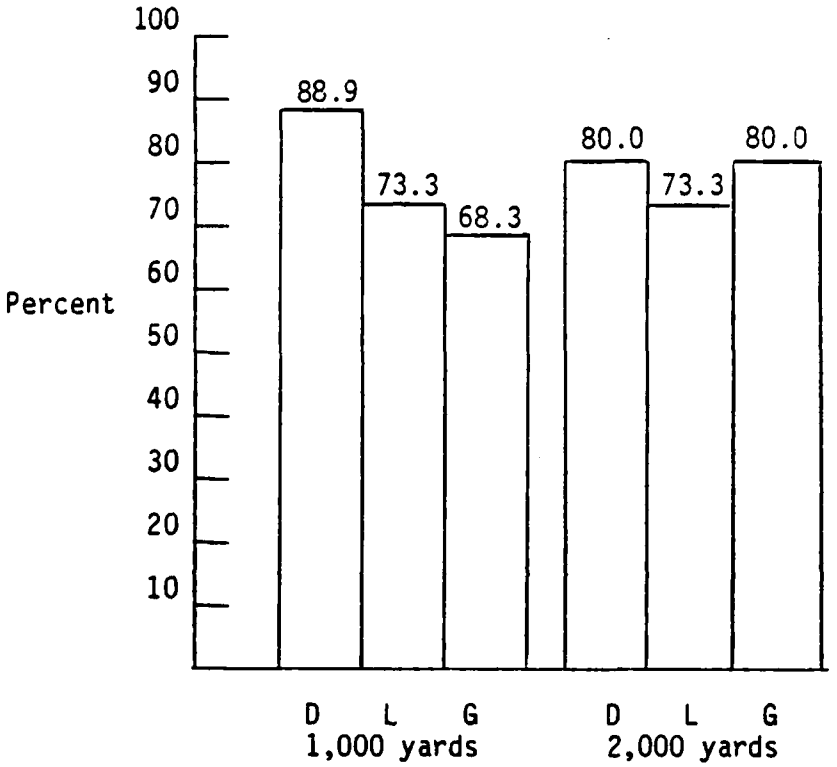



Figure 11

Evaluation 1: Percent of Trials Scored as "Hit" When Leading the Moving Target.

Based on 45 trials across drivers (D), 60 trials across loaders (L), and 60 trials across gunners (G).

## SECTION IV

## FIELD EVALUATION 2

This second field evaluation was conducted for two weeks beginning in February of 1982. The evaluation took place at Fort Hood, Texas and made use of eight M1 tank crews. Unlike Field Evaluation 1, the purpose of this evaluation was to assess content accuracy and user acceptance of the total sustainment training materials packages and field exercises, rather than just a sample tnereof.

### MATERIALS

Sustainment training materials evaluated during this evaluation included both scenario materials and field exercises. In addition, supporting materials were developed and employed. The contents of each of these materials is briefly described below.

#### Scenarios

The sample of scenarios pilot tested during the first field evaluation were revised and expanded based upon the results of that evaluation. In addition, a need for knowledge booklets to preceed the scenarios was identified. It became obvious from the first field evaluation that many of the crewmembers did not possess the basic knowledge required to effectively use the scenarios as training material. Thus, two knowledge booklets were developed for the purpose of providing basic instruction in the skills within the scenario booklets. The contents of these two booklets are briefly described below.

The first knowledge booklet deals with M1 tank fire commands. This booklet provides the general information required to prepare a fire command. It also describes how to announce a fire command, including crew's responses, for the following kinds of engagements:

- GPS/TIS Precision,
- GPS/TIS Battlesight,
- GAS Precision, and
- GAS Battlesight.

The booklet provides brief segments of written instruction followed by a number of multiple choice questions. The multiple choice questions are designed to allow the student to validly assess his mastery of the instruction content.

The second knowledge booklet deals with degraded mode gunnery on the M1 tank. This booklet contains descriptions of the following M1 tank gunnery systems:

- Crosswind Sensor
- Cant Sensor
- Lead Angle Sensor

- Laser Rangefinder
- Stabilization
- GPS View
- GPS Reticle
- Thermal Imaging System
- GPS Symbology
- Gunner's Power Control Handle Trigger
- Gunner's Power Control Handle

Descriptions of the above gunnery systems include the characteristics listed below.

- Function of the system,
- How to tell if the system has failed,
- How to correct for a failure during a non-immediate engagement,
- How to correct for a failure during an immediate engagement.

This knowledge booklet, like that developed for M1 tank fire commands, provides segments of instruction followed by multiple choice questions.

In addition to the two knowledge booklets just described, a knowledge/scenario booklet was developed dealing with multiple laser returns. This booklet not only contains a number of scenarios, but also discusses issues related to multiple returns. These issues include:

- Meaning of multiple returns,
- Identifying multiple returns,
- The laser RANGE switch, and
- Dealing with multiple returns.

Each of these issues are presented in short segments of written instruction. Further, the text includes a number of multiple choice questions designed for self-assessment of instruction content mastery.

These knowledge booklets, along with associated scenario booklets, comprised the scenario materials employed during Field Evaluation 2. The following is the complete list of those materials.

Fire Commands for the M1 Tank

Booklet 1 - Overview of Fire Commands (166 pages)
Booklet 2 - Classifying Threats (10 scenarios)
Booklet 3 - Ammunition/Weapon Selection (10 scenarios)
Booklet 4 - Fire Command Elements and Sequence (10 scenarios)
Booklet 5 - Single Target Engagements (12 scenarios)
Booklet 6 - Multiple/Simultaneous Target Engagements (27 scenarios)

M1 Tank Degraded Mode Gunnery

Booklet 1 - M1 Gunnery Systems (51 pages)
Booklet 2 - Non-Immediate Engagements (44 scenarios)
Booklet 3 - Immediate Engagements (32 scenarios)

M1 Tank Degraded Mode Gunnery

Multiple Returns (Information Section and 11 scenarios)

Each scenario booklet began with a user's guide which discussed the purpose of the booklet and instructions for its use. In addition, tank commander training notes are presented in the first booklet of each of fire command and degraded mode gunnery package. These training notes provide an overview of the booklets, discuss the purpose of the booklets, and describe how the booklets can be used by the crew. The scenarios within each booklet contained those scenario characteristics described in Section II.

Field Exercises

The two field exercises, Target Handoff, and Target Tracking and Leading, used during this evaluation were very similar to those used during the pilot test. Changes were made only in the step-by-step instructions for conducting the exercises. These changes resulted in exercise instructions that were extremely clear and easy for the TC to follow.

Supporting Materials

In addition to the materials listed above, supplementary data collection materials were developed for use during the evaluation. These materials include:

- Experience questionnaire. The questionnaire was very similar to that developed for Field Evaluation 1 in that it addressed crewmen data such as length in service, present pay grade, previous M1 tank experience, and other demographic information.

- Pre- and post-tests for fire command booklets. The pre-test and post-test were identical forms. The tests consisted of twenty multiple choice test items and five scenarios. Questions and scenarios were representative of the problems included in the fire command booklets.

- Pre- and post-tests for degraded mode gunnery booklets. The pre-test and post-test were identical forms. Tests consisted of twenty multiple choice test items and five scenarios which are representative of the problems included in the degraded mode gunnery booklets. Of the twenty multiple choice test items, three items were related to the problems presented in the multiple return booklet.

- Fire command booklets crew evaluation form. This evaluation form was employed to elicit crewmembers' (dirver, loader, gunner, and TC)

perceptions of, and attitude toward, the fire command scenarios via numerous completion and multiple choice questionnaire items.

- Fire command booklets TC evaluation form. This evaluation form was employed to identify TC perceptions of their crew's acceptance of the fire command booklets.

- Degraded mode gunnery crew evaluation form. The evaluation form was utilized as a tool for obtaining crewmember's comments regarding the degraded mode gunnery booklets. The evaluation form consisted of numerous completion and multiple choice questionnaire items.

- Degraded mode gunnery TC evaluation form. This form assisted in identifying TC perceptions of their crew's acceptance of the degraded mode gunnery booklets.

- Multiple return booklet evaluation form. This evaluation was employed to identify utility and acceptance of the multiple return booklet from the perspective of the crewmembers.

- Target handoff exercise evaluation form. This form consisted of free-response and multiple choice questionnaire items designed to identify the crewmembers attitude toward the target handoff exercise.

- Target tracking and leading exercise evaluation form. This form, like that employed for evaluating the target handoff exercise, consisted of free-response and multiple choice questionnaire items designed to elicit the crewmembers' attitude toward the target tracking and leading exercise.

The manner in which these materials were employed is discussed in the following paragraphs.

## PROCEDURES

All eight M1 tank crews participating in the evaluation were employed for the entire two-week period. Each day during the two weeks was divided into two periods -- morning (Period 1) and afternoon (Period 2). Period 1 was reserved for work on the scenario booklets while Period 2 was devoted for the conduct of the field exercises. The following paragraphs describe the evaluation procedures of Period 1 first, and follow with a discussion of Period 2 activities.

### Period 1

Period 1 on Day 1 began with an overview (given by Allen Cororation personnel), of the entire field evaluation. On this day, all tank crews participating were assembled together in a ready-room. Following the overview, experience questionnaires were administered. After questionnaire administration, drivers, loaders, and gunners were dismissed and only TCs remained. Since the TC would be responsible for material distribution and completion during this evaluation, their role was discussed and questions answered. TCs were then

given all the materials that their crews would be using over the following two weeks.

The eight crews participating in the evaluation were members of two separate platoons. Therefore, it was convenient to divide the eight crews by platoon. This grouping method was useful since only two rooms were available to the crews to work on the training materials.

Beginning on Day 2, each platoon (of four crews each) would meet in the morning in their assigned working areas. They would then work through the training materials following a structured training schedule. This training schedule is presented in Figure 12. During Period 1 of each day, Allen Corporation personnel would circulate between the two platoons to answer questions and administer pre-tests, post-tests, and evaluation forms.

Period 2

Period 2 of each day was devoted to the conduct of the field exercises. Again, the TCs were responsible for ensuring that an M1 tank was available and that the exercises were conducted properly. The field exercises were performed in the same maneuvering area used during Field Evaluation 1. Like Field Evaluation 1, the exercises were set up prior to each crews' arrival at the maneuvering area in an effort to make the best use of available training time. An Allen Corporation representative was present at all times on the maneuvering area during Period 2 to monitor progress and answer any questions that might arise. The training schedule employed for the conduct of the field exercises is presented in Figure 13.

As seen in Figures 12 and 13, Day 4 of the evaluation was designated as a company training holiday. Since this holiday was not scheduled or anticipated by the researchers, no provisions were made to assess its effect on training.

Special Conditions

As with the first field evaluation, several unexpected conditions were encountered which require mention. These special conditions relate to the testing environment and personnel availability.

Testing Environment. Although the conditions under which the scenario evaluation took place remained constant for all crews, the conditions were less than optimum. Specifically, the ready-rooms used by the crews contained no tables and very few, if any, chairs. As a result, crewmembers were required to complete the scenario booklets either standing up or sitting on the floor. Further, the rooms were not large enough to comfortably accommodate the number of soldiers present. Thus crowding was experienced which led to much conversation between personnel. Allen Corporation personnel would often find individuals comparing scenario answers and discussing how they felt about having to participate in the evaluation. Although this interaction was discouraged by the presence of Allen Corporation personnel, there was always one group working on the scenarios without Allen Corporation monitoring.

Personnel Availability. Personnel availability was a common problem throughout this evaluation. A total of eight crews (32 persons) were expected to be available for the evaluation. However, it was often found (especially during the latter portion of the evaluation) that many crewmembers, and sometimes an entire crew, were absent. TCs gave many reasons for the absence of

| | |
|---|---|
| DAY 1<br>(8 - 12) All Crews<br>* Experience Questionnaire<br>* Fire Commands - Pre-Test<br>* Fire Commands - Booklet 1 | DAY 6<br>(8 - 12) All Crews<br>* Degraded Mode Gunnery - Pre-Test<br>* Degraded Mode Gunnery - Booklet 1 |
| DAY 2<br>(8 - 12) All Crews<br>* Fire Commands - Booklet 2<br>* Fire Commands - Booklet 3 | DAY 7<br>(8 - 12) All Crews<br>* Degraded Mode Gunnery - Booklet 2 |
| DAY 3<br>(8 - 12) All Crews<br>* Fire Commands - Booklet 4<br>* Fire Commands - Booklet 5 | DAY 8<br>(8 - 12) All Crews<br>* Degraded Mode Gunnery - Booklet 3 |
| DAY 4<br>(Company Training Holiday) | DAY 9<br>(8 - 12) All Crews<br>* Multiple Return Booklet |
| DAY 5<br>(8 - 12) All Crews<br>* Fire Commands - Booklet 6<br>* Fire Commands - Post-Test<br>* Fire Commands - Crew Eval.<br>* Fire Commands - TC Eval. | DAY 10<br>(8 - 12) All Crews<br>* Degraded Mode Gunnery - Post-Test<br>* Degraded Mode Gunnery - Crew Eval.<br>* Degraded Mode Gunnery - TC Eval.<br>* Multiple Return - Crew Eval. |

Figure 12

Field Evaluation 2:
Scenario Training Schedule

| DAY 1 | DAY 6 |
|---|---|
| (1 - 2) Crew 1 - Loader<br>(2 - 3) Crew 2 - Loader<br>(3 - 4) Crew 3 - Loader<br>(4 - 5) Crew 4 - Loader | (1 - 2) Crew 1 - Loader<br>(2 - 3) Crew 2 - Loader<br>(3 - 4) Crew 3 - Loader<br>(4 - 5) Crew 4 - Loader |
| DAY 2 | DAY 7 |
| (1 - 2) Crew 5 - Loader<br>(2 - 3) Crew 6 - Loader<br>(3 - 4) Crew 7 - Loader<br>(4 - 5) Crew 8 - Loader | (1 - 2) Crew 5 - Driver<br>(2 - 3) Crew 6 - Driver<br>(3 - 4) Crew 7 - Driver<br>(4 - 5) Crew 8 - Driver |
| DAY 3 | DAY 8 |
| (1 - 2) Crew 1 - Driver<br>(2 - 3) Crew 2 - Driver<br>(3 - 4) Crew 3 - Driver<br>(4 - 5) Crew 4 - Driver | (1 - 2) Crew 1 - Loader<br>(2 - 3) Crew 2 - Loader<br>(3 - 4) Crew 3 - Loader<br>(4 - 5) Crew 4 - Loader |
| DAY 4<br>(Company Training Holiday) | DAY 9<br>(1 - 2) Crew 5 - Driver<br>(2 - 3) Crew 6 - Driver<br>(3 - 4) Crew 7 - Driver<br>(4 - 5) Crew 8 - Driver |
| DAY 5<br>(1 - 2) Crew 5 - Driver<br>(2 - 3) Crew 6 - Driver<br>(3 - 4) Crew 7 - Driver<br>(4 - 5) Crew 8 - Driver | DAY 10<br>(1 - 2) All Crews<br>* Handoff Exercise Evaluation<br>* Tracking/Leading Exercise Eval. |

Figure 13

Field Evaluation 2:
Field Exercise Training Schedule

some of their crewmembers. These reasons included: crewmember had duty the night before, illness, tardiness, scheduled leave, personal circumstances, and no reason at all. In general, TCs were not terribly concerned with ensuring that their entire crews were present. Some TCs even indicated that they thought the evaluation was a waste of their, and their crew's time.

The result of this non-availability of some personnel is a reduction in the total sample population which evaluated the training materials. In addition, the reader will find unequal sample sizes in the following discussion of results which present pre-test, post-test, field exercise, and training material evaluation data.

## RESULTS

The following is the presentation of Field Evaluation 2 results. The results cited are based upon several data/information sources. These sources include:

- Experience questionnaires
- Fire Command Pre- and Post-Tests
- Degraded Mode Gunnery Pre- and Post-Tests
- Crew Evaluations of the Fire Command Materials
- TC Evaluations of the Fire Command Materials
- Crew Evaluations of the Degraded Mode Gunnery Materials
- TC Evaluations of the Degraded Mode Gunnery Materials
- Target Handoff Exercise
- Target Tracking and Leading Exercise
- Crew Evaluations of the Target Handoff Exercise
- Crew Evaluations of the Target Tracking and Leading Exercise
- Allen Corporation Personnel Observations

The results are presented in five primary topic areas. These areas include: (1) Subject Experience; (2) Fire Command Booklets; (3) Degraded Mode Gunnery Booklets; (4) Multiple Return Booklet; and (5) Field Exercises.

### Subject Experience

The experience history of the crewmembers participating in this evaluation is summarized in Table 6. For purposes of comparison, personnel experience of Field Evaluation 1 is also summarized in this table. As can be seen, the average ages of crewmembers participating in this second evaluation ranged from 20 years for drivers to 26.5 years for TCs. Average length in service also varied across crew position and ranged from 19.2 months for loaders to 82.8 months for TCs. The greatest difference in subject experience, however, exists in the category "Average Total Time on Other Tanks".

When comparing Evaluation 2 with Evaluation 1 data, it can be seen that the greatest difference in experience lies in the time on other tanks and total time on tanks categories. It was found that only loaders had more experience on other tanks in Field Exercise 1 than in Field Exercise 2. However, when comparing total time in tanks, it is seen that both loaders and TCs in the first evaluation had more experience than loaders and TCs participating in Field Evaluation 2.

Because TCs participating in Field Evaluation 2 had more military experience in general, and more previous tank experience in specific, than did their

Table 6. Field Evaluation 2 - Summary of Selected Experience Questionnaire Items

| | | Average Age | Average Length In Service | Average Last Grade Completed | Average Total Time On M1 (Months) | Average Total Time On Other Tanks (Months) | Average Total Time On All Tanks (Months) |
|---|---|---|---|---|---|---|---|
| Driver | FE2 | 20.3 (N=9) | 28.8 (N=9) | 11.7 (N=9) | 10.5 (N=9) | 10.0 (N=3)* | 13.8 (N=9) |
| | FE1 | 21.0 (N=9) | 21.4 (N=9) | 11.8 (N=9) | 10.7 (N=8) | 11.3 (N=7) | 20.6 (N=8) |
| Loader | FE2 | 20.7 (N=7) | 19.2 (N=7) | 11.4 (N=7) | 6.3 (N=7) | 21.0 (N=2) | 12.3 (N=7) |
| | FE1 | 21.6 (N=9) | 13.4 (N=8) | 12.2 (N=9) | 6.8 (N=7) | 5.4 (N=4) | 9.9 (N=7) |
| Gunner | FE2 | 23.4 (N=8) | 51.8 (N=8) | 12.0 (N=7) | 10.3 (N=8) | 32.2 (N=6) | 34.4 (N=8) |
| | FE1 | 20.9 (N=8) | 32.7 (N=7) | 11.9 (N=8) | 10.4 (N=7) | 13.2 (N=6) | 12.3 (N=7) |
| Tank Commander | FE2 | 26.5 (N=6) | 82.8 (N=6) | 13.0 (N=6) | 12.3 (N=6) | 54.7 (N=3) | 39.6 (N=6) |
| | FE1 | 27.1 (N=9) | 96.0 (N=9) | 12.8 (N=9) | 10.1 (N=8) | 42.6 (N=9) | 43.5 (N=9) |

FE1 - Field Evaluation 1
FE2 - Field Evaluation 2
N - Number of Respondents

*5 additional drivers reported having other tank experience but did not quantify.

crewmembers, their influence on the drivers, loaders, and gunners was obvious to the researchers. It is believed that this influence often resulted in biasing other crewmember' attitudes towards the training materials. For example, many TCs verbally indicated their disagreement with much of the material content. Later in the evaluation, drivers, loaders, and gunners also began to question content accuracy in the same subject areas previously questioned by the TCs. Thus, data contamination is a very real possibility and should be considered when reviewing the results presented on the following pages.

Fire Command Booklets

As with Field Evaluation 1, the objective data relating to the training effectiveness of the fire command materials were obtained via the fire command pre- and post-tests. The difference between fire command pre- and post-test scores indicate an increase in performance following completion of the fire command booklets. As depicted in Figure 14, the average fire command pre-test score across crew position was 60.4 percent as compared to the improved average post-test score of 68.2 percent. This difference was found to be statistically significant at the 0.05 level ($t=2.098$, $df=47$). Although the fire command materials are presented in a very readable and logical manner, they are, nonetheless, extremely complex. Therefore, it is believed that the information booklet (Booklet 1 - Overview of Fire Commands) had a major impact on learning as seen in the increased post-test scores. The fire command materials employed during the two field evaluations were very different, in terms of content accuracy and amount of material present. Thus, a comparison of the pre-test/post-test scores of the two evalutions would lack meaningful results and would not lend themselves to interpretation.

Performance increases, (although not statistically significant) were evidenced by each crew position as illustrated in Figure 15. All crew positions displayed an increase in test scores; however, TC pre-test/post-test performance (71.3%/79.2%) remained the highest, followed in descending order by gunner (63.5%/72.0%), loader (57.1%/66.3%), and driver (52.9%/58.4%).

Table D-5 of Appendix D presents a summary of the fire command booklets evaluation. Some of the major points seen in that table include:

- No crewmember found the scenarios very interesting. Interest ranged from "fairly interesting" to "boring".
- The scenarios' SITUATION descriptions were generally easy to read and understand.
- The correct answers (following each scenario) were often viewed as needing more information. Further, crewmembers generally found the correct answers as being "sometimes inaccurate".
- Most crewmembers found the scenario booklets useful and most indicated they would "use them sometimes" if available.

The most likely hypothesis for the fire command materials being less than optimally received is that the participants viewed the content as often inaccurate. TCs repeatedly indicated that the fire commands presented in the booklets were not the ones that they were taught to use. Further, TCs often

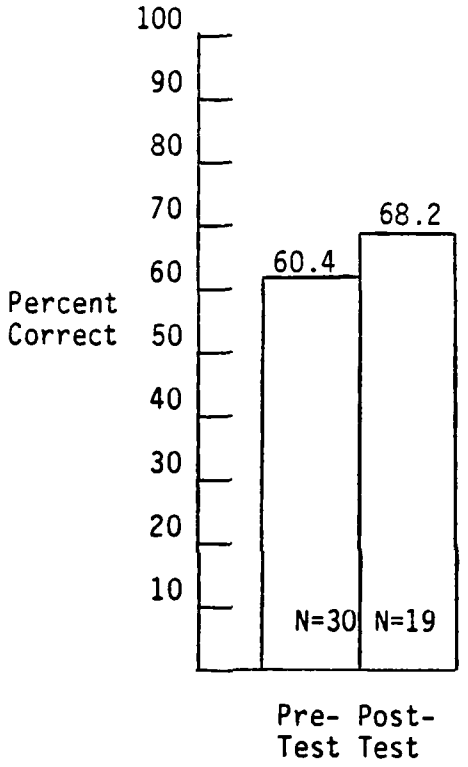



Figure 14

Evaluation 2: Results of Fire Command Pre- and Post-Tests.
Percent Correct Across Crew Position.

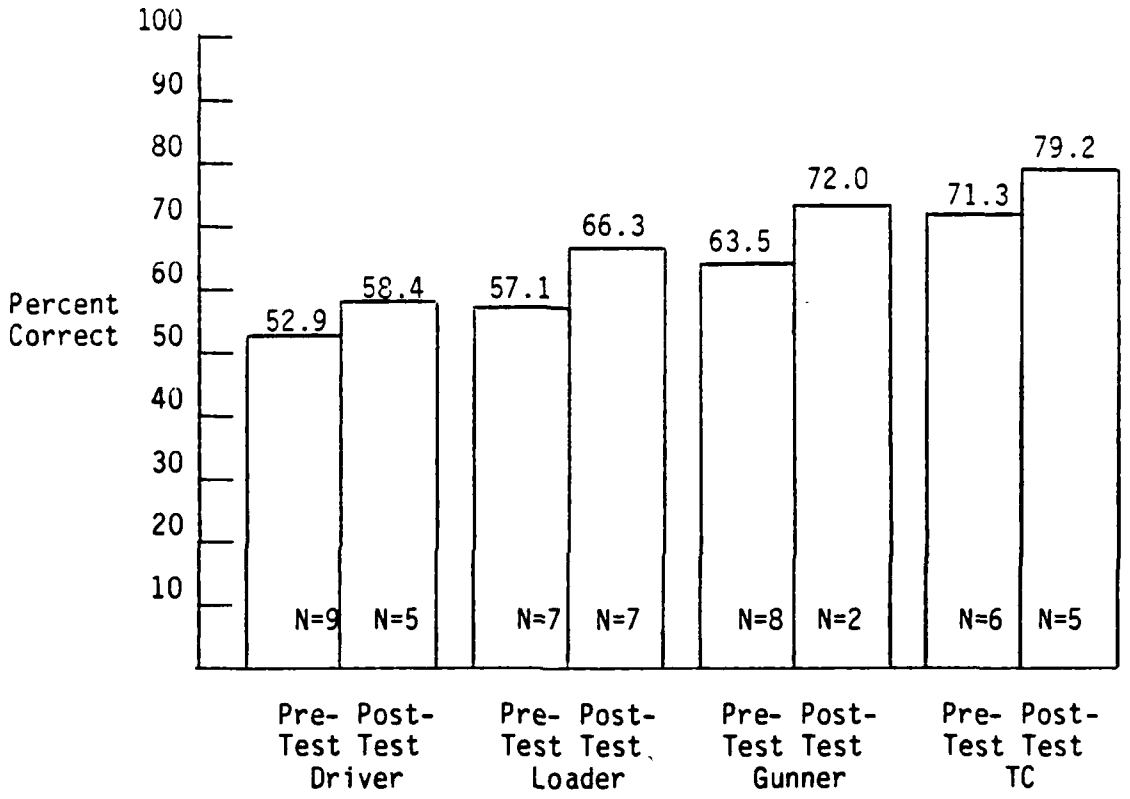



Figure 15

Evaluation 2: Results of Fire Command Pre- and Post-Tests. Percent Correct By Crew Position.

disagreed with the booklets in terms of weapon and ammunition selection for the various types of targets and target engagements presented.

The TCs evaluation of the fire command booklets, presented in Table D-6, indicates that the language used in the booklets is appropriate for their crewmembers' abilities and that most of the crews did learn "a little" by doing the scenario booklets. Although some TCs did not view the booklets as being very useful for train up purposes, all TCs indicated that the booklets would be useful for cross training.

The validity of the perceived lack of content accuracy experienced by crewmembers, particularily TCs, is at best, difficult to assess. As mentioned previously, subject matter expertise related to the sustainment training material content was provided by the NET Team, Fort Knox. These individuals are believed to be extremely familiar with the M1 in terms of its operation and capability. In contrast, M1 crew personnel evaluating the training material have interacted with the M1 tank for a considerbly shorter period of time. That interaction, however, has, and is occurring on a regular (i.e., day-to-day) basis.

Degraded Mode Gunnery Booklets

The primary method employed to determine whether learning occurred as a result of using the degraded mode gunnery booklets was the administration of degraded mode gunnery pre- and post-tests. Figure 16 depicts the results of those tests. As seen in that figure, there exists a large difference between pre-test scores and post-test scores. This difference is statistically significant beyond the 0.01 level ($t=3.250$, $df=37$) thus indicating that learning had indeed occurred. When reviewing pre- and post-test scores for each crew position (Figure 17), it is obvious that increases in post-test performance was not restricted to any one position. With the exception of the loaders, all crew positions displayed fairly high levels of post-test performance, especially TCs, who obtained an average post-test score of over 81 percent. Although all crew positions evidenced increases on the post-test, this increase in performance was found to be statistically significant only for TCs ($t=3.378^{**}$, $df=11$).

Subjective data related to the degraded mode gunnery booklets are presented in Table D-7, Evaluation of Degraded Mode Gunnery booklets. The following is a list of the most important and interesting points seen in that table.

- Most crewmembers found the information booklet "fairly interesting".
- The scenario booklets were easy to read and understand by most.
- In general, the scenarios were found to be "fairly interesting".
- Most respondents felt they had learned "some" after doing the scenarios.
- Most respondents found the scenario pictures "fairly realistic" and "fairly useful".
- Mixed reaction is seen in regards to the scenarios' correct answers' completeness and accuracy.

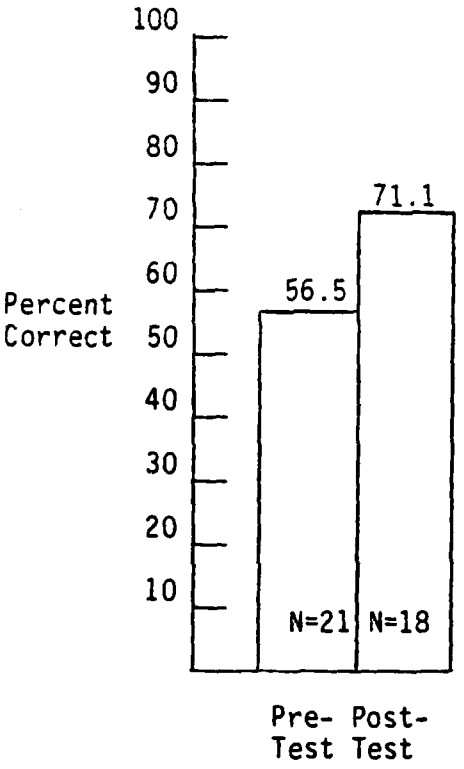



Figure 16

Evaluation 2: Results of Degraded Mode Gunnery Pre- and Post-Tests. Percent Correct Across Crew Position.

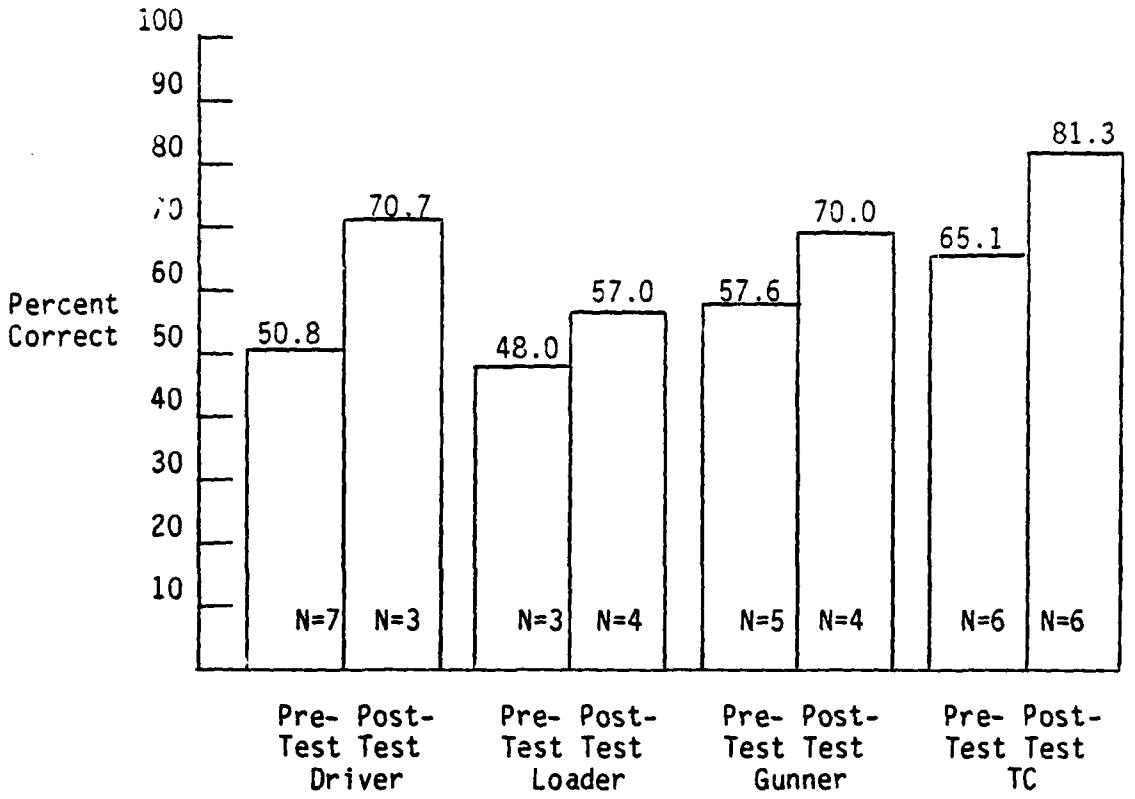



Figure 17

Evaluation 2: Results of Degraded Mode Gunnery Pre- and Post-Tests. Percent Correct By Crew Position.

- Very few (only 2) individuals had difficulty understanding the words used in the booklets.

- General TC comments indicate that the information presented in the booklets lacks accuracy.

The TCs evaluation of the degraded mode gunnery booklets is presented in summary form in Table D-8. That table shows that TCs generally feel that all crewmembers should be familiar with the information in Booklet 1. Further, all TCs indicated that their crews found the scenario booklets fairly interesting and easy to do. Although only half of the TCs felt that the booklets would be useful for train up purposes, all TCs indicated that the booklets would be fairly useful for cross training.

Multiple Return Booklet

Objective performance data was not collected separately for the multiple return booklet. As discussed previously, a multiple return booklet pre-test/post-test was not developed. Rather, due to the brevity of this material, three multiple choice test items related to this material were included in the degraded mode gunnery pre- and post-tests. However, subjective data were collected via an evaluation form. Table D-9 presents a summary of the multiple return booklet evaluation. That table shows that most participants found the material presented easy to read and understand. As with the other sustainment training materials, many crewmembers felt that the information presented was sometimes inaccurate.

Field Exercises

The two field exercises evaluated include the Target Handoff Exercise and the Target Tracking and Leading Exercise. The results of these exercises are briefly described in the following paragraphs.

Target Handoff Exercise. During the evaluation, an attempt was made to allow loaders and drivers to participate in the Target Handoff Exercise on two separate occasions, hereafter referred to as Practice 1 and Practice 2. A total of eight loaders and three drivers participated as the "gunner" during Practice 1. Of these crewmembers, four of the loaders and all three drivers participated during Practice 2. Each participant performed sixteen target handoffs (trial) during each practice session. Data collected during Practice 1 and Practice 2 are presented in Figures 18 through 19. Figure 18 illustrates that average target handoff time varied little between drivers and loaders. Further, average time for target handoffs varied only slightly between Practice 1 and Practice 2. Figure 19 shows that drivers achieved a somewhat higher level of accuracy of laying the reticle on target center-of-mass than did loaders during Practice 1. However, the reverse is true for Practice 2, as seen in Figure 20. Overall, participants performed slightly better during Practice 2, with drivers and loaders both scoring "center-of-mass" on more than 75 percent of the target handoffs.

Statistical analyses were not performed using data from the Target Handoff Exercise. The reasons for this are the same as those given for Evaluation 1, namely:

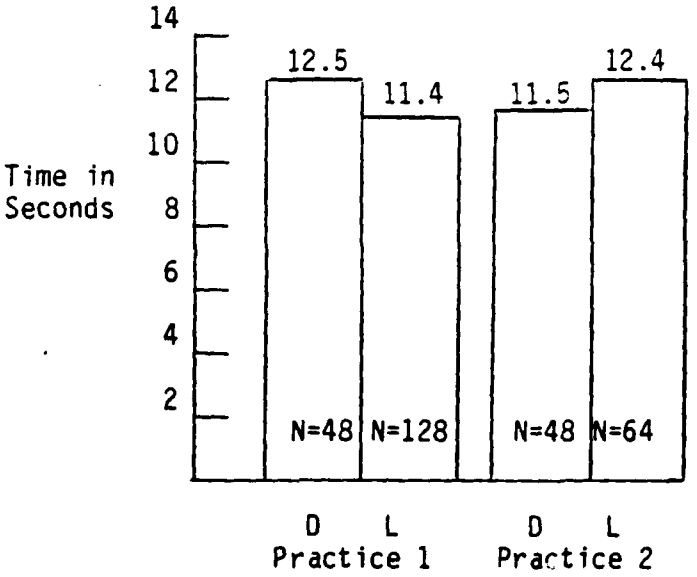



Figure 18

Evaluation 2: Average Target Handoff Time by Crew Position for Practice 1 and Practice 2.

Targets located at 1,000 yards (simulated) from M1 with 750 yards (simulated) between targets.
N = number of trials.
D = drivers, L = loaders.

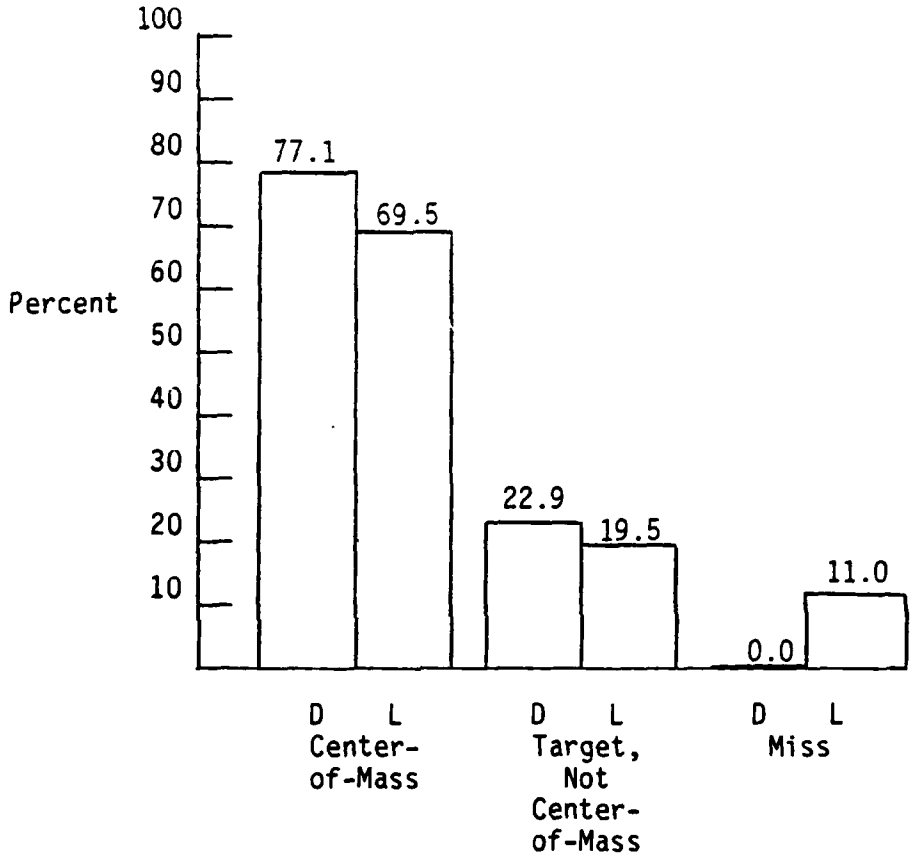



Figure 19

Evaluation 2: Accuracy, in Percent, of Laying Main Gun on Target During Handoff Exercise Practice 1.

Based on 48 trials across drivers (D) and 128 trials across loaders (L).

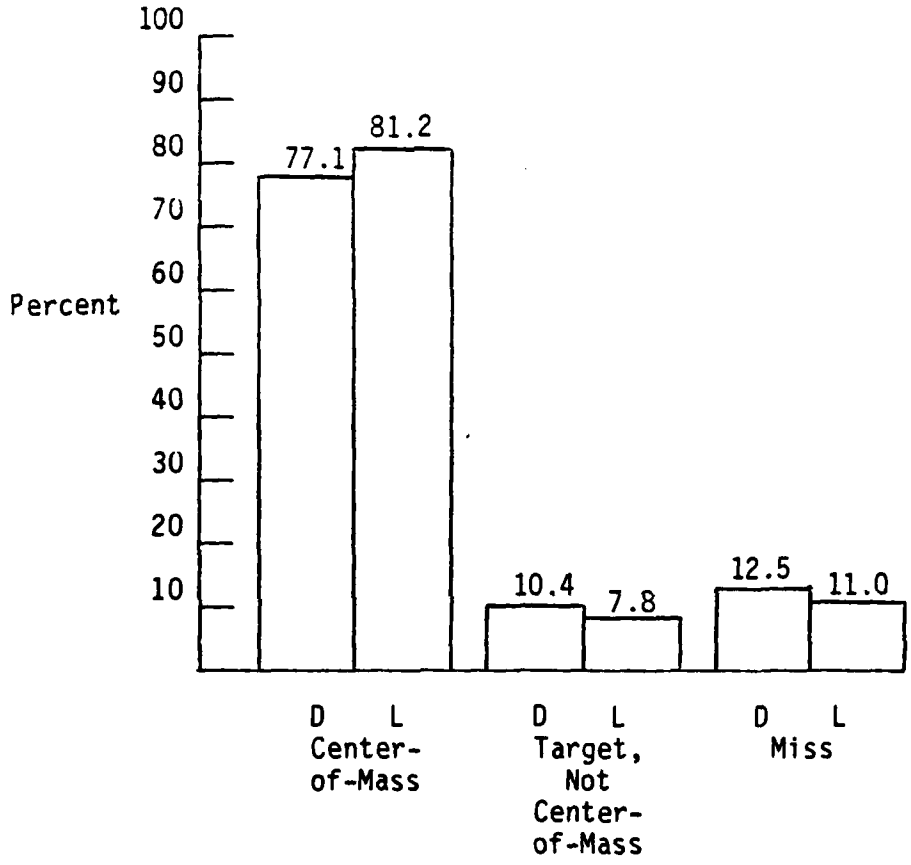



Figure 20

Evaluation 2: Accuracy, in Percent, of Laying Main Gun on Target During Handoff Exercise Practice 2.

Based on 48 trials across drivers (D) and 64 trials across loaders (L).

- Standardization of timekeeping cannot be assessed. It is believed that a great deal of variation in timekeeping activity existed between crews.

- Standardization of TC scoring cannot be assessed. Scoring may have varied among TCs due to the fact that it is somewhat subjective in nature. Thus, consistency may not have been maintained.

Again, the intent of evaluating this exercise was not to obtain detailed performance data. Rather, exercise utility and user acceptance were the primary issues of concern.

The target handoff exercise evaluation summarized in Table D-10 shows that crewmembers generally found the exercise interesting and easy to do. Furtner, most crewmembers indicated they received little handoff practice and they felt this exercise is useful for practice.

Target Tracking and Leading Exercise. As with the Target Handoff Exercise, an effort was made to have drivers and loaders participate in the Target Tracking and Leading Exercise on two occasions -- Practice 1 and Practice 2. A total of three drivers and eight loaders participated as the "gunner" during Practice 1. Of these crewmembers, four of the loaders and all three drivers participated during Practice 2. Each participant was scored fifteen times when tracking the target at 1,000 yards (simulated) and 2,000 yards (simulated) for Practice 1 and Practice 2. In addition, participants were scored the same number of times when leading the moving target at simulated ranges of 1,000 yards and 2,000 yards during Practices 1 and 2.

The results of the Target Tracking and Leading Exercise are presented in Figures 21 and 22. Target tracking accuracy (Figure 21) varied little between drivers and loaders during both Practice 1 and Practice 2. It is interesting to note, however, that tracking the moving target at 2,000 yards appeared to be somewhat more difficult, especially during Practice 1, and resulted in decreased performance for both drivers and loaders.

Figure 22 illustrates that target leading performance varied considerably between drivers and loaders at the 1,000 yard simulated range. This statement is particularly true when reviewing the Practice 1 data. However, at the 2,000 yard range, driver/loader performance differences were found to be greatly reduced. As with the target handoff data, no statistical tests were performed using the target tracking and leading scores. The reasons previously given for not performing statistical tests for the Handoff Exercise apply to this exercise as well.

Table D-11 presents the results of the Target Tracking and Leading Exercise. Subject reaction toward this exercise was very similar to that shown for the Target Handoff Exercise. Again, most crewmembers indicated that the exercise was fairly interesting, fairly realistic, and fairly useful for practice.

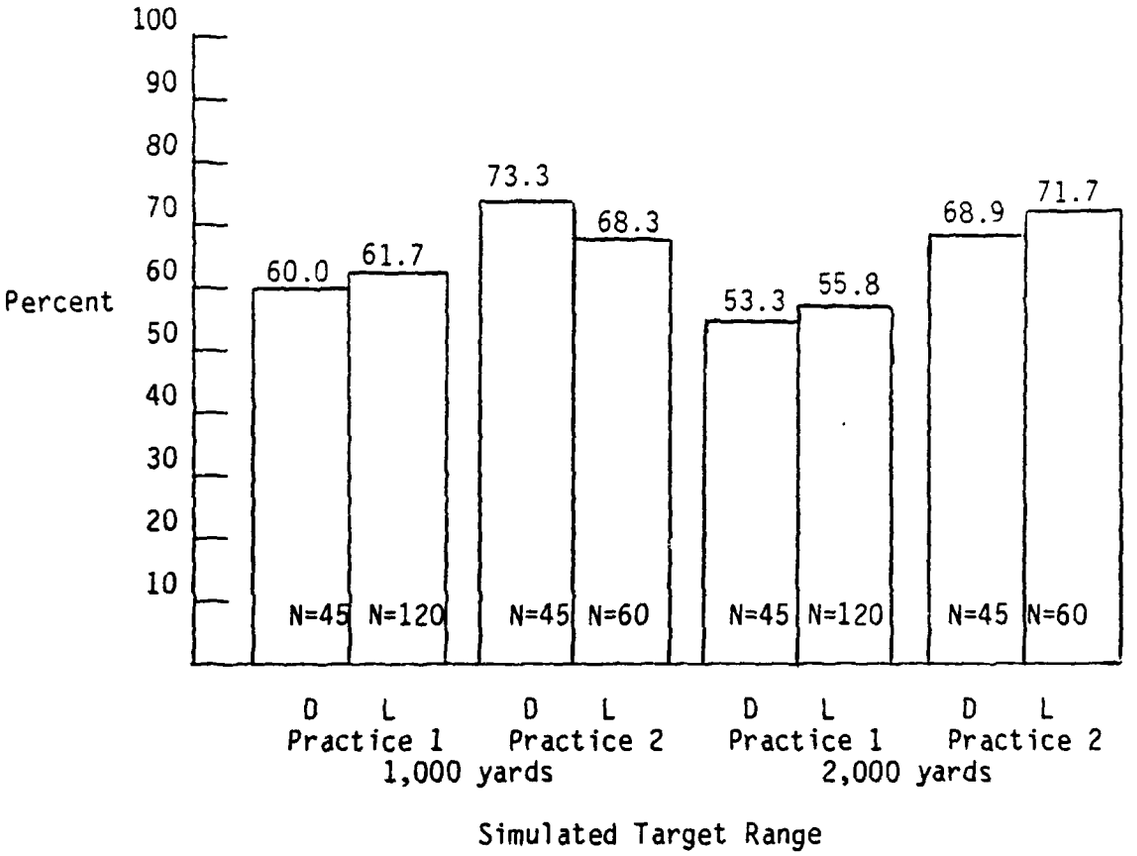



Figure 21

Evaluation 2: Percent of Trials Scored as "Hit" When Tracking a Moving Target.

D = drivers, L = loaders, N = number of trials.

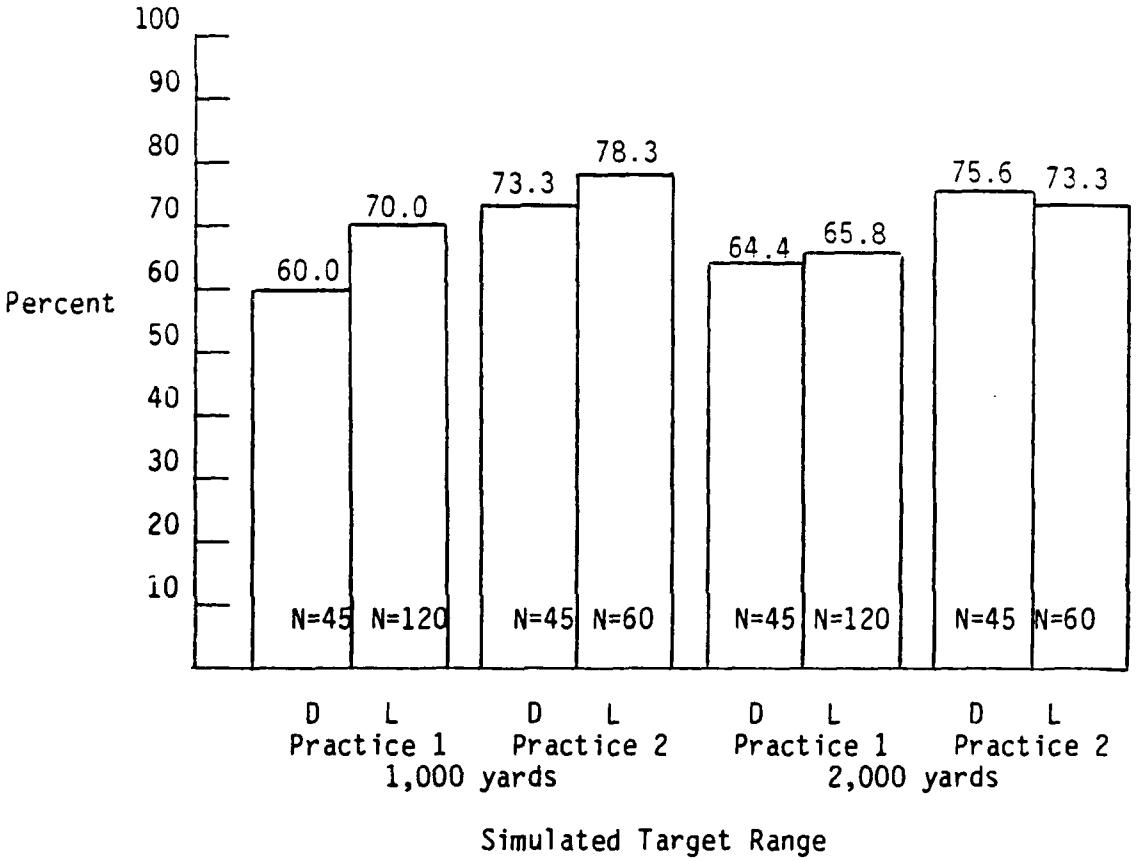



Figure 22

Evaluation 2: Percent of Trials Scored as "Hit" When Leading a Moving Target.

D = drivers, L = loaders, N = number of trials.

## SECTION V

## CONCLUSIONS

Based upon data collected and analyzed during the field evaluations, and observations made by the researchers, the following conclusions were derived.

1. One of the major deterrents to learning encountered during Evaluation 2 was the lack of acceptance of the technical content by the tank commanders. Their attitude clearly influenced the perception of the evaluation and acceptance of the materials by their crews. Certainly, effective leaders do largely control the attitudes of the personnel they supervise. The disagreement over technical content is not surprising, given the nature of the emerging weapon system. This is further compounded by the fact that the M1 tactical doctrine has not been solidly established. As these issues are resolved and uniformity is imposed on the armor community, these obstacles will be removed. At that time, the crews using these training materials will exhibit even larger learning gains. That is, tank commanders will endorse the technical content and confer a positive attitude on the training materials. Consequently, their crews will be positively influenced to use them and accept the technical data.

2. The scenario booklets developed and employed were found to be useful media for the type tasks trained in the present research. Most crewmembers found the concept of the scenarios to be extremely effective.

3. The sizing of the exercises, in terms of amount of material to be learned, appeared somewhat inappropriate for the academic level of the targeted population of learners. This conclusion is especially true in regard to the fire command booklets. Issuing fire commands, including the identification of the type of command to issue, is a complex task. Many variations exist and must be considered when engaging threat targets. It was observed that many crewmembers, especially drivers, loaders, and some gunners, found this information somewhat overwhelming.

4. The language used in the training material appeared to be appropriate for the target population. Further, uninformed readers reviewed the materials to assess readability and found that the materials were very acceptable in this regard.

5. The conditions under which the field evaluations took place may have detracted from subject interest, thus degrading study results. The conditions were less than optimal. For example, areas designated for use during the evaluation were harsh and uncomfortable, and thus did not provide a supportive learning environment.

6. Scenarios, such as those evaluated during this research, may not be totally appropriate for "in-the-cracks" training. "In-the-cracks" training refers to training during periods of availability under varying conditions, ranging from "in the field" to "in the barracks". The conditions of the present evaluation were somewhat similar to conditions which may be expected to exist during "in-the-cracks" training. However, as stated above, it is these conditions that may have detracted from the users' acceptance of the training materials evaluated.

7. The field exercises were successful in part because they were novel experiences for the crewmembers being cross trained. These crewmembers, the driver and loader, exhibited a great deal of enthusiasm regarding participation. It is well known that a positive attitude towards a task contributes to its learning. In addition, the field exercises were generally well accepted by all crewmembers as the exercises gave them an opportunity to practice skills that they do not use unless they are on a gunnery range.

8. The knowledge/scenario booklets support both cross training and train up requirements. The pre- and post-test data gathered during Evaluation 2 clearly show a learning gain across crewmembers. This conclusion, supported by the quantitative data, contradicts the tank commanders' subjective opinion that the training materials were useful only for cross training purposes.

9. In Evaluation 1, the fire command material pre- and post-tests showed a learning decrement. That finding suggested that the trainees could not learn from the scenarios alone (and were possibly confused, thus the decrement). As a result, knowledge booklets supporting the scenarios were designed and developed. The inclusion of the knowledge booklets was a major difference between the two evaluations. It is therefore concluded that they were largely responsible for the positive learning gains evidenced by all crewmembers in Evaluation 2.

# SECTION VI

# RECOMMENDATIONS

This section presents recommendations related to use of training materials developed and future possibilities for armor unit training. The recommendations are based on study results and conclusions, and Allen Corporation's observations and understanding of the problem. Recommendations are grouped as follows:

- Fire Command Booklets
- Degraded Mode Gunnery Booklets
- Multiple Return Booklet
- Fire Command, Degraded Mode Gunnery, and Multiple Return Booklets
- Field Exercises
- Procedure Guides
- General Recommendations

## FIRE COMMAND BOOKLETS

Conclusions related to the use of the fire command booklets indicate that the users in many instances did not accept the technical content. In addition, the sizing of the booklets may have been inappropriate due to the large amount and complex nature of the material. Finally, it was concluded that the knowledge booklet contributed to learning gains. Recommendations in regard to the fire command booklets are as follows:

- During the evaluations, instruction took place in an intensified training period. This was observed to have an intimidating effect on the soldiers. In actual application, instructional units should be distributed over longer periods of time. This will serve to diminish the psychological consequence of the students' feeling overwhelmed.
- Include in the fire command booklets many more opportunities for practice. One method which can be employed to provide the user with more practice activities is the inclusion of many more multiple choice test items in the knowledge booklets. Further, the brief segments of written instruction, followed by multiple choice test items, can be followed by one or two relatively simple scenarios related to that segment of instruction. This method will not only afford the user more practice, but will also familiarize the user with scenarios, similar to those that will be presented in the remaining fire command booklets.

DEGRADED MODE GUNNERY BOOKLETS

Major conclusions related to the degraded mode gunnery booklets include: the knowledge booklet contributed to learning gains, and the technical content of the material presented in the booklets requires investigation to determine accuracy. Recommendations related to the degraded mode gunnery booklets are as follows:

- Modify the knowledge booklet to include many more practice test items. These test items will assist the user in assessing his mastery of the instruction presented.

- Include one or two simple scenarios, similar in format to those presented in the scenario booklets, for each system. These scenarios should follow the description of each system within the knowledge booklet.

MULTIPLE RETURN BOOKLET

As with the fire command and degraded mode gunnery booklets, the primary conclusion related to the multiple return booklet is that the issue of content accuracy requires resolution in order to ensure user acceptance of the material. Only one recommendation appears warranted specifically in regard to the multiple return booklet.

- Multiple return booklet instruction and scenarios should be integrated with the degraded mode gunnery knowledge and scenario booklets. The material presented in the multiple return booklet could be included under the system section entitled "Laser Rangefinder".

FIRE COMMAND, DEGRADED MODE GUNNERY, AND MULTIPLE RETURN BOOKLETS

It was concluded from the results of this research that the knowlege and scenario booklets support both cross training and train up requirements. Further, the scenarios were found to be useful media for the type of tasks trained. The following recommendations are related to all knowlege and scenario booklets.

- Reduce the knowledge and scenario booklets down to pocket size. Many of the participants indicated this reduction would be desirable.

- Produce scenarios using professional artist renditions for the illustrations. Scenario illustrations would be much more realistic if they possessed accurate range cues and target shapes. Advice and guidance from an expert in armor tactics should also be elicited when structuring the situational elements to increase realism.

- Investigate the feasibility of knowledge/scenario booklet conversion to CAI program formats. Such a program would permit enhancement of remediation. A further benefit is that instruction would become more personalized. That is, incorrect responses to a question would be immediately identified and explanations would be provided. The user would then have the option of receiving remedial instruction. Should the user choose remediation, the program would automatically present that information supporting the particualr problem at hand. Additionally, a CAI program

format would eliminate the requirement for reading booklets. Users may find the use of a terminal much more interesting, thus increasing motivation.

FIELD EXERCISES

The field exercises were extremely successful in that the participants found the exercises both interesting and easy to do. Based on these conclusions, only one recommendation is given.

- Reduce the exercise material to a size that will fit into the soldiers' pocket or will lend itself to easy storage within the tank. These exercises appear very useful for "in-the-cracks" training. Thus, reducing the size of the materials could very well increase the probability of their use in the field.

PROCEDURE GUIDES

Although the procedure guides were not evaluated by Allen Corporation, it is assumed that these materials are very useful due to their similarity to Job Performance Aids (JPAs). Research literature indicates that JPAs have a significant positive impact on user performance. Based upon the above assumption, the following is recommended.

- Expand the procedure guides to include other operational and maintenance tasks.

GENERAL RECOMMENDATIONS

The following is a list of general recommendations related to the sustainment training materials developed during this research, use of these training materials, and considerations for future training research and evaluations in armor unit training.

- Conduct a study to identify other skill/task areas where this low-cost media (scenarios and field exercises) could be useful for training.

- Ensure that SMEs provide technically accurate information prior to evaluating future training materials. Thus, if information presented is at variance with the users' expectations, the user could be informed that the information is new, accurate, and not subject to question.

- Ensure the presence of adequate management control prior to conducting field evaluations of training material. One major problem encountered in the present research was that the sample of participants constantly changed because there was no pressure to perform or cooperate in an appropriate fashion.

- Conduct future field evaluations under conditions more conducive to learning. That is, equipment and facility requirements should be clearly specified in advance to assure that these requirements are met. This does not imply that facilities be elaborate; rather, they should merely be appropriate for the type of activities to be performed and should remain consistent from one training period to the next.

- Select one type of alternative media (refer to the candidate media types presented in Figure 2) and perform a comparison study with the scenario booklets as the second media type. For example, content from one of the fire command scenario booklets could be presented using a timed slide presentation. Performance measurements obtained using this media type could be compared to measurements of performance resulting from using the scenarios. This type of study would focus on assessing user performance rather than on the assessment of training effectiveness. Finally, a cost-benefit analysis could be conducted to determine if the increase in media cost is warranted.

During the course of this research, Allen Corporation developed a computer game-type target tracking and leading program. Although not a contract requirement, this program was developed to assess its potential utility as a training aid. It is recommended that research on this computer game program be conducted to definitively assess its value as a learning tool. The program is being submitted to ARI as part of the contract final deliverable.

## APPENDICES

A. CREW PROCEDURES

B. KNOWLEDGE AND SCENARIO BOOKLETS

C. FIELD EXERCISES

D. ADDITIONAL EVALUATION RESULTS

# APPENDIX A

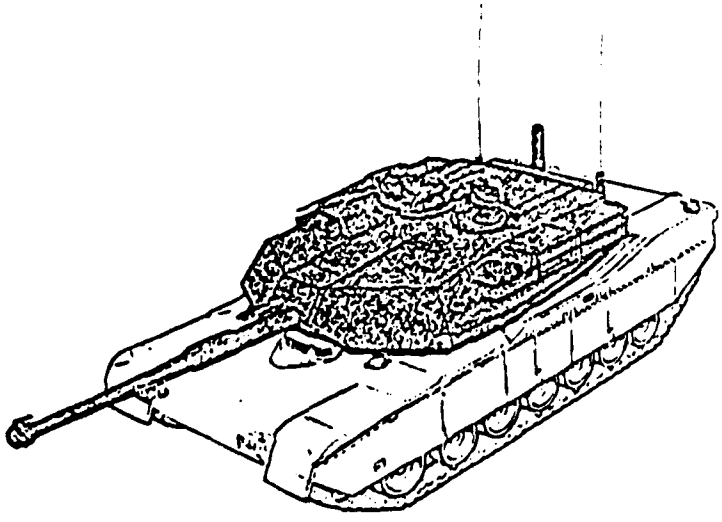
## CREW PROCEDURE GUIDES

This Appendix contains the cover page and table of contents from each of the four procedure guides. In addition, the procedures for one tank commander task is presented.

# TANK COMMANDER

PROCEDURE GUIDES

M1 TANK



JULY 1981

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## GENERAL INFORMATION

This booklet contains M1 tank commander procedure guides. Each guide is for a single pre-operation, post-operation, or during operation activity. Each guide is matched to TM-9-2350-255-10 (Operator's Manual for Tank, Combat, Full-Tracked, 105 MM, M1).

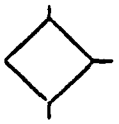
## PURPOSE OF PROCEDURE GUIDES

The guides in this booklet will not take the place of the M1 TM or M1 training materials. The guides will aid you in remembering long or difficult sets of procedures. In short, the guides will help to "jog your memory."

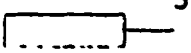
## USE OF THIS BOOKLET

The Table of Contents (on the next page) lists the procedure guides in this booklet. Each guide gives you a step-by-step outline for completing an activity. The following will help you to better use each guide.

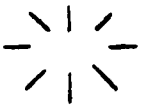
1. Some steps within a procedure guide are followed by a page number. On that page you will find a detailed breakdown of the step.



2. Some of the procedure guides include a question(s). Each question is stated inside a diamond shape. Your "yes" or "no" to the question will show you which path to follow.



3. Some steps within a procedure guide are followed by a box. In the box you will find more information on the step or a caution/warning.



4. Certain steps within a procedure guide require that a knob or switch be turned to a certain position. In some cases, that position might be written like the symbol to the left. The symbol means that a light should also come on.

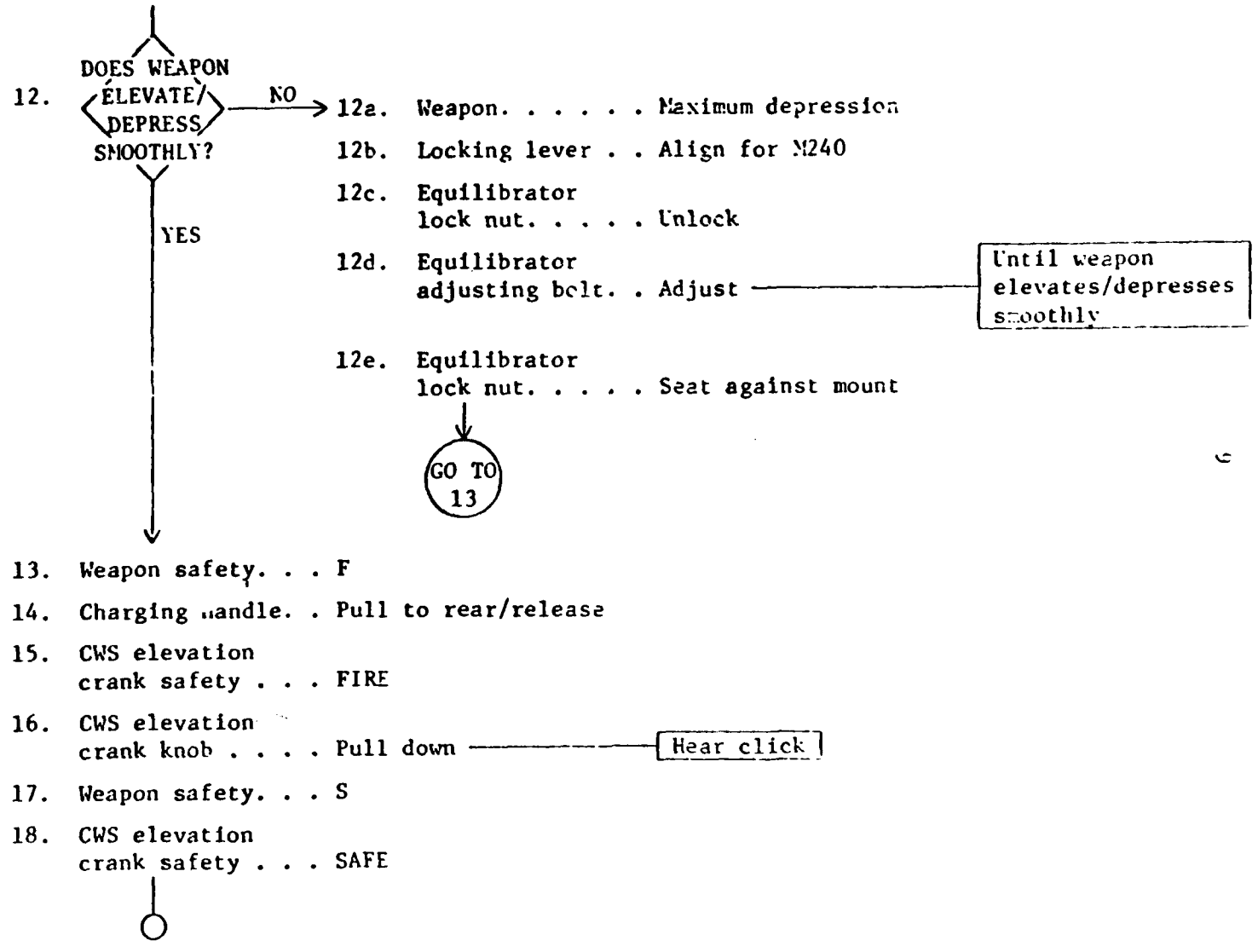
5. Master check-off lists of all before, during, and after operations PMCS performed by crewmembers are included as an aid in your supervision of these activities.

6. Pictures of selected panels/equipment can be found at the end of this booklet.

TABLE OF CONTENTS

# INSTALL WEAPON - M240

1. Weapon . . . . . Clear (page 26)
2. CWS elevation crank safety . . . SAFE
3. M240 mounting pins . . . . . Remove
4. Weapon . . . . . Put in mount
5. Front/rear receiver holes . . Lined up with mount holes
6. M240 mounting pins . . . . . Install
7. Trigger cable bight. . . . . Remove from stowage
8. Trigger cable bight. . . . . Connect — Around weapon charger guide/ over trigger
9. Trigger cable wing nut . . . . . Loosen
10. Trigger cable. . . Tight around trigger — Do not depress trigger
11. Trigger cable wing nut . . . . . Tighten


12. DOES WEAPON ELEVATE/DEPRESS SMOOTHLY?
NO
YES
12a. Weapon. . . . . Maximum depression
12b. Locking lever . . Align for M240
12c. Equilibrator lock nut. . . . . Unlock
12d. Equilibrator adjusting bolt. . Adjust
Until weapon elevates/depresses smoothly
12e. Equilibrator lock nut. . . . . Seat against mount
GO TO 13
13. Weapon safety. . . F
14. Charging handle. . Pull to rear/release
15. CWS elevation crank safety . . . FIRE
16. CWS elevation crank knob . . . . Pull down
Hear click
17. Weapon safety. . . S
18. CWS elevation crank safety . . . SAFE

GUNNER

# PROCEDURE GUIDES

## M1 TANK

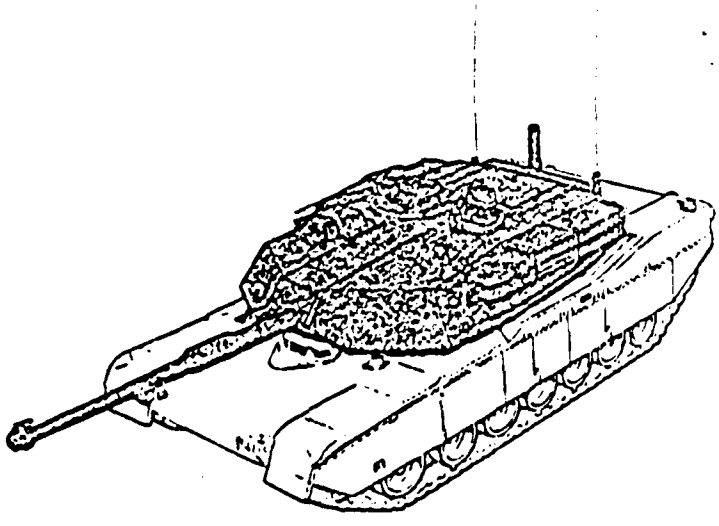


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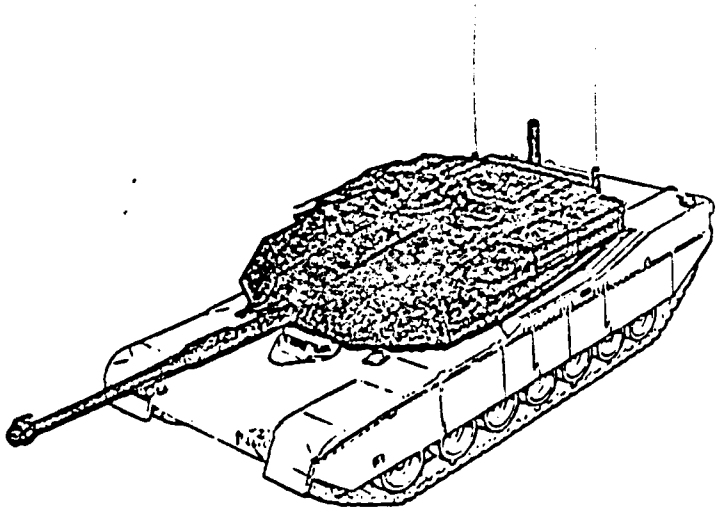
TABLE OF CONTENTS
(Cont'd)

# DRIVER

PROCEDURE GUIDES

M1 TANK



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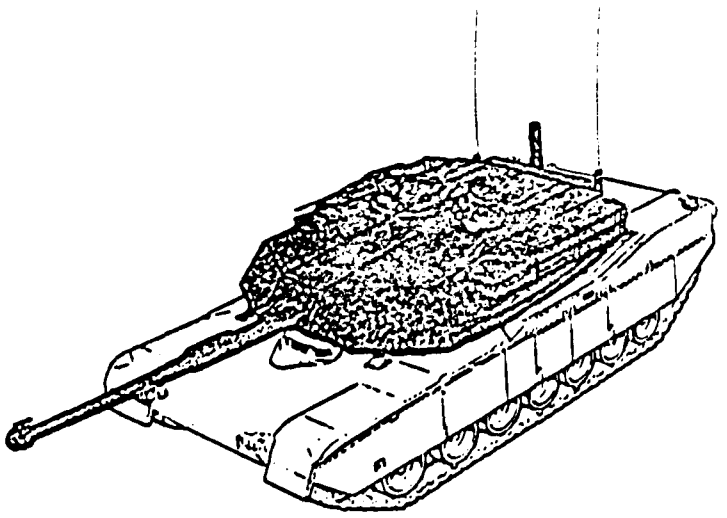
# LOADER

PROCEDURE GUIDES

M1 TANK



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# APPENDIX B

## KNOWLEDGE AND SCENARIO BOOKLETS

This Appendix contains a sample from the Fire Commands knowledge booklet (Booklet 1) and a sample from the Degraded Mode Gunnery booklet which presents non-immediate engagements (Booklet 2).

# FIRE COMMANDS FOR THE M1 TANK

## BOOKLET 1

## OVERVIEW OF FIRE COMMANDS

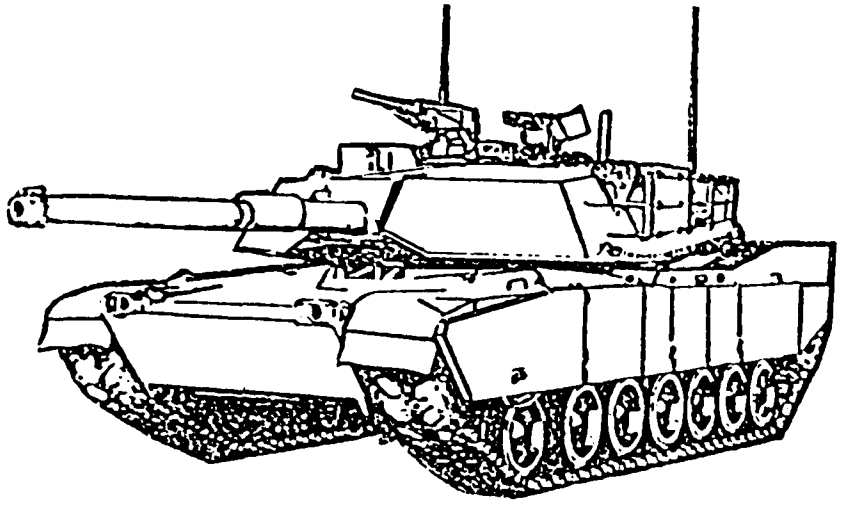

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TABLE OF CONTENTS

BOOKLET NUMBER 1

M1 TANK FIRE COMMANDS

USER'S GUIDE

This is booklet 1 in a set of 6 booklets. the set deals with issuing fire commands on the M1 tank. When you have finished the complete set, you will be able to:

| |
|---|
| ISSUE A CORRECT FIRE COMMAND FOR THE MAIN GUN OR ANY MACHINEGUN IN EITHER SINGLE, MULTIPLE, OR SIMULTANEOUS TARGET ENGAGEMENTS. |

B-4

BACKGROUND

In order to prepare a correct fire command, you must be aware of certain kinds of target and gunnery information. Also, you must know what statements you make, and your crew's responses, if a fire command is to be useful. With that information, you will be able to prepare and announce a fire command which results in target destruction.



THIS BOOKLET

This booklet will provide the general information required to prepare a fire command. It will also tell you how to announce a fire command, including your crew's responses, for the following kinds of engagements:

| |
|---|
| GPS/TIS PRECISION<br>GPS/TIS BATTLESIGHT<br>GAS PRECISION<br>GAS BATTLESIGHT |

HOW TO USE THIS BOOKLET

1. Read each section within the booklet carefully.
2. Pay special attention to the examples provided.
3. Many pages in the booklet have questions on them. Be sure you answer the questions and check your answers.
4. Refer to:

   • FM 17-12-1

   if you have any further questions.

## BEFORE YOU USE THIS SET OF BOOKLETS

Before using this set of booklets, you should have some existing knowledge related to fire commands:

1. Knowledge of Soviet Bloc weapon capabilities
2. Knowledge of M1 systems and nomenclature
3. Familiarity with FM 17-12-1

## A COMMENT ON THE BOOKLET SET

The fire commands discussed in this set of booklets are considered to be the most commonly used on the battlefield. There are other fire command variations which are not discussed. These other variations include:

1. Where the tank commander cannot quickly lay the main gun for direction and elevation.
2. Where estimated range is manually input into the M1 computer when firing GPS/TIS precision engagements.
3. Where weapon stoppages occur.



These variations, and others, are discussed in FM 17-12-1.

## TANK COMMANDER TRAINING NOTES

Training notes are presented at the back of this booklet.

SECTION ONE

PREPARING FOR FIRE COMMANDS

Before constructing fire commands, a tank commander requires specific information on targets and tank gunnery. The information is needed to construct each fire command. This section reviews that information. In this section you will find brief descriptions of:

- THE FIRE COMMAND
- CLASSES OF TARGETS
- AMMUNITION/WEAPON CHOICES
- PERSONNEL TO OPERATE WEAPONS
- SINGLE, MULTIPLE, AND SIMULTANEOUS ENGAGEMENTS
- INITIAL AND SUBSEQUENT FIRE COMMANDS
- ENGAGEMENT TECHNIQUES

B-6



PREPARING FOR FIRE COMMANDS

THE FIRE COMMAND

A fire command is used to provide information to the tank crew. You issue a fire command to tell the crew members:

- WHAT IS GOING TO HAPPEN
- WHO IS EXPECTED TO DO WHAT

Your crew's responses during and after the fire command help you to decide:

- IF THE PREPARATIONS FOR THE ENGAGEMENT ARE COMPLETE
- WHEN THE ENGAGEMENT SHOULD BE ENDED

With a well-stated and understood fire command, your crew's chances of success (survival) are high. With a poorly-stated fire command, your crew's chances of success (survival) are reduced.

The issuing of a fire command is not difficult. The difficult part is assessing the battle situation so that you can prepare the best fire command.

## QUESTIONS

1. A purpose of the fire command is to:

   A. Detect the most dangerous threat.
   B. Tell the crew what they are to do.
   C. Identify and kill the enemy.
   D. Describe the status of gunnery.

2. If the crew does not understand the fire command:

   A. They may not know which target to engage.
   B. They may not know who will engage the target.
   C. They may not survive the battle.
   D. All of the above.

3. The difficult part of a fire command is:

   A. Issuing the fire command.
   B. Preparing the fire command.
   C. Assuring its survival.
   D. All of the above.

4. Crew responses to a fire command help you decide:

   A. If the engagement should begin.
   B. If engagement preparations are complete.
   C. Who will do what in the engagement.
   D. Whether your tank will survive.



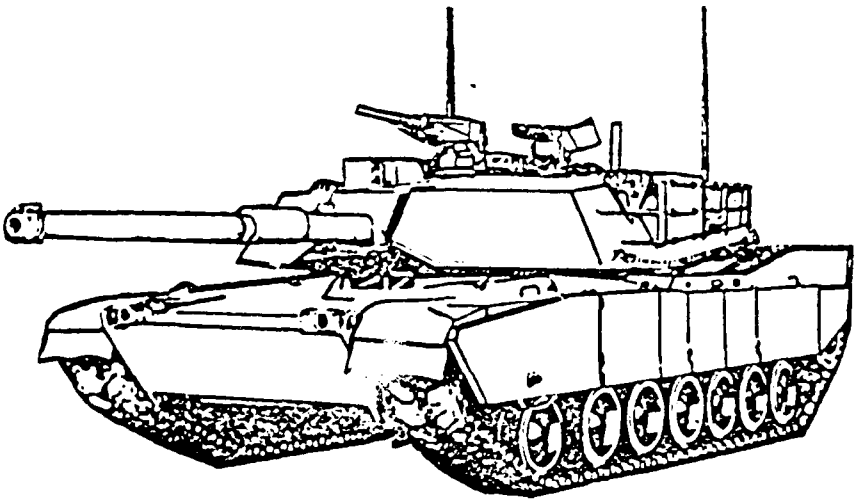


Answers: 1.B 2.D 3.B 4.B

# M1 TANK DEGRADED MODE GUNNERY

## BOOKLET 2

## NON-IMMEDIATE ENGAGEMENTS



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BOOKLET NUMBER 2

DEGRADED MODE GUNNERY - NON-IMMEDIATE ENGAGEMENTS
USER'S GUIDE

This is booklet number 2 in a set of 3 booklets. The set deals with degraded mode gunnery on the M1 tank. When you have finished the complete set, you will be able to:

| TAKE THE CORRECT ACTIONS IF A GUNNERY SYSTEM FAILS DURING A NON-IMMEDIATE OR IMMEDIATE ENGAGEMENT |
|---|

DEFINITION OF NON-IMMEDIATE AND IMMEDIATE ENGAGEMENTS

The terms non-immediate engagement and immediate engagement may be new to you. They will be used in all of the booklets. They are defined as follows:

| NON-IMMEDIATE ENGAGEMENT -<br>• The threat has not seen you or cannot kill you.<br>• Before you engage, you do have time to identify and correct for unknown gunnery system failures. |
|---|

| IMMEDIATE ENGAGEMENT -<br>• The threat has seen you or can kill you.<br>• Before you engage, you do not have time to identify and correct for unknown gunnery system failures. |
|---|

The actions you take in this set of booklets, and in battle, will depend on whether the engagement is non-immediate or immediate.

| BE SURE YOU CAN DEFINE EACH TYPE OF ENGAGEMENT! |
|---|

THIS BOOKLET

This booklet will give you practice in dealing with degraded mode gunnery during non-immediate engagements.

The booklet contains a number of battlefield scenarios. Each scenario contains:

| • A PICTURE OF THE BATTLEFIELD SITUATION.<br>• A SHORT WRITTEN DESCRIPTION OF THE BATTLEFIELD SITUATION AND THE STATUS OF YOUR TANK.<br>• A QUESTION FOR YOU TO ANSWER. |
|---|

FOR PURPOSES OF THESE SCENARIOS, YOU SHOULD ATTEMPT TO ENGAGE ALL TARGETS SEEN.

HOW TO USE THIS BOOKLET

1. Look at the scenario picture.
2. Read the short written description.
3. Read and answer the scenario question.

SOME QUESTIONS ARE FOLLOWED BY A LIST OF POSSIBLE ANSWERS. FOR THESE QUESTIONS, YOU SHOULD SELECT THE CORRECT ANSWER.

SOME QUESTIONS DO NOT HAVE A LIST OF POSSIBLE ANSWERS. FOR THESE QUESTIONS, YOU MUST PROVIDE YOUR OWN ANSWER.

4. Check your answer with the Answer Key on the page following the scenario.
5. Complete the rest of the scenarios.

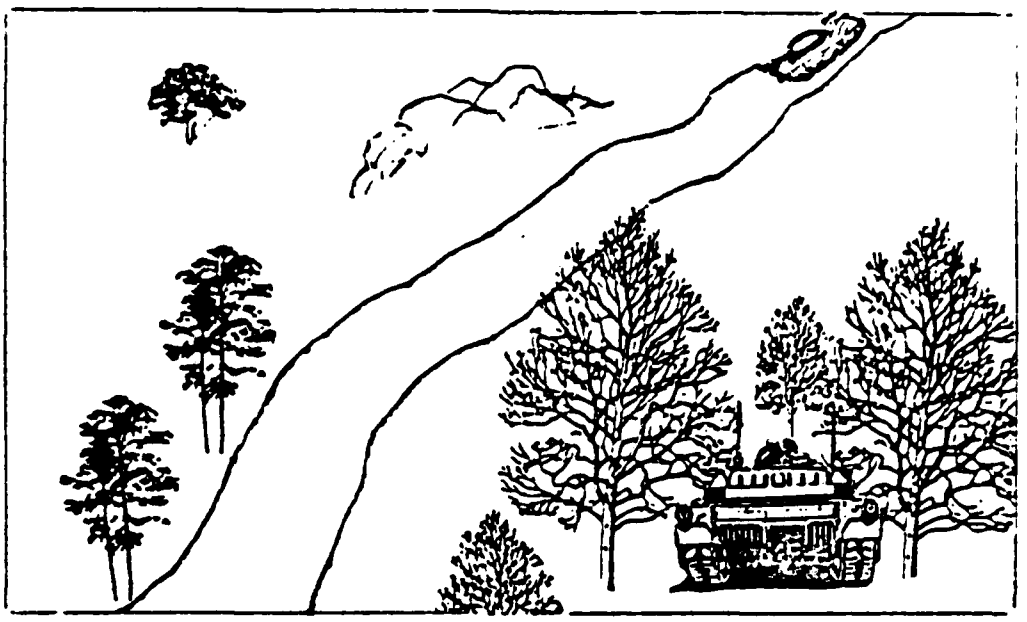
BEFORE YOU USE THIS BOOKLET

Before you use this booklet, be sure you have completed Booklet 1 of the set.

TANK COMMANDER TRAINING NOTES

Training notes are presented in Booklet 1.

SCENARIO 1



THE SITUATION

- M1 is in trees, undetected.
- Target is a T-72 at 1800 meters.
- F has just appeared in GPS.

What should you do now?

| A | B | C | D |
|---|---|---|---|
| Cancel CANT input key | Perform computer self test | Apply manual lead and engage target | Use GAS and apply BOT |

SCENARIO 1 ANSWER

You should have selected B: Perform computer self test

When the F appears in GPS during a non-immediate engagement always run a computer self test. The self test will tell you which system has failed.

WRONG ANSWERS

A. You do not know if the CANT sensor has failed.

C. You do not know if the lead angle sensor has failed.

D. Run a self test first. You may not have to use the GAS.

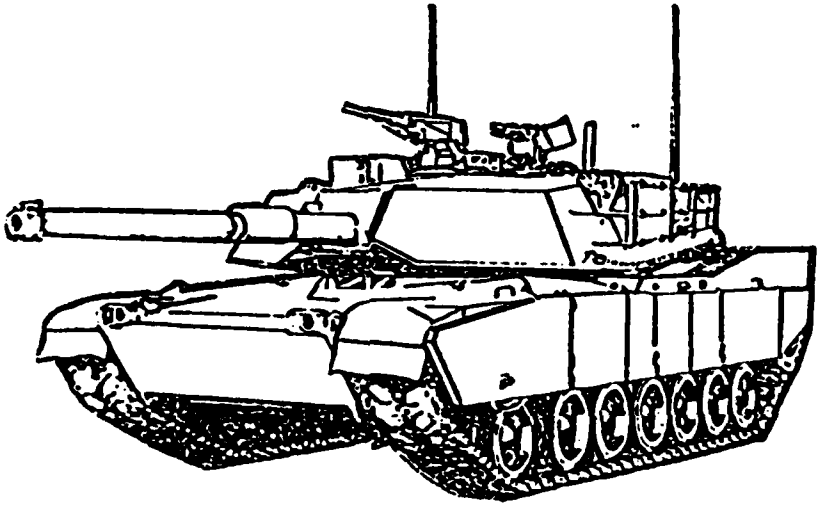
# APPENDIX C

## FIELD EXERCISES

This Appendix contains portions of both the Target Handoff Exercise and the Target Tracking and Leading Exercise.

# M1 TANK GUNNERY

# TARGET HANDOFF PRACTICE



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## TARGET HANDOFF PRACTICE

### INFORMATION FOR THE TANK COMMANDER

This exercise will help you and your crew practice target handoff. Good handoff skills are essential on the battlefield. If your crew masters these skills:

1) You will be able to turn over control of laying the gun to the gunner at the right time.
2) The gunner will see the target in the GPS when he takes over the controls, and
3) The gunner will be able to quickly and accurately place the reticle on the target.

This booklet contains directions for setting up the targets and instructions for conducting the handoff exercise when a maneuvering area is available for use. There will be times, however, when you may want to modify this exercise so that it can be used when an open area is not available. You may also wish to make practice more complex and challenging once your crew has mastered the tasks required for this exercise. Page 13 presents alternative methods which can be used for target handoff practice. Using



these alternative methods, and your skill and imagination, you can design handoff exercises which can be used almost anywhere at anytime.

#### SET UP

The set up directions on page 3, tell you how to make the targets for this exercise and where to place them. Have your crew follow these directions carefully.

#### EXERCISE INSTRUCTIONS

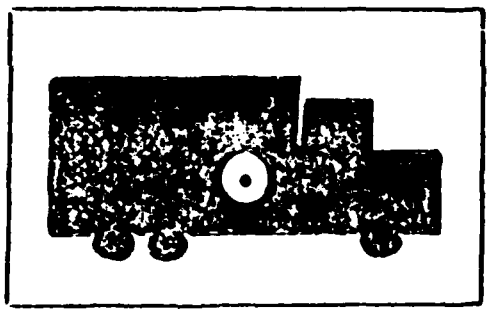
These instructions, on page 7, describe how this exercise is to be conducted and how to score performance. If you take your time and read carefully, you will find that this exercise is really easy to conduct.

SET UP

1) Prepare Targets

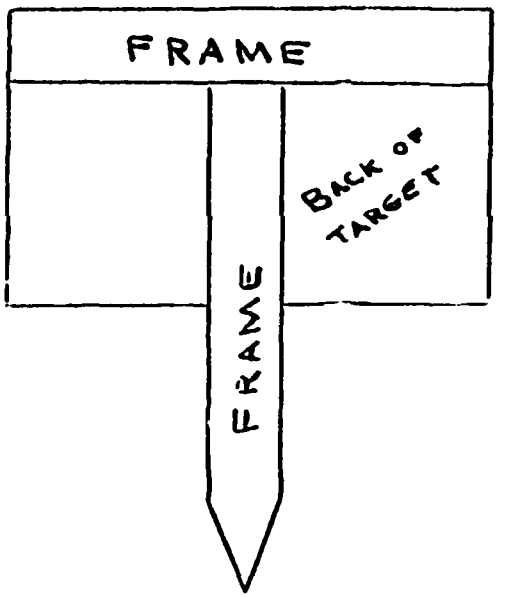
A. Use 5 white poster boards.
B. Draw a target on each poster board.
C. Targets should be about 2½ ft. long and 9 inches high.
D. Draw a bulls eye on target center-of-mass like the one below.

C-4





E. Number the targets 1-5 like in the picture.
F. Attach the poster boards on a frame like the one below.

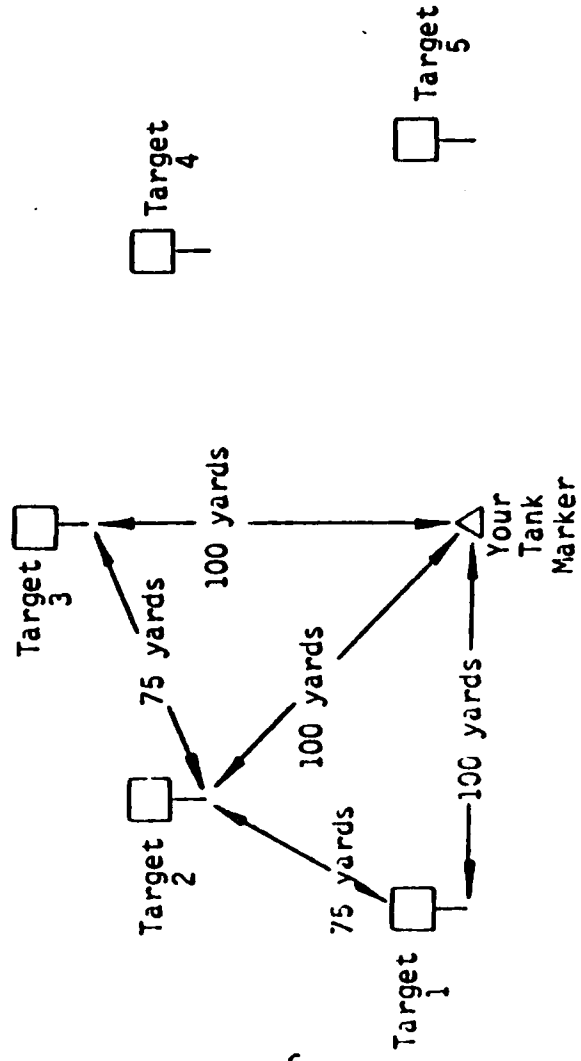


2) Place Targets

A. Put a marker where your tank will be.
B. Use a tape measure and go 100 yards from your tank marker.
C. Put a target at this new place.
D. Now use another tape measure and go 75 yards from the first target. Make sure you are still 100 yards from your tank marker.
E. Do the steps above until you have placed all 5 targets.
F. Drive your tank so that it is on top of the tank marker.
G. The practice area will look like the following picture.

C-5





## GENERAL INSTRUCTIONS

Target handoff is a shared task for the TC and gunner. In a battle situation, however, the TC and/or gunner may be transferred to another unit or may become disabled. For this reason, it is important that all crewmembers become familiar with the handoff task.

In this exercise the crew should rotate so that the gunner, loader, and driver all have the chance to do the gunner's part of the handoff task.

The M1 will remain stationary during this exercise. The driver will not be required to move the tank.

The entire crew is needed at all times to do this exercise. Because the crew will be rotating positions during this exercise, the crew's job will be described by position. For example, when the instructions say "GUNNER", it means the person in the gunner's place. The same applies when the directions describe the "LOADER's" job.





To do this exercise, the crew will need:

- 1 stopwatch
- 1 pen or pencil
- 3 copies of the score sheets

Step-by-step instructions for this exercise begin on the next page. Review these instructions with your crew to make sure everyone understands how the exercise will be conducted. The exercise score sheet is found on page Make copies of this score sheet so that each crewmember's performance can be recorded.

## STEP-BY-STEP INSTRUCTIONS

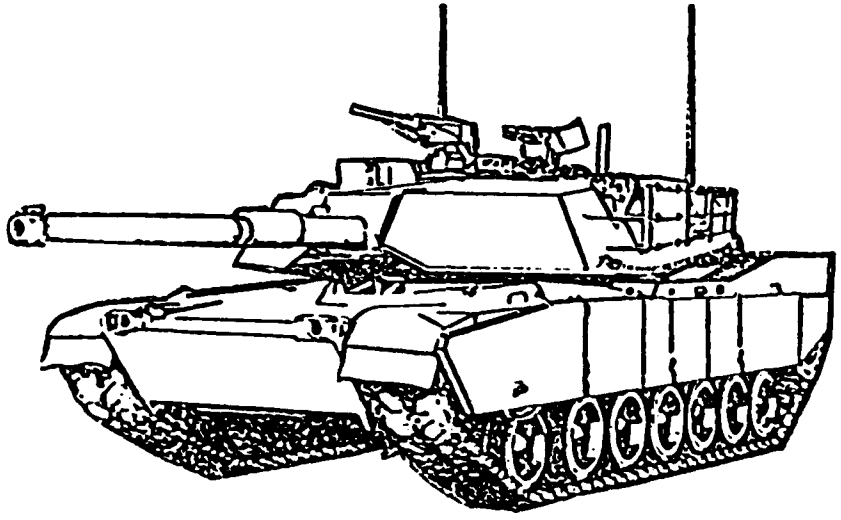
1) TC - in TC position
2) Crewmember in GUNNER's position.
3) Crewmember in LOADER's position.
4) Crewmember in DRIVER's position.
5) GUNNER - target 1 in GPS. Move gun around keeping target 1 in GPS.
6) GUNNER - GPS in 3X.
7) TC - check score sheet to see what the next target will be.
8) TC - announce "READY" when everyone is ready to begin the exercise.
9) LOADER - tap TC on knee and start stopwatch at same time.
10) TC - move gun to next target. At the same time, issue fire command for the target.
11) LOADER - announce "UP".
12) GUNNER - announce "IDENTIFIED" when target is seen in GPS.
13) TC - release TC's power control handle.
14) GUNNER - switch to 10X when target is identified.



15) GUNNER - place aiming point on target center-of-mass.
16) GUNNER - announce "ON THE WAY". At same time, release power control palm switches.
17) LOADER - stop stopwatch when GUNNER announces "ON THE WAY".
18) LOADER - report time to TC.
19) TC - use GPSE to see if aiming point is on center-of-mass.
20) TC - record time and accuracy on score sheet. Check off either CENTER-OF-MASS, or TARGET (on target but not center-of-mass), or MISS (not on target.)
21) GUNNER - GPS in 3X.
22) GUNNER - move gun around this target keeping target in GPS.
23) Go to STEP 7 and continue.
24) After the crewmember in the GUNNER position has completed all trials on his score sheet, rotate crewmembers.
25) Continue exercise until gunner, loader, and driver have all been in the GUNNER position.
26) TC - total the time and accuracy score sheets for each crewmember. This will let you see which crewmember did the best or if the crewmembers did better than the last handoff practice.

# M1 TANK GUNNERY

# TARGET TRACKING AND LEADING PRACTICE



(PRELIMINARY DRAFT - NOT FOR DISTRIBUTION)

Allen Corporation
of America

## TARGET TRACKING AND LEADING PRACTICE

### INFORMATION FOR THE TANK COMMANDER

This exercise will help your gunner practice tracking and leading a moving target. Good tracking and leading skills are essential on the battlefield. If your gunner masters these skills:

1) He will be able to accurately track roving targets keeping the reticle aiming point on center-of-mass.

2) He will be able to accurately track moving targets consistently, applying the correct manual lead when the lead angle sensor has failed.

This booklet contains directions for setting up the targets and instructions for conducting the tracking/leading exercise when a maneuvering area is available for use. There will be times, however, when you may want to modify this exercise so that it can be used when an open area is not available. You may also wish to make practice more complex and challenging once your gunner has mastered the tasks required for this exercise. Page 23 presents alternative



methods which can be used for tracking/leading practice. Using these alternative methods, and your skill and imagination, you can design tracking/leading exercises which can be used almost anywhere at anytime.

### SET UP

The set up directions on page 3 tell your crew how to make the target and how to set up the exercise area. Have your crew follow these directions carefully.

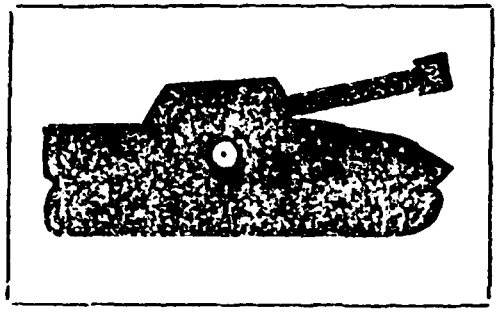
### EXERCISE INSTRUCTIONS

These instructions, on page 7 describe how the exercise is to be conducted and how to score performance. If you take your time and read carefully, you will find that this exercise is really easy to conduct.

SET UP

1) Prepare Target

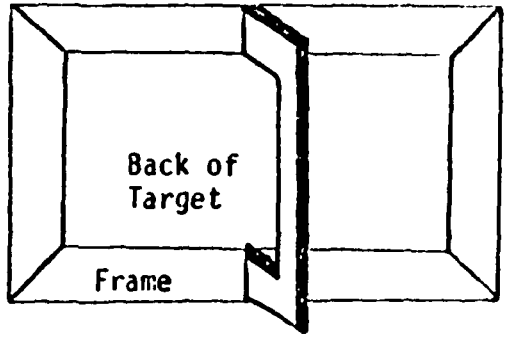
A. Use 1 white poster board.
B. Draw a target on the poster board.
C. Target should be about 2½ ft. long and 9 inches high.
D. Draw a bulls eye on target center-of-mass like the one below.







E. Attach the poster board to a frame.
F. Make a handle so the picture can be carried.
G. The frame and handle can look something like the one below.

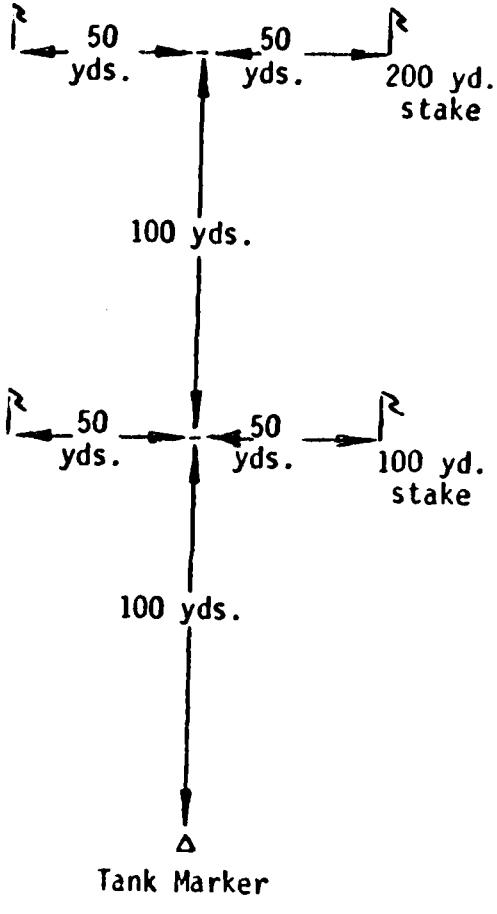


2) Place Markers

A. Make 5 stakes, each about 3 ft. long.
B. Tie a bright colored cloth at the top of each stake.
C. Put 1 stake in the ground to use as the tank marker.
D. Use a tape measure to measure 100 yds. from the tank stake. Mark this place.
E. Measure 50 yds. on both sides of the place just marked and put a stake in the ground at each 50 yd. measure.
F. Do steps D and E again. This time measure 200 yds. from the tank stake.
G. The following picture shows how the practice area should look.







## GENERAL INSTRUCTIONS

Target tracking/leading is an important task which the gunner must do by himself. In a battle situation, however, the gunner may be transferred to another unit or may become disabled. For this reason, it is important that all crewmembers become familiar with the tracking/leading task.

In this exercise the crew should rotate so that the gunner, loader, and driver all have the chance to do the gunner's task of tracking/leading.

The M1 will remain stationary during this exercise. The driver will not be required to move the tank.

The entire crew is needed at all times to do this exercise. Because the crew will be rotating positions during this exercise, the crew's job will be described by the positions below:

TC - the tank commander
GUNNER - the person in the gunner's station
LOADER - the person carrying the target
DRIVER - the person in the driver's station



To do this exercise, the crew will need:

- 1 pen or pencil.
- 3 copies of the score sheets.
- the poster board target.

TARGET RANGE. When the target is at 100 yds., as shown on page , it will look like a tank at 1,000 yds. When the target is at 200 yds., it will look like the real thing at 2,000 yds.

TARGET SPEED. When the LOADER carries the target, he must walk at 1 step/second or 2 steps/second. 1 step/second will make the target appear to be going about 20 mph. 2 steps/second will make the target appear to go about 40 mph. Have to LOADER practice walking at 1 step/second and 2 steps/second before starting the exercise. Each step should be about 1 yd. long. When the LOADER is carrying the target, he should try to avoid sudden movements which would make target movement appear unrealistic.

The tracking/leading exercise consists of 8 parts. These 8 parts, and the order in which they will be presented, are as follows:

| Part | GUNNER'S Task | Target Range | LOADER'S Walk |
|---|---|---|---|
| 1 | Track Target | 100 yds. | 1 step/ second |
| 2 | Lead Target | 100 yds. | 1 step/ second |
| 3 | Track Target | 100 yds. | 2 steps/ second |
| 4 | Lead Target | 100 yds. | 2 steps/ second |
| 5 | Track Target | 200 yds. | 1 step/ second |
| 6 | Lead Target | 200 yds. | 1 step/ second |
| 7 | Track Target | 200 yds. | 2 steps/ second |
| 8 | Lead Target | 200 yds. | 2 steps/ second |





Step-by-step instructions for this exercise begin on the next page. Review these instructions with your crew to make sure everyone understands how the exercise will be conducted. The exercise score sheets are found beginning on page 15. Make copies of the score sheets so that each crewmember's performance can be recorded.

STEP-BY-STEP INSTRUCTIONS

1) TC - in TC position and have score sheets ready.

2) Crewmember - in GUNNER's position.

3) Crewmember - in DRIVER's position.

4) Crewmember - in position to carry target. (LOADER)

5) LOADER - hold target at 100 yd. marker.

6) GUNNER - target in GPS.

7) TC - announce "READY" when crew is ready to begin exercise.

8) TC - signal LOADER to walk 1 step/second to the other 100 yd. marker. When LOADER gets to the other 100 yd. marker, he should walk back to the first marker.

9) GUNNER - track target keeping aiming point on center-of-mass.

10) TC - look in GPSE and watch GUNNER track.

11) TC - announce "FIRE" about every 5 secs.

12) GUNNER - continue tracking.

13) TC - record accuracy on score sheet each time you announce "FIRE". Check HIT if aiming point was on target or MISS if aiming point was off target.

14) TC - continue announcing "FIRE" about every 5 secs. and record accuracy until





score sheet is complete (15 trials).

15) TC - announce to GUNNER to apply manual lead. Announce type of ammo to use. Lead should be: 2½ mils for SABOT
5 mils for HEAT
7½ mils for HEP.

16) GUNNER - track target and apply the correct manual lead.

17) TC - continue to announce "FIRE" and record accuracy on score sheet. Check HIT if correct lead is applied, or MISS if the lead applied is not correct.

18) CREW - continue until this score sheet is complete.

19) TC - signal LOADER to walk at 2 steps/second.

20) GUNNER - continue tracking, this time keeping aiming point on target.

21) TC - continue as before until this score sheet is complete.

22) TC - announce to GUNNER to apply manual lead and announce type of ammo.

23) CREW - continue until this score sheet is complete.

24) TC - signal LOADER to go to 200 yd. marker and continue exercise as before until all score sheets are completed for this crewmember at the 200 yd. range.

25) Gunner, driver, and loader - change positions.

26) CREW - repeat the entire exercise until the gunner, loader, and driver have been in the GUNNER position and have completed all trials on their score sheets.

# APPENDIX D

## ADDITIONAL EVALUATION RESULTS

This Appendix contains the data obtained via the sustainment training material evaluation forms. Specifically, the data presented in this Appendix include:

Table D-1. Field Evaluation 1 - Evaluation of Fire Command Scenarios

Table D-2. Field Evaluation 1 - Evaluation of Degraded Mode Gunnery Scenarios

Table D-3. Field Evaluation 1 - Evaluation of Target Handoff Exercise

Table D-4. Field Evaluation 1 - Evaluation of Target Tracking and Leading Exercise

Table D-5. Field Evaluation 2 - Evaluation of Fire Command Booklets

Table D-6. Field Evaluation 2 - Tank Commander Evaluation of Fire Command Booklets

Table D-7. Field Evaluation 2 - Evaluation of Degraded Mode Gunnery Booklets

Table D-8. Field Evaluation 2 - Tank Commander Evaluation of Degraded Mode Gunnery Booklets

Table D-9. Field Evaluation 2 - Evaluation of Multiple Returns Booklet

Table D-10. Field Evaluation 2 - Evaluation of Target Handoff Exercise

Table D-11. Field Evaluation 2 - Evaluation of Target Tracking and Leading Exercise

Table D-1. Field Evaluation 1 -
Evaluation of Fire Command Scenarios

| Question | Responses | | | |
|---|---|---|---|---|
| | Driver | Loader | TC | Total |
| 1. The instructions were ___ to read. | | | | |
| ___very easy | 1 | 1 | 2 | 4 |
| ___easy | 3 | 2 | 7 | 12 |
| ___a little hard | 1 | 1 | | 2 |
| ___very hard | 0 | 0 | 0 | 0 |
| 2. The instructions were ___ to understand. | | | | |
| ___very easy | 0 | 0 | 2 | 2 |
| ___easy | 3 | 2 | 7 | 12 |
| ___a little hard | 2 | 2 | 0 | 4 |
| ___very hard | 0 | 0 | 0 | 0 |
| 3. The instructions were ___. | | | | |
| ___very complete | 1 | 1 | 0 | 2 |
| ___mostly complete | 1 | 2 | 5 | 8 |
| ___complete, but could use more information | 3 | 1 | 4 | 8 |
| ___incomplete, needed much more information | 0 | 0 | 0 | 0 |
| 4. The SITUATION description was ___ to read. | | | | |
| ___very easy | 0 | 1 | 2 | 3 |
| ___easy | 3 | 2 | 7 | 12 |
| ___a little hard | 2 | 0 | 0 | 2 |
| ___very hard | 0 | 1 | 0 | 1 |

Table D-1. (cont'd.)

| Question | Responses: Driver | Loader | TC | Total |
|---|---|---|---|---|
| 5. The SITUATION description was ___ to understand. | | | | |
| ___very easy | 0 | 0 | 2 | 2 |
| ___easy | 2 | 4 | 6 | 12 |
| ___a little hard | 3 | 0 | 1 | 4 |
| ___very hard | 0 | 0 | 0 | 0 |
| 6. The SITUATION description had ___ information. | | | | |
| ___too much | 0 | 0 | 1 | 1 |
| ___the right amount of | 3 | 3 | 4 | 10 |
| ___not quite enough | 2 | 1 | 4 | 7 |
| ___not nearly enough | 0 | 0 | 0 | 0 |
| 7. The pictures were ___ in doing the scenarios. | | | | |
| ___very helpful | 3 | 3 | 6 | 12 |
| ___a little helpful | 1 | 0 | 3 | 4 |
| ___not very helpful | 1 | 0 | 0 | 1 |
| ___not helpful at all | 0 | 1 | 0 | 1 |
| 8. The pictures and SITUATION descriptions were ___. | | | | |
| ___very realistic | 1 | 1 | 1 | 3 |
| ___fairly realistic | 3 | 3 | 4 | 10 |
| ___not realistic, but useful | 1 | 0 | 4 | 5 |
| ___not realistic and not useful | 0 | 0 | 0 | 0 |
| 9. The answers were ___. | | | | |
| ___very accurate and complete | 1 | 1 | 0 | 2 |
| ___fairly accurate and complete | 2 | 2 | 6 | 10 |
| ___accurate, but not complete | 2 | 1 | 2 | 5 |
| ___not accurate or complete | 0 | 0 | 1 | 1 |

Table D-1. (cont'd )

| Question | Responses Driver | Loader | TC | Total |
|---|---|---|---|---|
| 10. The scenarios were ___ to do. | | | | |
| ___too hard | 0 | 0 | 0 | 0 |
| ___hard | 1 | 2 | 1 | 4 |
| ___easy | 4 | 2 | 8 | 14 |
| ___too easy | 0 | 0 | 0 | 0 |
| 11. The scenarios were ___ to do. | | | | |
| ___very interesting | 3 | 2 | 3 | 8 |
| ___fairly interesting | 2 | 2 | 6 | 10 |
| ___not very interesting | 0 | 0 | 0 | 0 |
| ___boring | 0 | 0 | 0 | 0 |
| 12. The scenarios are ___ for practice. | | | | |
| ___very useful | 4 | 3 | 7 | 14 |
| ___fairly useful | 1 | 1 | 2 | 4 |
| ___not very useful | 0 | 0 | 0 | 0 |
| ___useless | 0 | 0 | 0 | 0 |
| 13. By doing the scenarios, I learned ___. | | | | |
| ___a lot | 2 | 3 | 3 | 8 |
| ___some | 3 | 1 | 4 | 8 |
| ___not very much | 0 | 0 | 2 | 2 |
| ___nothing at all | 0 | 0 | 0 | 0 |
| 14. If many of these scenarios were available, I would ___. | | | | |
| ___use them a lot | 2 | 1 | 5 | 8 |
| ___use them sometimes | 3 | 3 | 4 | 10 |
| ___not use them much | 0 | 0 | 0 | 0 |
| ___not use them at all | 0 | 0 | 0 | 0 |

Table D-2 Field Evaluation 1 -
Evaluation of Degraded Mode Gunnery Scenarios

| Question | Responses | | | |
|---|---|---|---|---|
| | Driver | Loader | Gunner | Total |
| 1. The instructions were ___ to read. | | | | |
| ___very easy | 0 | 2 | 1 | 3 |
| ___easy | 3 | 1 | 5 | 9 |
| ___a little hard | 1 | 1 | 1 | 3 |
| ___very hard | 0 | 1 | 0 | 1 |
| 2. The instructions were ___ to understand. | | | | |
| ___very easy | 0 | 1 | 1 | 2 |
| ___easy | 3 | 2 | 4 | 9 |
| ___a little hard | 1 | 2 | 2 | 5 |
| ___very hard | 0 | 0 | 0 | 0 |
| 3. The instructions were ___. | | | | |
| ___very complete | 0 | 1 | 2 | 3 |
| ___mostly complete | 3 | 1 | 2 | 6 |
| ___complete, but could use more information | 1 | 3 | 3 | 7 |
| ___incomplete, needed much more information | 0 | 0 | 0 | 0 |
| 4. The SITUATION description was ___ to read. | | | | |
| ___very easy | 0 | 2 | 1 | 3 |
| ___easy | 4 | 2 | 4 | 10 |
| ___a little hard | 0 | 1 | 2 | 3 |
| ___very hard | 0 | 0 | 0 | 0 |

Table D-2. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | Total |
|---|---|---|---|---|
| 5. The SITUATION description was ___ to understand. | | | | |
| ___very easy | 0 | 1 | 0 | 1 |
| ___easy | 4 | 3 | 4 | 11 |
| ___a little hard | 0 | 0 | 2 | 2 |
| ___very hard | 0 | 1 | 1 | 2 |
| 6. The SITUATION description had ___ information. | | | | |
| ___too much | 0 | 0 | 1 | 1 |
| ___the right amount of | 3 | 3 | 3 | 9 |
| ___not quite enough | 1 | 2 | 3 | 6 |
| ___not nearly enough | 0 | 0 | 0 | 0 |
| 7. The pictures were ___ in doing the scenarios. | | | | |
| ___very helpful | 3 | 4 | 5 | 12 |
| ___a little helpful | 1 | 1 | 1 | 3 |
| ___not very helpful | 0 | 0 | 1 | 1 |
| ___not helpful at all | 0 | 0 | 0 | 0 |
| 8. The pictures and SITUATION descriptions were ___. | | | | |
| ___very realistic | 1 | 1 | 3 | 5 |
| ___fairly realistic | 3 | 3 | 2 | 8 |
| ___not realistic, but useful | 0 | 1 | 2 | 3 |
| ___not realistic and not useful | 0 | 0 | 0 | 0 |
| 9. The answers were ___. | | | | |
| ___very accurate and complete | 1 | 2 | 1 | 4 |
| ___fairly accurate and complete | 3 | 1 | 5 | 9 |
| ___accurate, but not complete | 0 | 1 | 1 | 2 |
| ___not accurate or complete | 0 | 1 | 0 | 1 |

Table D-2. (cont'd.)

| Question | Responses Driver | Loader | Gunner | Total |
|---|---|---|---|---|
| 10. The scenarios were ___ to do. | | | | |
| ___too hard | 0 | 0 | 0 | 0 |
| ___hard | 1 | 3 | 3 | 7 |
| ___easy | 3 | 2 | 4 | 9 |
| ___too easy | 0 | 0 | 0 | 0 |
| 11. The scenarios were ___ to do. | | | | |
| ___very interesting | 2 | 0 | 2 | 4 |
| ___fairly interesting | 2 | 3 | 3 | 8 |
| ___not very interesting | 0 | 2 | 0 | 2 |
| ___boring | 0 | 0 | 1 | 1 |
| | | (1 abstention) | | |
| 12. The scenarios are ___ for practice. | | | | |
| ___very useful | 3 | 3 | 3 | 9 |
| ___fairly useful | 1 | 2 | 4 | 7 |
| ___not very useful | 0 | 0 | 0 | 0 |
| ___useless | 0 | 0 | 0 | 0 |
| 13. By doing the scenarios, I learned ___. | | | | |
| ___a lot | 2 | 0 | 2 | 4 |
| ___some | 2 | 4 | 4 | 10 |
| ___not very much | 0 | 0 | 1 | 1 |
| ___nothing at all | 0 | 1 | 0 | 1 |
| 14. If many of these scenarios were available, I would ___. | | | | |
| ___use them a lot | 2 | 1 | 4 | 7 |
| ___use them sometimes | 2 | 4 | 2 | 8 |
| ___not use them much | 0 | 0 | 1 | 1 |
| ___not use them at all | 0 | 0 | 0 | 0 |

Table D-3. Field Evaluation 1 -
Evaluation of Target Handoff Exercise

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 1. The instructions were ___ to read. | | | | | |
| ___very easy | 0 | 5 | 1 | 1 | 7 |
| ___easy | 6 | 1 | 4 | 5 | 16 |
| ___a little hard | 0 | 0 | 0 | 0 | 0 |
| ___very hard | 0 | 0 | 0 | 0 | 0 |
| 2. The instructions were ___ to understand. | | | | | |
| ___very easy | 2 | 4 | 1 | 1 | 8 |
| ___easy | 4 | 2 | 4 | 5 | 15 |
| ___a little hard | 0 | 0 | 0 | 0 | 0 |
| ___very hard | 0 | 0 | 0 | 0 | 0 |
| 3. The instructions were ___. | | | | | |
| ___very complete | 2 | 4 | 1 | 1 | 8 |
| ___mostly complete | 3 | 1 | 4 | 4 | 12 |
| ___complete, but could use more information | 1 | 1 | 0 | 1 | 3 |
| ___incomplete, needed much more information | 0 | 0 | 0 | 0 | 0 |
| 4. The target handoff exercise was ___. | | | | | |
| ___very realistic | 1 | 1 | 2 | 2 | 6 |
| ___fairly realistic | 5 | 5 | 2 | 4 | 16 |
| ___not realistic, but useful | 0 | 0 | 1 | 0 | 1 |
| ___not realistic and not useful | 0 | 0 | 0 | 0 | 0 |

Table D-3. (cont'd.)

| Question | Responses Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 5. The dark targets make the GPS reticle ___ to see. | | | | | |
| ___too easy | 0 | 0 | 1 | 1 | 2 |
| ___easy | 6 | 6 | 4 | 5 | 21 |
| ___a little hard | 0 | 0 | 0 | 0 | 0 |
| ___too hard | 0 | 0 | 0 | 0 | 0 |
| 6. The exercise was ___ to do. | | | | | |
| ___too hard | 0 | 0 | 0 | 0 | 0 |
| ___hard | 0 | 0 | 0 | 0 | 0 |
| ___easy | 6 | 6 | 4 | 6 | 22 |
| ___too easy | 0 | 0 | 1 | 0 | 1 |
| 7. The handoff exercise was ___. | | | | | |
| ___very interesting | 2 | 2 | 3 | 2 | 9 |
| ___fairly interesting | 4 | 4 | 2 | 4 | 14 |
| ___not very interesting | 0 | 0 | 0 | 0 | 0 |
| ___boring | 0 | 0 | 0 | 0 | 0 |
| 8. The excercise is ___ for practice. | | | | | |
| ___very useful | 4 | 5 | 4 | 3 | 16 |
| ___fairly useful | 2 | 1 | 1 | 3 | 7 |
| ___not very useful | 0 | 0 | 0 | 0 | 0 |
| ___useless | 0 | 0 | 0 | 0 | 0 |
| 9. By doing the exercise, I learned ___. | | | | | |
| ___a lot | 1 | 3 | 1 | 2 | 7 |
| ___some | 5 | 3 | 3 | 3 | 14 |
| ___not very much | 0 | 0 | 0 | 1 | 1 |
| ___nothing at all | 0 | 0 | 1 | 0 | 1 |

Table D-3. (cont'd.)

| Question | Responses Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 10. By doing exercises like this one, my handoff skills would ___. | | | | | |
| ___improve a lot | 2 | 4 | 2 | 4 | 12 |
| ___improve a little | 3 | 2 | 3 | 2 | 10 |
| ___not improve | 0 | 0 | 0 | 0 | 0 |
| ___get worse | 0 | 0 | 0 | 0 | 0 |

11. The thing I liked most about this exercise was:

Driver: Laying on the targets. Learning about the gunner position, and how and what I do.

Loader: Scanning, and trying to beat the clock. Target practice. Getting some time in the gunner's seat. It was not difficult.

Gunner: Practice using the controls. More experience. Leaving the motor pool. It was easy but helpful.

TC: Everything. Laying the gun for direction and working with the gunner. Each crew member got to familiarize himself with the gunner's skills. The coordination between TC and gunner. The practice.

12. The thing I liked least about this exercise was:

Driver: All the paperwork. Lining the reticle up.

Loader: I liked it all. Paperwork. Wished I had more time.

Gunner: Too simple.

TC: Due to the closeness of the targets, the TC does not get any practice laying the gun. Not having my own gunner.

| | | | | | |
|---|---|---|---|---|---|
| 13. If many of these exercises were available, I would ___. | | | | | |
| ___use them a lot | 5 | 1 | 0 | 3 | 9 |
| ___use them sometimes | 1 | 5 | 4 | 2 | 13 |
| ___not use them much | 0 | 0 | 0 | 0 | 0 |
| ___not use them at all | 0 | 0 | 1 | 0 | 1 |

Table D-4. Field Evaluation 1 -
Evaluation of Target Tracking and Leading Exercise

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 1. The instructions were ___ to read. | | | | | |
| ___very easy | 0 | 2 | 0 | 0 | 2 |
| ___easy | 2 | 1 | 4 | 3 | 10 |
| ___a little hard | 0 | 0 | 0 | 1 | 1 |
| ___very hard | 0 | 0 | 0 | 0 | 0 |
| 2. The instructions were ___ to understand. | | | | | |
| ___very easy | 0 | 2 | 1 | 1 | 4 |
| ___easy | 2 | 1 | 3 | 3 | 9 |
| ___a little hard | 0 | 0 | 0 | 0 | 0 |
| ___very hard | 0 | 0 | 0 | 0 | 0 |
| 3. The instructions were ___. | | | | | |
| ___very complete | 1 | 2 | 1 | 1 | 5 |
| ___mostly complete | 1 | 1 | 3 | 3 | 8 |
| ___complete, but could use more information | 0 | 0 | 0 | 0 | 0 |
| ___incomplete, needed much more information | 0 | 0 | 0 | 0 | 0 |
| 4. The target tracking and leading exercises were ___. | | | | | |
| ___very realistic | 0 | 0 | 1 | 1 | 2 |
| ___fairly realistic | 2 | 2 | 2 | 2 | 8 |
| ___not realistic, but useful | 0 | 1 | 1 | 1 | 3 |
| ___not realistic and not useful | 0 | 0 | 0 | 0 | 0 |

Table D-4. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 5. The dark targets make the GPS reticle ___ to see. | | | | | |
| ___too easy | 0 | 0 | 0 | 1 | 1 |
| ___easy | 2 | 3 | 4 | 3 | 12 |
| ___a little hard | 0 | 0 | 0 | 0 | 0 |
| ___too hard | 0 | 0 | 0 | 0 | 0 |
| 6. During the exercises, the target ___. | | | | | |
| ___bounced up and down too much | 1 | 0 | 2 | 2 | 5 |
| ___looked like a target moving over rough terrain | 1 | 1 | 2 | 2 | 6 |
| ___did not move up and down much | 0 | 0 | 0 | 0 | 0 |
| ___should move up and down more | 0 | 0 | 0 | 0 | 0 |
| 7. The exercises were ___ to do. | | | | | |
| ___too hard | 0 | 0 | 0 | 0 | 0 |
| ___hard | 0 | 0 | 1 | 3 | 4 |
| ___easy | 2 | 3 | 3 | 1 | 9 |
| ___too easy | 0 | 0 | 0 | 0 | 0 |
| 8. The tracking and leading exercises were ___. | | | | | |
| ___very interesting | 0 | 1 | 2 | 1 | 4 |
| ___fairly interesting | 2 | 2 | 2 | 3 | 9 |
| ___not very interesting | 0 | 0 | 0 | 0 | 0 |
| ___boring | 0 | 0 | 0 | 0 | 0 |
| 9. The exercises are ___ for practice. | | | | | |
| ___very useful | 2 | 2 | 2 | 2 | 8 |
| ___fairly useful | 0 | 1 | 2 | 2 | 5 |
| ___not very useful | 0 | 0 | 0 | 0 | 0 |
| ___useless | 0 | 0 | 0 | 0 | 0 |

Table D-4. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 10. By doing exercises, I learned ___. | | | | | |
| ___a lot | 1 | 2 | 2 | 1 | 6 |
| ___some | 1 | 1 | 2 | 3 | 7 |
| ___not very much | 0 | 0 | 0 | 0 | 0 |
| ___nothing at all | 0 | 0 | 0 | 0 | 0 |
| 11. By doing exercises like these, my tracking and leading skills would ___. | | | | | |
| ___improve a lot | 1 | 1 | 2 | 3 | 7 |
| ___improve a little | 1 | 2 | 2 | 1 | 6 |
| ___not improve | 0 | 0 | 0 | 0 | 0 |
| ___get worse | 0 | 0 | 0 | 0 | 0 |

12. The thing I liked most about this exercise was:

Driver: No comments.

Loader: Tracking in front of the target. Searching and identifying the target. It was easy to do.

Gunner: It gave me a chance to experience. Riding outside the motor pool on the M1. Tracking capabilities. We each got to do it.

TC: The practice time. Actually laying the gun and tracking. Helped become familiar with the reticle and using the proper lead. It was challenging to the gunner.

13. The thing I liked least about this exercise was:

Driver: No comments.

Loader: Walking with the tank target.

Gunner: Moving with the target.

TC: The target was moving too fast for the short distance. The use of people from the crew to carry the target. Too much target movement.

Table D-4. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 14. If many of these exercises were available, I would ___. | | | | | |
| ___use them a lot | 1 | 0 | 2 | 2 | 5 |
| ___use them sometimes | 1 | 3 | 2 | 2 | 8 |
| ___not use them much | 0 | 0 | 0 | 0 | 0 |
| ___not use them at all | 0 | 0 | 0 | 0 | 0 |

Table D-5. Field Evaluation 2 -
Evaluation of Fire Command Booklets

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 1. The information booklet (Booklet 1) was ___. | | | | | |
| ___very easy to read | 2 | 2 | 0 | 2 | 6 |
| ___easy to read | 3 | 4 | 2 | 3 | 12 |
| ___a little hard to read | 0 | 0 | 0 | 0 | 0 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 2. The information booklet (Booklet 1) had ___. | | | | | |
| ___too much information | 2 | 1 | 0 | 0 | 3 |
| ___the right amount of information | 2 | 4 | 1 | 1 | 8 |
| ___not quite enough information | 1 | 1 | 1 | 3 | 6 |
| ___much too little information | 0 | 0 | 0 | 1 | 1 |
| 3. The information booklet (Booklet 1) was ___. | | | | | |
| ___very interesting | 0 | 1 | 0 | 0 | 1 |
| ___fairly interesting | 3 | 2 | 1 | 3 | 9 |
| ___not very interesting | 1 | 2 | 1 | 2 | 6 |
| ___boring | 1 | 1 | 0 | 0 | 2 |
| 4. After reading the information booklet (Booklet 1) I think I learned ___. | | | | | |
| ___a lot | 0 | 0 | 0 | 0 | 0 |
| ___some | 3 | 4 | 2 | 3 | 12 |
| ___not very much | 2 | 2 | 0 | 2 | 6 |
| ___nothing | 0 | 0 | 0 | 0 | 0 |
| 5. I found the questions in the booklet (Booklet 1) ___. | | | | | |
| ___very helpful | 1 | 1 | 0 | 0 | 2 |
| ___somewhat helpful | 2 | 2 | 2 | 4 | 10 |
| ___not very helpful | 2 | 2 | 0 | 1 | 5 |
| ___not helpful at all | 0 | 0 | 0 | 0 | 0 |
| | | | (1 abstention) | | |

Table D-5. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 6. The scenario booklets (Booklets 2 - 6) were ___. | | | | | |
| ___very easy to read | 2 | 1 | 0 | 1 | 4 |
| ___easy to read | 2 | 3 | 1 | 4 | 10 |
| ___a little hard to read | 1 | 1 | 1 | 0 | 3 |
| ___very hard to read | 0 | 1 | 0 | 0 | 1 |
| 7. The instructions for doing the scenarios were ___. | | | | | |
| ___very easy to understand | 2 | 1 | 0 | 2 | 5 |
| ___easy to understand | 1 | 3 | 2 | 3 | 9 |
| ___a little hard to understand | 2 | 2 | 0 | 0 | 4 |
| ___very hard to understand | 0 | 0 | 0 | 0 | 0 |
| 8. The scenarios were ___. | | | | | |
| ___very interesting | 0 | 0 | 0 | 0 | 0 |
| ___fairly interesting | 4 | 4 | 1 | 2 | 11 |
| ___not very interesting | 0 | 1 | 1 | 3 | 5 |
| ___boring | 1 | 1 | 0 | 0 | 2 |
| 9 After doing the scenarios in Booklets 2 - 6, I think I learned ___. | | | | | |
| ___a lot | 2 | 0 | 0 | 0 | 2 |
| ___some | 2 | 4 | 2 | 3 | 11 |
| ___not very much | 1 | 2 | 0 | 2 | 5 |
| ___nothing | 0 | 0 | 0 | 0 | 0 |
| 10. The scenario pictures were ___. | | | | | |
| ___very realistic | 1 | 0 | 1 | 1 | 3 |
| ___fairly realistic | 0 | 3 | 1 | 2 | 6 |
| ___not realistic, but useful | 4 | 2 | 0 | 2 | 8 |
| ___not realistic and not useful | 0 | 1 | 0 | 0 | 1 |

Table D-5. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 11. When doing the scenarios, I found the pictures ___. | | | | | |
| ___very helpful | 2 | 1 | 1 | 0 | 4 |
| ___fairly helpful | 2 | 4 | 1 | 2 | 9 |
| ___not very helpful | 1 | 0 | 0 | 1 | 2 |
| ___not helpful at all | 0 | 0 | 0 | 0 | 0 |
| | | (3 abstentions) | | | |
| 12. If the scenario pictures were more realistic, it would ___. | | | | | |
| ___help a lot | 1 | 0 | 1 | 2 | 4 |
| ___help a little | 1 | 4 | 1 | 1 | 7 |
| ___not help, but would be nice | 2 | 1 | 0 | 1 | 4 |
| ___make no difference | 1 | 1 | 0 | 1 | 3 |
| 13. If the scenario pictures were in color, they would ___. | | | | | |
| ___be much more useful | 1 | 0 | 0 | 0 | 1 |
| ___be a little more useful | 0 | 2 | 2 | 2 | 6 |
| ___not be any more useful | 4 | 3 | 0 | 2 | 9 |
| | | (2 abstentions) | | | |
| 14. The SITUATION descriptions were ___. | | | | | |
| ___very easy to read | 1 | 1 | 0 | 1 | 3 |
| ___easy to read | 1 | 3 | 2 | 4 | 10 |
| ___a little hard to read | 3 | 2 | 0 | 0 | 5 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 15. I found the SITUATION descriptions ___. | | | | | |
| ___very easy to understand | 2 | 0 | 0 | 1 | 3 |
| ___easy to understand | 1 | 4 | 2 | 3 | 10 |
| ___a little hard to understand | 2 | 2 | 0 | 1 | 5 |
| ___very hard to understand | 0 | 0 | 0 | 0 | 0 |

Table D-5. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 16. The SITUATION descriptions had ___. | | | | | |
| ___too much information | 1 | 0 | 0 | 0 | 1 |
| ___the right amount of information | 2 | 3 | 1 | 0 | 6 |
| ___not quite enough information | 2 | 2 | 1 | 5 | 10 |
| ___not nearly enough information | 0 | 1 | 0 | 0 | 1 |
| 17. I found that the correct answers were ___. | | | | | |
| ___very complete | 0 | 0 | 0 | 0 | 0 |
| ___mostly complete | 3 | 4 | 0 | 0 | 7 |
| ___complete, but could use more information | 1 | 1 | 1 | 2 | 5 |
| ___incomplete, needed much more information | 1 | 1 | 1 | 2 | 5 |
| | | (1 abstention) | | | |
| 18. I found that the correct answers were ___. | | | | | |
| ___very accurate | 0 | 0 | 0 | 0 | 0 |
| ___usually accurate | 0 | 5 | 0 | 0 | 5 |
| ___sometimes inaccurate | 5 | 1 | 2 | 5 | 13 |
| ___usually inaccurate | 0 | 0 | 0 | 0 | 0 |
| 19. Sometimes, there was a brief explanation of the wrong answers. I found these explanations ___. | | | | | |
| ___very useful | 1 | 1 | 0 | 1 | 3 |
| ___fairly useful | 3 | 3 | 2 | 2 | 10 |
| ___not very useful | 0 | 1 | 0 | 2 | 3 |
| ___useless | 0 | 1 | 0 | 0 | 1 |
| | | (1 abstention) | | | |

Table D-5. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 20. When the wrong answers were explained, the explanations usually had ___. | | | | | |
| ___too much information | 1 | 0 | 0 | 0 | 1 |
| ___the right amount of information | 2 | 3 | 0 | 1 | 6 |
| ___not quite enough information | 1 | 3 | 2 | 3 | 9 |
| ___not nearly enough information | 1 | 0 | 0 | 1 | 2 |
| 21. The words used in the booklets were ___. | | | | | |
| ___too simple | 1 | 0 | 0 | 1 | 2 |
| ___just right | 1 | 5 | 2 | 3 | 11 |
| ___sometimes hard to understand | 3 | 1 | 0 | 1 | 5 |
| ___often hard to understand | 0 | 0 | 0 | 0 | 0 |
| 22. If many more fire command gunnery scenario booklets were available, I would ___. | | | | | |
| ___use them a lot | 0 | 0 | 0 | 0 | 0 |
| ___use them sometimes | 1 | 3 | 2 | 4 | 10 |
| ___not use them much | 3 | 1 | 0 | 1 | 5 |
| ___not use them at all | 1 | 1 | 0 | 0 | 2 |
| | | (1 abstention) | | | |
| 23. If scenario booklets on other topics were available, I would ___. | | | | | |
| ___use them a lot | 2 | 0 | 0 | 0 | 2 |
| ___use them sometimes | 0 | 4 | 2 | 4 | 10 |
| ___not use them much | 2 | 0 | 0 | 1 | 3 |
| ___not use them at all | 1 | 1 | 0 | 0 | 2 |
| | | (1 abstention) | | | |

Table D-5. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 24. The scenario booklets were printed on regular size paper. If these booklets were made smaller so they could fit in my pocket, I would ___. | | | | | |
| ___use them much more | 1 | 0 | 1 | 0 | 2 |
| ___use them a little more | 0 | 3 | 0 | 2 | 5 |
| ___not use them any more than the way they are now | 3 | 0 | 0 | 2 | 5 |
| ___use them less | 0 | 1 | 1 | 1 | 3 |
| | | (3 abstentions) | | | |

25. Other comments: No comments.

Table D-6. Field Evaluation 2 -
Tank Commander Evaluation of Fire Command Booklets

| Question | TC Responses |
|---|---|
| 1. During the past week, you have actually sent your crew through a mini training program. The fire command booklets (Booklets 1 - 6) contained notes for the tank commander and instructions for using the booklets. How complete were these notes and instructions? | |
| ___very complete | 1 |
| ___mostly complete | 2 |
| ___complete, but could use more information | 2 |
| ___not complete, needed much more information | 0 |
| 2. Most of your crew found the information in Booklet 1 ___. | |
| ___very easy to understand | 0 |
| ___easy to understand | 4 |
| ___a little hard to understand | 1 |
| ___very hard to understand | 0 |
| 3. Did any of your crewmembers have difficulty going through the information booklet? | |
| ___yes | 2 |
| ___no | 3 |
| If yes, which crewmember(s) had the most difficulty? | |
| ___Driver | 2 |
| ___Loader | 1 |
| ___Gunner | 0 |
| 4. The language used in Booklet 1 was ___. | |
| ___very easy for your crew to understand | 0 |
| ___just right for your crew to understand | 5 |
| ___a little hard for your crew to understand | 0 |
| ___very hard for your crew to understand | 0 |

Table D-6. (cont'd.)

| Question | TC Responses |
|---|---|
| 5. Which crewmember(s) would you want to be familiar with information in Booklet 1? | |
| ___Driver | 2 |
| ___Loader | 3 |
| ___Gunner | 5 |
| 6. Most of your crew found the information booklet (Booklet 1) ___. | |
| ___very interesting | 0 |
| ___fairly interesting | 5 |
| ___not very interesting | 0 |
| ___boring | 0 |
| 7. By doing the scenario booklets, most of your crew learned ___. | |
| ___a lot | 0 |
| ___a little | 5 |
| ___not much | 0 |
| ___nothing | 0 |
| 8. Most of your crew found the scenario booklets ___. | |
| ___very interesting | 0 |
| ___fairly interesting | 4 |
| ___not very interesting | 1 |
| ___boring | 0 |
| 9. Most of your crew found the scenarios ___. | |
| ___very easy to do | 0 |
| ___easy to do | 4 |
| ___a little hard to do | 1 |
| ___very hard to do | 0 |

Table D-6. (cont'd.)

| Question | TC Responses |
|---|---|
| 10. For train up purposes, this set of booklets is ___. | |
| ___very useful | 1 |
| ___fairly useful | 2 |
| ___not very useful | 2 |
| ___useless | 0 |
| 11. For cross training, this set of booklets is ___. | |
| ___very useful | 0 |
| ___fairly useful | 5 |
| ___not very useful | 0 |
| ___useless | 0 |
| 12. If many more fire command scenario booklets were available, how often would you want your crew to use them? | |
| ___very often | 2 |
| ___sometimes | 2 |
| ___not very often | 1 |
| ___never | 0 |
| 13. If many more scenario booklets on other topics were available, how often would you want your crew to use them? | |
| ___very often | 2 |
| ___sometimes | 2 |
| ___not very often | 1 |
| ___never | 0 |

Table D-6. (cont'd.)

| Question | TC Responses |
|---|---|
| 14. If you had score sheets on which to track your crewmember's performance, would you find them helpful? | |
| ___yes | 4 |
| ___no | 1 |
| If yes, for what purposes? | |
| - To find weaknesses. | |
| - Common skills tasks. | |
| - To see how much knowledge they get from the booklets. | |
| 15. Are there other tasks that could be taught using booklets/scenarios like these? | |
| ___yes | 1 |
| ___no | 3 |
| | (1 abstention) |
| If so, please list these tasks: | No comments |
| 16. General Comments: | |
| - Overall, crews found these books fairly hard because they are not trained in all stations. | |

Table D-7. Field Evaluation 2 -
Evaluation of Degraded Mode Gunnery Booklets

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 1. The information booklet (Booklet 1) was ___. | | | | | |
| ___very easy to read | 1 | 2 | 0 | 1 | 4 |
| ___easy to read | 3 | 1 | 4 | 5 | 13 |
| ___a little hard to read | 1 | 0 | 0 | 0 | 1 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 2. The information booklet (Booklet 1) had ___. | | | | | |
| ___too much information | 0 | 0 | 0 | 0 | 0 |
| ___the right amount of information | 2 | 2 | 3 | 1 | 8 |
| ___not quite enough information | 2 | 1 | 0 | 4 | 7 |
| ___much too little information | 1 | 0 | 1 | 1 | 3 |
| 3. The information booklet (Booklet 1) was ___. | | | | | |
| ___very interesting | 1 | 0 | 0 | 1 | 2 |
| ___fairly interesting | 2 | 2 | 3 | 4 | 11 |
| ___not very interesting | 1 | 0 | 1 | 1 | 3 |
| ___boring | 1 | 1 | 0 | 0 | 2 |
| 4. After reading the information booklet (Booklet 1) I think I learned ___. | | | | | |
| ___a lot | 1 | 0 | 0 | 0 | 1 |
| ___some | 3 | 2 | 3 | 2 | 10 |
| ___not very much | 0 | 1 | 1 | 4 | 6 |
| ___nothing | 1 | 0 | 0 | 0 | 1 |
| 5. I found the questions in the booklet (Booklet 1) ___. | | | | | |
| ___very helpful | 0 | 2 | 0 | 1 | 3 |
| ___somewhat helpful | 4 | 0 | 3 | 4 | 11 |
| ___not very helpful | 1 | 1 | 1 | 1 | 4 |
| ___not helpful at all | 0 | 0 | 0 | 0 | 0 |

Table D-7. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 6. The scenario booklets (Booklets 2 and 3) were ___. | | | | | |
| ___very easy to read | 1 | 0 | 0 | 1 | 2 |
| ___easy to read | 3 | 3 | 4 | 5 | 15 |
| ___a little hard to read | 1 | 0 | 0 | 0 | 1 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 7. The instructions for doing the scenarios were ___. | | | | | |
| ___very easy to understand | 2 | 0 | 0 | 1 | 3 |
| ___easy to understand | 1 | 3 | 4 | 5 | 13 |
| ___a little hard to understand | 2 | 0 | 0 | 0 | 2 |
| ___very hard to understand | 0 | 0 | 0 | 0 | 0 |
| 8. The scenarios were ___. | | | | | |
| ___very interesting | 1 | 1 | 0 | 1 | 3 |
| ___fairly interesting | 2 | 1 | 3 | 5 | 11 |
| ___not very interesting | 1 | 0 | 1 | 0 | 2 |
| ___boring | 1 | 1 | 0 | 0 | 2 |
| 9 After doing the scenarios in Booklets 2 and 3, I think I learned ___. | | | | | |
| ___a lot | 0 | 0 | 0 | 0 | 0 |
| ___some | 4 | 3 | 3 | 3 | 13 |
| ___not very much | 0 | 0 | 1 | 3 | 4 |
| ___nothing | 1 | 0 | 0 | 0 | 1 |
| 10. The scenario pictures were ___. | | | | | |
| ___very realistic | 0 | 0 | 0 | 1 | 1 |
| ___fairly realistic | 3 | 2 | 3 | 2 | 10 |
| ___not realistic, but useful | 0 | 1 | 0 | 3 | 4 |
| ___not realistic and not useful | 2 | 0 | 1 | 0 | 3 |

Table D-7. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 11. When doing the scenarios, I found the pictures ___. | | | | | |
| ___very helpful | 1 | 0 | 1 | 1 | 3 |
| ___fairly helpful | 3 | 3 | 2 | 3 | 11 |
| ___not very helpful | 0 | 0 | 1 | 2 | 3 |
| ___not helpful at all | 1 | 0 | 0 | 0 | 1 |
| 12. If the scenario pictures were more realistic, it would ___. | | | | | |
| ___help a lot | 2 | 1 | 0 | 1 | 4 |
| ___help a little | 1 | 2 | 4 | 2 | 9 |
| ___not help, but would be nice | 0 | 0 | 0 | 2 | 2 |
| ___make no difference | 2 | 0 | 0 | 1 | 3 |
| 13. If the scenario pictures were in color, they would ___. | | | | | |
| ___be much more useful | 1 | 0 | 1 | 0 | 2 |
| ___be a little more useful | 0 | 1 | 1 | 3 | 5 |
| ___not be any more useful | 4 | 2 | 2 | 3 | 11 |
| 14. The SITUATION descriptions were ___. | | | | | |
| ___very easy to read | 2 | 1 | 0 | 1 | 4 |
| ___easy to read | 1 | 2 | 4 | 5 | 12 |
| ___a little hard to read | 2 | 0 | 0 | 0 | 2 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 15. I found the SITUATION descriptions ___. | | | | | |
| ___very easy to understand | 2 | 0 | 0 | 1 | 3 |
| ___easy to understand | 2 | 3 | 4 | 5 | 14 |
| ___a little hard to understand | 1 | 0 | 0 | 0 | 1 |
| ___very hard to understand | 0 | 0 | 0 | 0 | 0 |

Table D-7. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 16. The SITUATION descriptions had ___. | | | | | |
| ___too much information | 1 | 0 | 0 | 0 | 1 |
| ___the right amount of information | 2 | 2 | 2 | 2 | 8 |
| ___not quite enough information | 1 | 1 | 2 | 3 | 7 |
| ___not nearly enough information | 1 | 0 | 0 | 1 | 2 |
| 17. I found that the correct answers were ___. | | | | | |
| ___very complete | 2 | 0 | 0 | 0 | 2 |
| ___mostly complete | 0 | 1 | 3 | 2 | 6 |
| ___complete, but could use more information | 2 | 2 | 0 | 2 | 6 |
| ___incomplete, needed much more information | 1 | 0 | 1 | 2 | 4 |
| 18. I found that the correct answers were ___. | | | | | |
| ___very accurate | 0 | 0 | 0 | 0 | 0 |
| ___usually accurate | 1 | 2 | 2 | 1 | 6 |
| ___sometimes inaccurate | 3 | 1 | 1 | 3 | 8 |
| ___usually inaccurate | 1 | 0 | 1 | 2 | 4 |
| 19. Sometimes, there was a brief explanation of the wrong answers. I found these explanations ___. | | | | | |
| ___very useful | 3 | 0 | 1 | 1 | 5 |
| ___fairly useful | 0 | 2 | 2 | 3 | 7 |
| ___not very useful | 1 | 1 | 1 | 2 | 5 |
| ___useless | 1 | 0 | 0 | 0 | 1 |
| 20. When the wrong answers were explained, the explanations usually had ___. | | | | | |
| ___too much information | 0 | 0 | 0 | 0 | 0 |
| ___the right amount of information | 3 | 1 | 2 | 4 | 10 |
| ___not quite enough information | 1 | 2 | 1 | 2 | 6 |
| ___not nearly enough information | 1 | 0 | 1 | 0 | 2 |

Table D-7. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 21. The words used in the booklets were ___. | | | | | |
| ___too simple | 0 | 0 | 0 | 1 | 1 |
| ___just right | 3 | 2 | 4 | 5 | 14 |
| ___sometimes hard to understand | 1 | 0 | 0 | 0 | 1 |
| ___often hard to understand | 1 | 0 | 0 | 0 | 1 |
| | | (1 abstention) | | | |
| 22. If many more degraded mode gunnery scenario booklets were available, I would ___. | | | | | |
| ___use them a lot | 0 | 0 | 0 | 0 | 0 |
| ___use them sometimes | 3 | 2 | 3 | 5 | 13 |
| ___not use them much | 1 | 0 | 1 | 1 | 3 |
| ___not use them at all | 1 | 0 | 0 | 0 | 1 |
| | | (1 abstention) | | | |
| 23. If scenario booklets on other topics were available, I would ___. | | | | | |
| ___use them a lot | 1 | 0 | 0 | 0 | 1 |
| ___use them sometimes | 3 | 2 | 3 | 5 | 13 |
| ___*not use them much* | 0 | 0 | 1 | 1 | 2 |
| ___not use them at all | 1 | 0 | 0 | 0 | 1 |
| | | (1 abstention) | | | |
| 24. The scenario booklets were printed on regular size paper. If these booklets were made smaller so they could fit in my pocket, I would ___. | | | | | |
| ___use them much more | 0 | 0 | 0 | 0 | 0 |
| ___use them a little more | 3 | 2 | 2 | 2 | 9 |
| ___not use them any more than the way they are now | 2 | 0 | 2 | 3 | 7 |
| ___use them less | 0 | 0 | 0 | 1 | 1 |
| | | (1 abstention) | | | |

Table D-7. (cont'd.)

25. QUESTION: If you would like to see these booklets made smaller, what size should they be?

RESPONSES:

Driver: 3 x 1, 3 x 5

Loader: pocket size, 3 x 5

Gunner: 5 x 9, pocket size

TC: pocket size, smaller won't help - pockets filled up now

26. Other comments:

Driver: No comments

Gunner: Incorrect answers which made it boring. It should be made by experienced M1 tank commanders and crew.

TC: Information needs to be more accurate and answers should be complete with what crews have been trained to do. The people writing the booklets need to get themselves familiarized with the tank - to be able to have the correct answers and know how the tank works.

Some of the questions were unreal or had the wrong weapon for the wrong target.

There is some disagreement on what the accurate answer should be.

Table D-8. Field Evaluation 2 -
Tank Commander Evaluation of Degraded Mode Gunnery Booklets

| Question | TC Responses |
|---|---|
| 1. During the past week, you have actually sent your crew through a mini training program. The degraded mode gunnery booklets (Booklets 1 - 3) contained notes for the tank commander and instructions for using the booklets. How complete were these notes and instructions? | |
| ___very complete | 0 |
| ___mostly complete | 2 |
| ___complete, but could use more information | 3 |
| ___not complete, needed much more information | 1 |
| 2. Most of your crew found the information in Booklet 1 ___. | |
| ___very easy to understand | 0 |
| ___easy to understand | 5 |
| ___a little hard to understand | 1 |
| ___very hard to understand | 0 |
| 3. Did any of your crewmembers have difficulty going through the information booklet? | |
| ___yes | 2 |
| ___no | 4 |
| If yes, which crewmember(s) had the most difficulty? | |
| ___Driver | 2 |
| ___Loader | 1 |
| ___Gunner | 0 |
| 4. The language used in Booklet 1 was ___. | |
| ___very easy for your crew to understand | 1 |
| ___just right for your crew to understand | 5 |
| ___a little hard for your crew to understand | 0 |
| ___very hard for your crew to understand | 0 |

Table D-8. (cont'd.)

| Question | TC Responses |
|---|---|
| 5. Which crewmember(s) would you want to be familiar with information in Booklet 1? | |
| ___Driver | 2 |
| ___Loader | 4 |
| ___Gunner | 4 |
| 6. Most of your crew found the information booklet (Booklet 1) ___. | |
| ___very interesting | 0 |
| ___fairly interesting | 6 |
| ___not very interesting | 0 |
| ___boring | 0 |
| 7. By doing the scenario booklets, most of your crew learned ___. | |
| ___a lot | 0 |
| ___a little | 5 |
| ___not much | 1 |
| ___nothing | 0 |
| 8. Most of your crew found the scenario booklets ___. | |
| ___very interesting | 0 |
| ___fairly interesting | 6 |
| ___not very interesting | 0 |
| ___boring | 0 |
| 9. Most of your crew found the scenarios ___. | |
| ___very easy to do | 0 |
| ___easy to do | 6 |
| ___a little hard to do | 0 |
| ___very hard to do | 0 |

Table D-8. (cont'd.)

| Question | TC Responses |
|---|---|
| 10. For train up purposes, this set of booklets is ___. | |
| ___very useful | 0 |
| ___fairly useful | 3 |
| ___not very useful | 3 |
| ___useless | 0 |
| 11. For cross training, this set of booklets is ___. | |
| ___very useful | 0 |
| ___fairly useful | 6 |
| ___not very useful | 0 |
| ___useless | 0 |
| 12. If many more degraded mode gunnery scenario booklets were available, how often would your crew want to use them? | |
| ___very often | 2 |
| ___sometimes | 2 |
| ___not very often | 2 |
| ___never | 0 |
| 13. If many more scenario booklets on <u>other topics</u> were available, how often would you want your crew to use them? | |
| ___very often | 2 |
| ___sometimes | 3 |
| ___not very often | 1 |
| ___never | 0 |

Table D-8. (cont'd.)

| Question | TC Responses |
|---|---|
| 14. If you had score sheets on which to track your crewmember's performance, would you find them helpful? | |
| ___yes | 5 |
| ___no | 1 |
| If yes, for what purpos. | |
| - To know if crew had general knowledge to take another crew position. | |
| 15. Are there other tasks that could be taught using booklets/scenarios like these? | |
| ___yes | 2 |
| ___no | 3 |
| | (1 abstention) |
| If so, please list these tasks: | |
| - First aid. | |
| - Navigation. | |
| - Putting tank equipment into operation. | |
| - Operating in different situations, such as combat and gunnery. | |
| 16. General Comments: | |
| - The booklets could be very helpful if they contained the proper information and the proper answers. The authors of the book need to be proficient on the tank to be able to test the individuals using the book. | |
| - Need FM-17-12-1 for more information on M1 task. | |
| - Fairly good (referring to the training package). | |

Table D-9. Field Evaluation 2 -
Evaluation of Multiple Returns Booklet

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 1. The information section was ___. | | | | | |
| ___very easy to read | 2 | 1 | 2 | 0 | 5 |
| ___easy to read | 0 | 3 | 2 | 5 | 10 |
| ___a little hard to read | 1 | 0 | 0 | 0 | 1 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 2. The information section had ___. | | | | | |
| ___too much information | 0 | 0 | 1 | 0 | 1 |
| ___the right amount of information | 2 | 3 | 2 | 3 | 10 |
| ___not quite enough information | 1 | 1 | 1 | 2 | 5 |
| ___much too little information | 0 | 0 | 0 | 0 | 0 |
| 3. The information section was ___. | | | | | |
| ___very interesting | 0 | 0 | 0 | 0 | 0 |
| ___fairly interesting | 2 | 3 | 3 | 4 | 12 |
| ___not very interesting | 0 | 0 | 1 | 0 | 1 |
| ___boring | 1 | 1 | 0 | 0 | 2 |
| | | | (1 abstention) | | |
| 4. After reading the information section, I think I learned ___. | | | | | |
| ___a lot | 0 | 0 | 0 | 0 | 0 |
| ___some | 2 | 4 | 3 | 4 | 13 |
| ___not very much | 0 | 0 | 1 | 1 | 2 |
| ___nothing | 1 | 0 | 0 | 0 | 1 |
| 5. I found the questions in the information section ___. | | | | | |
| ___very helpful | 1 | 0 | 1 | 0 | 2 |
| ___somewhat helpful | 1 | 4 | 2 | 5 | 12 |
| ___not very helpful | 0 | 0 | 1 | 0 | 1 |
| ___not helpful at all | 1 | 0 | 0 | 0 | 1 |

Table D-9. (cont'd.)

| Question | Responses: Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 6. The scenarios were ___. | | | | | |
| ___very easy to read | 2 | 1 | 0 | 0 | 3 |
| ___easy to read | 1 | 3 | 4 | 5 | 13 |
| ___a little hard to read | 0 | 0 | 0 | 0 | 0 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 7. The instructions for doing the scenarios were ___. | | | | | |
| ___very easy to understand | 1 | 1 | 0 | 0 | 2 |
| ___easy to understand | 2 | 3 | 4 | 5 | 14 |
| ___a little hard to understand | 0 | 0 | 0 | 0 | 0 |
| ___very hard to understand | 0 | 0 | 0 | 0 | 0 |
| 8. The scenarios were ___. | | | | | |
| ___very interesting | 1 | 1 | 0 | 0 | 2 |
| ___fairly interesting | 1 | 2 | 3 | 5 | 11 |
| ___not very interesting | 0 | 1 | 1 | 0 | 2 |
| ___boring | 1 | 0 | 0 | 0 | 1 |
| 9 After doing the scenarios, I think I learned ___. | | | | | |
| ___a lot | 0 | 0 | 0 | 0 | 0 |
| ___some | 2 | 3 | 3 | 4 | 12 |
| ___not very much | 0 | 1 | 1 | 1 | 3 |
| ___nothing | 1 | 0 | 0 | 0 | 1 |
| 10 The scenario pictures were ___. | | | | | |
| ___very realistic | 1 | 0 | 0 | 0 | 1 |
| ___fairly realistic | 2 | 4 | 4 | 5 | 15 |
| ___not realistic, but useful | 0 | 0 | 0 | 0 | 0 |
| ___not realistic and not useful | 0 | 0 | 0 | 0 | 0 |

Table D-9. (cont'd.)

| Question | Responses Driver | Loader | Gunner | TC | Total |
|---|---|---|---|---|---|
| 11. When doing the scenarios, I found the pictures ___. | | | | | |
| ___very helpful | 0 | 0 | 0 | 0 | 0 |
| ___fairly helpful | 3 | 3 | 4 | 5 | 15 |
| ___not very helpful | 0 | 1 | 0 | 0 | 1 |
| ___not helpful at all | 0 | 0 | 0 | 0 | 0 |
| 12. If the scenario pictures were more realistic, it would ___. | | | | | |
| ___help a lot | 0 | 1 | 0 | 0 | 1 |
| ___help a little | 0 | 2 | 4 | 3 | 9 |
| ___not help, but would be nice | 1 | 1 | 0 | 2 | 4 |
| ___make no difference | 2 | 0 | 0 | 0 | 2 |
| 13. If the scenario pictures were in color, they would ___. | | | | | |
| ___be much more useful | 0 | 1 | 0 | 0 | 1 |
| ___be a little more useful | 0 | 1 | 3 | 4 | 8 |
| ___not be any more useful | 3 | 2 | 1 | 1 | 7 |
| 14. The SITUATION descriptions were ___. | | | | | |
| ___very easy to read | 2 | 1 | 0 | 0 | 3 |
| ___easy to read | 1 | 3 | 4 | 5 | 13 |
| ___a little hard to read | 0 | 0 | 0 | 0 | 0 |
| ___very hard to read | 0 | 0 | 0 | 0 | 0 |
| 15. I found the SITUATION descriptions ___. | | | | | |
| ___very easy to understand | 1 | 0 | 0 | 0 | 1 |
| ___easy to understand | 2 | 4 | 4 | 5 | 15 |
| ___a little hard to understand | 0 | 0 | 0 | 0 | 0 |
| ___very hard to understand | 0 | 0 | 0 | 0 | 0 |

Table D-9. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 16. The SITUATION descriptions had ___. | | | | | |
| ___too much information | 0 | 0 | 0 | 0 | 0 |
| ___the right amount of information | 2 | 4 | 3 | 2 | 11 |
| ___not quite enough information | 0 | 0 | 1 | 3 | 4 |
| ___not nearly enough information | 1 | 0 | 0 | 0 | 1 |
| 17. I found that the correct answers were ___. | | | | | |
| ___very complete | 0 | 0 | 0 | 0 | 0 |
| ___mostly complete | 1 | 2 | 1 | 1 | 5 |
| ___complete, but could use more information | 1 | 1 | 2 | 3 | 7 |
| ___incomplete, needed much more information | 1 | 1 | 1 | 1 | 4 |
| 18. I found that the correct answers were ___. | | | | | |
| ___very accurate | 0 | 0 | 0 | 0 | 0 |
| ___usually accurate | 1 | 3 | 2 | 2 | 8 |
| ___sometimes inaccurate | 1 | 1 | 2 | 3 | 7 |
| ___usually inaccurate | 1 | 0 | 0 | 0 | 1 |
| 19. Sometimes, there was a brief explanation of the wrong answers. I found these explanations ___. | | | | | |
| ___very useful | 1 | 1 | 1 | 0 | 3 |
| ___fairly useful | 1 | 3 | 2 | 2 | 8 |
| ___not very useful | 0 | 0 | 1 | 3 | 4 |
| ___useless | 1 | 0 | 0 | 0 | 1 |

Table D-9. (cont'd.)

| Question | Responses | | | | |
|---|---|---|---|---|---|
| | Driver | Loader | Gunner | TC | Total |
| 20. When the wrong answers were explained, the explanations usually had ___. | | | | | |
| ___too much information | 0 | 1 | 0 | 1 | 2 |
| ___the right amount of information | 1 | 3 | 4 | 0 | 8 |
| ___not quite *enough* information | 1 | 0 | 0 | 4 | 5 |
| ___not nearly enough information | 1 | 0 | 0 | 0 | 1 |
| 21. The words used in the booklets were ___. | | | | | |
| ___too simple | 0 | 0 | 0 | 0 | 0 |
| ___just right | 2 | 3 | 4 | 4 | 13 |
| ___sometimes hard to understand | 0 | 1 | 0 | 1 | 2 |
| ___often hard to understand | 1 | 0 | 0 | 0 | 1 |
| 22. If many more multiple return scenario booklets were available, I would ___. | | | | | |
| ___use them a lot | 0 | 0 | 0 | 0 | 0 |
| ___use them sometimes | 0 | 4 | 4 | 3 | 11 |
| ___not use them much | 1 | 0 | 0 | 2 | 3 |
| ___not use them at all | 2 | 0 | 0 | 0 | 2 |

Table D-10. Field Evaluation 2 -
Evaluation of Target Handoff Exercise

| Question | Responses | | | |
|---|---|---|---|---|
| | Driver | Loader | TC | Total |
| 1. The instructions for doing this exercise were ___. | | | | |
| ___very easy to understand | 1 | 1 | 2 | 4 |
| ___easy to understand | 0 | 1 | 2 | 3 |
| ___a little hard to understand | 1 | 0 | 0 | 1 |
| ___very hard to understand | 0 | 0 | 0 | 0 |
| 2. The target handoff exercise was ___. | | | | |
| ___very realistic | 1 | 1 | 2 | 4 |
| ___fairly realistic | 0 | 1 | 0 | 1 |
| ___not realistic, but useful | 1 | 0 | 2 | 3 |
| ___not realistic and not useful | 0 | 0 | 0 | 0 |
| 3. I found that this exercise was ___. | | | | |
| ___too hard to do | 0 | 0 | 0 | 0 |
| ___hard to do | 1 | 0 | 0 | 1 |
| ___easy to do | 1 | 2 | 4 | 7 |
| ___too easy to do | 0 | 0 | 0 | 0 |
| 4. The handoff exercise was ___. | | | | |
| ___very interesting | 1 | 1 | 1 | 3 |
| ___fairly interesting | 1 | 1 | 2 | 4 |
| ___not very interesting | 0 | 0 | 1 | 1 |
| ___boring | 0 | 0 | 0 | 0 |
| 5. This exercise is ___. | | | | |
| ___very useful for practice | 2 | 1 | 1 | 4 |
| ___fairly useful for practice | 0 | 1 | 3 | 4 |
| ___not very useful for practice | 0 | 0 | 0 | 0 |
| ___useless | 0 | 0 | 0 | 0 |

Table D-10. (cont'd.)

| Question | Responses Driver | Loader | TC | Total |
|---|---|---|---|---|
| 6. By doing this exercise, I think I learned ___. | | | | |
| ___a lot | 1 | 0 | 0 | 1 |
| ___some | 1 | 1 | 3 | 5 |
| ___not very much | 0 | 1 | 1 | 2 |
| ___nothing at all | 0 | 0 | 0 | 0 |
| 7. By doing this exercise, I think my handoff skills would ___. | | | | |
| ___improve a lot | 1 | 2 | 1 | 4 |
| ___improve a little | 1 | 0 | 2 | 3 |
| ___stay the same | 0 | 0 | 1 | 1 |
| ___get worse | 0 | 0 | 0 | 0 |

8. Was there anything that stands out about this exercise that you really like?

   Driver: Gunnery because I'm a Driver. The ride.

   Loader: No comments.

   TC: It gave my loader hands-on experience in the gunner's seat is all.

9. Was there anything that stands out about this exercise that you really dislike?

   Driver: The tank owner wouldn't let the gun travel as fast as possible.

   Loader: No comments.

   TC: Hands-on equipment.

| 10. If other types of handoff exercises like this one were available, I would ___. | | | | |
|---|---|---|---|---|
| ___use them a lot | 1 | 1 | 1 | 3 |
| ___use them sometimes | 1 | 1 | 2 | 4 |
| ___not use tnem much | 0 | 0 | 1 | 1 |
| ___not use them at all | 0 | 0 | 0 | 0 |

Table D-10. (cont'd.)

| Question | Responses Driver | Loader | TC | Total |
|---|---|---|---|---|
| 11. If exercises like this one were available that helped me practice other skills, I would ___. | | | | |
| ___use them a lot | 1 | 1 | 1 | 3 |
| ___use them sometimes | 1 | 1 | 2 | 4 |
| ___not use them much | 0 | 0 | 0 | 0 |
| ___not use them at all | 0 | 0 | 0 | 0 |
| 12. At present, how much target handoff practice do you get? | | | | |
| ___a lot | 0 | 0 | 1 | 1 |
| | (when in the field) | | | |
| ___a little | 1 | 2 | 2 | 5 |
| ___not very much | 0 | 0 | 1 | 1 |
| | (in the motor pool) | | | |
| ___none | 1 | 0 | 0 | 1 |

13. General comments:

Driver: No comments.

Loader: On the practice, if you didn't hit center-of-mass it was called a miss -- in real battle if you didn't hit center-of-mass you would more than likely still get a hit.

TC: No comments.

Table D-11. Field Evaluation 2 -
Evaluation of Target Tracking and Leading Exercise

| Question | Responses Driver | Loader | TC | Total |
|---|---|---|---|---|
| 1. The instructions for doing this exercise were ___. | | | | |
| ___very easy to understand | 1 | 1 | 3 | 5 |
| ___easy to understand | 0 | 1 | 1 | 2 |
| ___a little hard to understand | 1 | 0 | 0 | 1 |
| ___very hard to understand | 0 | 0 | 0 | 0 |
| 2. The tracking/leading exercise was ___. | | | | |
| ___very realistic | 0 | 0 | 1 | 1 |
| ___fairly realistic | 0 | 2 | 2 | 4 |
| ___not realistic, but useful | 2 | 0 | 1 | 3 |
| ___not realistic and not useful | 0 | 0 | 0 | 0 |
| 3. During the exercise, the target ___. | | | | |
| ___bounced up and down too much | 0 | 1 | 1 | 2 |
| ___looked like a target moving over rough ground | 0 | 0 | 2 | 2 |
| ___did not move up and down much | 0 | 1 | 0 | 1 |
| ___should move up and down more | 1 | 0 | 1 | 2 |
| | | (1 abstention) | | |
| 4. I found that this exercise was ___. | | | | |
| ___too hard to do | 0 | 0 | 0 | 0 |
| ___hard to do | 0 | 1 | 1 | 2 |
| ___easy to do | 2 | 1 | 3 | 6 |
| ___too easy to do | 0 | 0 | 0 | 0 |

Table D-11. (cont'd.)

| Question | Responses Driver | Loader | TC | Total |
|---|---|---|---|---|
| 5. The tracking/leading exercise was ___. | | | | |
| ___very interesting | 0 | 0 | 1 | 1 |
| ___fairly interesting | 2 | 2 | 3 | 7 |
| ___not very interesting | 0 | 0 | 0 | 0 |
| ___boring | 0 | 0 | 0 | 0 |
| 6. This exercise is ___. | | | | |
| ___very useful for practice | 1 | 1 | 1 | 3 |
| ___fairly useful for practice | 1 | 1 | 3 | 5 |
| ___not very useful for practice | 0 | 0 | 0 | 0 |
| ___useless | 0 | 0 | 0 | 0 |
| 7. By doing this exercise, I think I learned ___. | | | | |
| ___a lot | 0 | 0 | 0 | 0 |
| ___some | 2 | 2 | 2 | 6 |
| ___not very much | 0 | 0 | 2 | 2 |
| ___nothing at all | 0 | 0 | 0 | 0 |
| 8. By doing this exercise, I think my tracking/leading skills would ___. | | | | |
| ___improve a lot | 1 | 2 | 1 | 4 |
| ___improve a little | 1 | 0 | 1 | 2 |
| ___stay the same | 0 | 0 | 2 | 2 |
| ___get worse | 0 | 0 | 0 | 0 |

9. Was there anything that stands out about this exercise that you really like?

Driver: Gunnery.

Loader: No comments.

TC: It has some benefit as to doing some cross training of a crewmember in the motor pool. Learning the system more and how to track targets and lead them.

Table D-11. (cont'd.)

| Question | Responses Driver | Loader | TC | Total |
|---|---|---|---|---|
| 10. Was there anything that stands out about this exercise that you really dislike? | | | | |
| Driver: No comments. | | | | |
| Loader: The moving target bounced up and down too much and you cannot keep the same speed. | | | | |
| TC: Could not lase to engage L.A.S. Also, target bounced around with the stride of the crewmember. | | | | |
| 11. If other types of tracking/leading exercises like this one were available, I would ___. | | | | |
| ___use them a lot | 0 | 2 | 1 | 3 |
| ___use them sometimes | 2 | 0 | 3 | 5 |
| ___not use them much | 0 | 0 | 0 | 0 |
| ___not use them at all | 0 | 0 | 0 | 0 |
| 12. If exercises like this one were available that helped me practice other skills, I would ___. | | | | |
| ___use them a lot | 0 | 1 | 2 | 3 |
| ___use them sometimes | 2 | 1 | 2 | 5 |
| ___not use them much | 0 | 0 | 1 | 1 |
| ___not use them at all | 0 | 0 | 0 | 0 |
| | (1 TC would use them a lot in the field, but not much in the motor pool) | | | |

Table D-11. (cont'd.)

| Question | Responses Driver | Loader | TC | Total |
|---|---|---|---|---|
| 13. At present, how much target tracking and leading practice do you get? | | | | |
| ___a lot | 0 | 0 | 1 | 1 |
| ___a little | 0 | 2 | 2 | 4 |
| ___not very much | 1 | 0 | 2 | 3 |
| ___none | 1 | 0 | 0 | 1 |
| | (1 TC gets a lot of practice in the field, but not very much in the motor pool) | | | |
| 14. General comments: None. | | | | |