

AD A139623

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Research Product 82-08

GUIDELINES FOR USE OF WEAPONER DURING
BASIC RIFLE MARKSMANSHIP TRAINING

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November 1982

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
1. REPORT NUMBER Research Product 82-08	2. GOVT ACCESSION NO. AD-A139623	3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) Guidelines for use of Weaponeer during Basic Rifle Marksmanship Training	5. TYPE OF REPORT & PERIOD COVERED Research Product		
7. AUTHOR(s) Joel D. Schendel (ARI) and Gary P. Williams (Litton)	6. PERFORMING ORG. REPORT NUMBER ---		
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA 22333 Litton Mellonics, Fort Benning, GA 31905	8. CONTRACT OR GRANT NUMBER(s) MDA-903-80-C-0545		
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Avenue Alexandria, VA 22333	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 2Q263743A794		
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) ---	12. REPORT DATE November 1982		
	13. NUMBER OF PAGES 95		
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.	15. SECURITY CLASS. (of this report) Unclassified		
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE ---		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) ---			
18. SUPPLEMENTARY NOTES ---			
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Rifle Marksmanship Training M16A1 Rifle Training Weaponeer Basic Rifle Marksmanship Program			
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Weaponeer is a training device that simulates the live-fire conditions of the M16A1 Rifle. This guide provides specific information on the use of Weaponeer in Basic Rifle Marksmanship Training. The guide is based on information gathered through extensive field observations and informal interviews and summarizes the results of original research designed to provide a better understanding of how Weaponeer should be used in rifle marksmanship training.			

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The guide focuses on the use of Weaponeer to diagnose shooting problems. However, it includes: (a) a description of Weaponeer's (and tactical Weaponeer's) major components (rifle, target assembly, and console), how they work, and how to operate them; (b) an analysis of the basic problems of Weaponeer use with recommendations on how to meet these problems; (c) a discussion of potential uses of Weaponeer; (d) a summary of the research that has been conducted to test and evaluate Weaponeer; and (e) an overview of how Weaponeer currently is used Army-wide.

FOREWORD

The Fort Benning Field Unit, along with its resident contractor, Mellonics Systems Development Division of Litton Systems, Inc., have conducted a large amount of research on Army marksmanship training. This research has impacted directly on the revision of the Basic Rifle Marksmanship (BRM) program of instruction, which now includes more feedback, improved instructor training, and better supporting materials. Some of this research is referenced in this report, and summary articles appear in the July-August and September-October 1981 issues of Infantry magazine.

Weaponeer is a training device that simulates the live-fire conditions of the M16A1 rifle. No matter how well designed, training devices like Weaponeer must be used correctly to be of any value. This guide provides specific information on the use of Weaponeer during BRM training. While it was written for those concerned with training on Weaponeer, it also should be read by those involved in decisions to acquire the device for training.

This guide was prepared in response to a request from the United States Army Infantry School (USAIS) which is the proponent agency for M16A1 rifle marksmanship training.



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GUIDELINES FOR USE OF WEAPONER DURING BASIC RIFLE MARKSMANSHIP TRAINING

BRIEF

Requirement:

Weaponeer is a training device that simulates the live-fire conditions of the M16A1 rifle. The purpose of this guide is to provide specific information on the use of Weaponeer during BRM training.

Procedure:

This guide is based mainly on information gathered through field observations and informal interviews. It also includes a review of the literature on Weaponeer and original research designed to promote a better understanding of how Weaponeer should be used in rifle marksmanship training.

The guide focuses on the use of Weaponeer to diagnose shooting problems. It includes: (a) a description of the Weaponeer's (and tactical Weaponeer's) major components (rifle, target assembly, and console), how they work, and how to operate them; (b) an analysis of the basic problems of Weaponeer use with recommendations on how to meet these problems; (c) a discussion of potential uses of Weaponeer; (d) a summary of the research which has been conducted to test and evaluate Weaponeer; and (e) an overview of how Weaponeer currently is used Army-wide.

Findings:

There appear to be three basic problems affecting the use of Weaponeer: (a) limited supply of Weaponeers and high demand for their use; (b) over-reliance on Weaponeer as a cure-all for shooting problems; and (c) lack of a standardized set of procedures for Weaponeer use (e.g., diagnosis). Evidence is reviewed which suggests that Weaponeer can be used quickly and effectively to diagnose shooting problems, and two alternative approaches for using Weaponeer in a diagnostic mode during BRM training are recommended. The first approach involves the use of three or more instructors. One of these is the Weaponeer instructor; the other two help conduct remedial training exercises. The second approach is similar in concept to the first, but it involves the use of two instructors. A minimum of two instructors is required to get the most out of time spent firing on Weaponeer.

Other potential uses of Weaponeer in BRM training, Advanced Rifle Marksmanship (ARM) training, and unit training also are identified and discussed. For BRM training, these uses include proficiency testing of Weaponeer instructors, diagnosing shooting problems from the prone unsupported position, and serving as a substitute for live-fire or missed training. For ARM training, these uses include diagnosing shooting problems from advanced shooting positions, demonstrating automatic fire, and moving target engagement training. For unit training, these uses include maintaining readiness and predicting M16A1 record fire performance.

Testing done with Weaponeer indicates that Weaponeer is safe for its intended use and highly reliable. Data gathered on its training effectiveness are mixed and appear to depend on how Weaponeer is used in training. Data gathered on the use of Weaponeer to predict record fire performance suggest that Weaponeer performance is a good predictor of record fire performance and that this prediction is enhanced when firing position and later shots are considered on the device.

Results of an Army-wide survey of Weaponeer users revealed positive to very positive attitudes toward the use of Weaponeer and extreme confidence in its training potential. The survey also revealed that all 11 posts currently using Weaponeer use it to diagnose and remediate shooting problems. Structured observations of three Weaponeer instructors as they worked with 26 initial entry soldiers at Fort Benning indicated that Weaponeer can be used to diagnose shooting problems that can not be diagnosed by observation alone.

Utilization of Findings:

This guide may be used by USAIS to provide specific information on how to use Weaponeer more productively in BRM training. This information also may impact upon future Army decisions to acquire additional devices to support Army marksmanship training.

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INTRODUCTION

Purpose and Scope

The purpose of this guide is to help Army trainers use Weaponeer more effectively. The guide focuses on the use of Weaponeer to diagnose shooting problems in BRM training. It includes: (a) a description of Weaponeer's (and tactical Weaponeer's) major components (rifle, target assembly, and console), how they work, and how to operate them; (b) an analysis of the basic problems of Weaponeer use with recommendations on how to meet these problems; (c) a discussion of potential uses of Weaponeer; (d) a summary of the research that has been conducted to test and evaluate Weaponeer; and, (e) an overview of how Weaponeer currently is used Army-wide.

Who Should Read This Guide?

This guide was written for Weaponeer instructors, but it should be read by all personnel who share responsibility for BRM training. It is essential that these personnel understand the problems that affect the use of Weaponeer. This is the only way these problems can be overcome.

This guide also should be read by those who are involved in decisions to acquire Weaponeer. Information presented in virtually every section of this guide is directly relevant to these decisions.

How to Use This Guide

This guide will tell you everything you need to know to get the most out of time spent using Weaponeer. Read the guide through completely. Then, keep a copy as a handy reference, noting those sections which are particularly relevant to you. The guide is organized to facilitate this type of use.

WEAPONER: GENERAL INFORMATION

What is Weaponer?

Weaponer is a training device that simulates the live-fire conditions of the M16A1 rifle. It requires a space of about 6 feet in width and 18 feet in length, and is designed to simulate all the standard firing positions. Figure 1 shows Weaponer set up for training in the foxhole supported position. (See Appendix A, p. 37 for a description of Weaponer's major components and their operation. Also, see Appendix B, p. 48 for the same information on tactical Weaponer.)

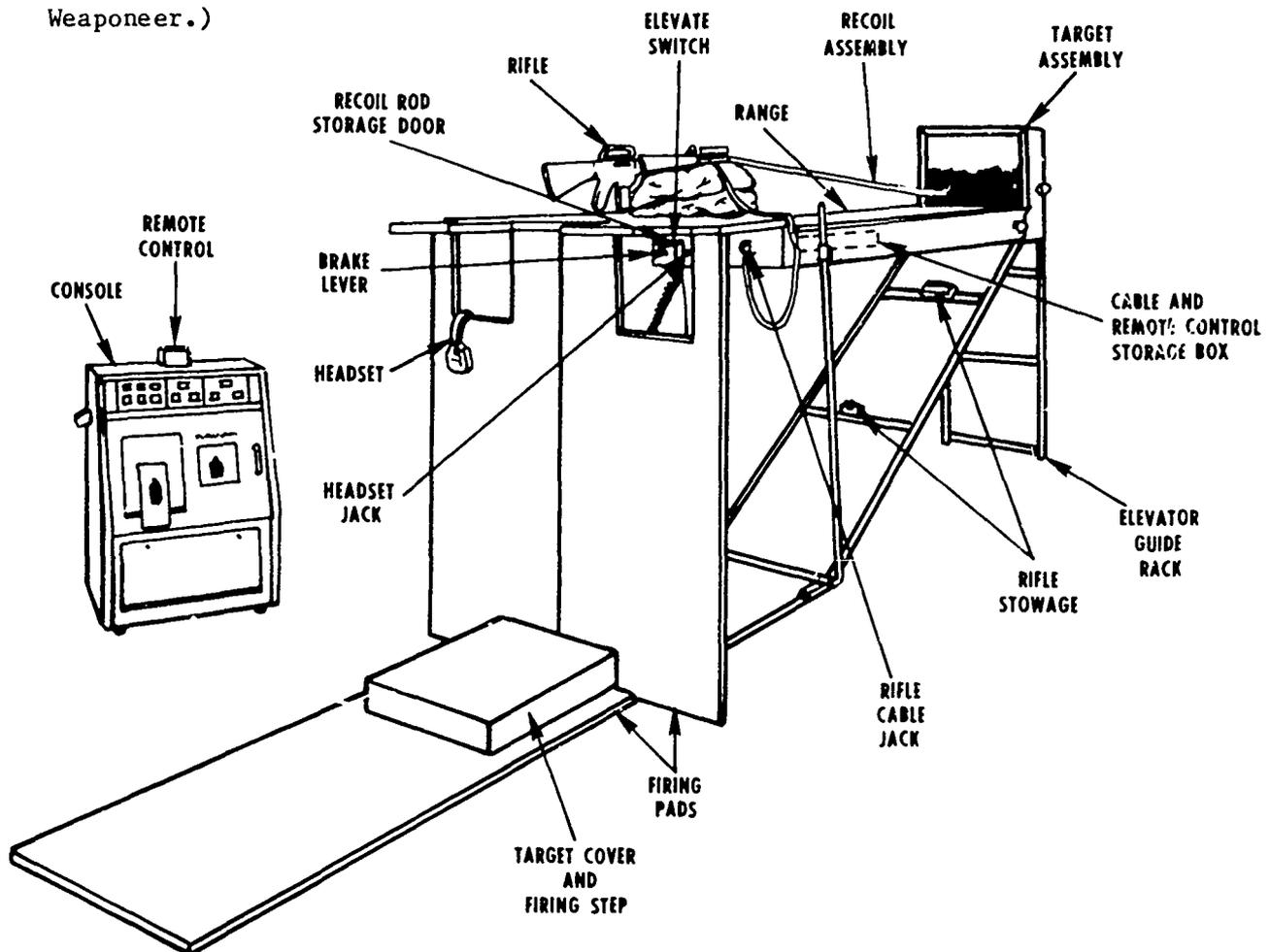


Figure 1. Weaponer set up for training in the foxhole supported position.

PROBLEMS IN WEAPONER USE

The first step toward using Weaponeer more effectively is to identify the problems that affect its use. Procedures then can be developed for overcoming these problems.

There appear to be three basic problems affecting Weaponeer's use: (a) limited supply of Weaponeers and high demand for their use; (b) over-reliance on Weaponeer as a cure-all for shooting problems; and (c) lack of a standardized set of procedures for Weaponeer use (e.g., diagnosis).

Limited Supply/High Demand

Currently, the Army has 28 Weaponeers divided among 11 posts (see Appendix D, p. 56). Conditions differ from post to post, but demand virtually always exceeds supply. For example, during BRM training, only the worst shooters usually ever get to use the device. Even then, these shooters rarely are permitted to spend more than 5 to 10 minutes actually firing.

The Army plans to purchase an additional 170 Weaponeers with 88 of these being designated for use by the Reserves and National Guard. However, the purchase of these Weaponeers probably will not alleviate the supply problem. Indeed, the supply problem may worsen as more soldiers are exposed to Weaponeer and demand for the device increases! The only way to alleviate the supply problem--apart from continuing to buy more (and more) Weaponeers--is to develop more efficient approaches toward using available devices. The approach suggested here should enable most, if not all, soldiers to use Weaponeer, not just some of the worst problem shooters.

Over-Reliance

A recent Army-wide survey of Weaponeer instructors (see Appendix D, p. 57) revealed "positive" to "very positive" attitudes toward the use of Weaponeer and extreme confidence in Weaponeer's training potential. These favorable attitudes and high expectations were expressed not only by the instructors themselves, but were attributed to practically everyone concerned with the use of Weaponeer in marksmanship training, including NCO's and commanding officers.

These positive attitudes and high expectations are welcome signs of Weaponeer's acceptance. But they also have contributed to considerable over-reliance on the device as a cure-all for shooting problems. This over-reliance has led to the neglect of other, more traditional forms of marksmanship training which could be very helpful to the problem shooter. Second, those who would otherwise be providing this training have begun to use Weaponeer as a crutch. Problem: this soldier can not shoot. Answer: send him (or her) to Weaponeer. Obviously, remediating soldiers' shooting problems is not as simple as that. Finally, over-reliance inflates demand for Weaponeer. This inflated demand has resulted, at times, in soldiers standing in line for long durations waiting to use Weaponeer. This "waiting time" usually is very unproductive and, in fact, some soldiers wait, but never get a chance to use the device. The approach suggested here avoids these problems by tying the use of Weaponeer directly into more traditional (but too often neglected) forms of remedial training exercises.

Lack of Standardized Set of Procedures

Procedures used with Weaponeer have been largely determined by the individual Weaponeer instructor. With no guidelines to follow, the instructor is put in a "learn as you go" situation. Most try to make the best of it. But with no tested and established guidelines for Weaponeer use, and with a high rate of turnover among Weaponeer instructors, inefficient and counterproductive procedures are bound to be used.

To optimize the value of time spent on Weaponeer, standardized procedures for Weaponeer training must be developed and then followed. Without them, there is no guarantee that what is being done on Weaponeer makes the slightest bit of difference in how well soldiers shoot.

USE OF WEAPONER IN BRM TRAINING

Procedures for improving Weaponeer usage, particularly during BRM training, are presented in this chapter. Adhering to these procedures will help soldiers get the most out of time spent on Weaponeer. It also will help ensure that time spent in more traditional forms of remedial training is spent helping soldiers where they need help the most.

Diagnosis Versus Remediation

The task of diagnosis is to identify sources of shooting errors. Diagnosis is a necessary first step toward remediating, or correcting, these errors and producing good shooters.

It is recommended that Weaponeer be used primarily as a diagnostic device during BRM training. One of the reasons Weaponeer is so valuable as a diagnostic device is because it eliminates most of the errors in shooting caused by the rifle, ammunition, and environmental conditions (e.g., wind). This makes it easy to trace shooting problems back to the shooter. A second reason is because features on Weaponeer provide more information about soldiers' shooting problems than is currently available through any other means. Observing the shooter (see Appendix F, p. 70) or using various aids while diagnosing and remediating shooting problems (see Appendix F, Pp. 74 - 78) will enable the trainer to detect many violations of the four fundamentals of rifle marksmanship (see Appendix E, p. 61). However, features on Weaponeer, most notably the replay feature, permit far more refined analyses of shooting problems. Even slight violations of the shooting fundamentals are detectable using these features.

While diagnosis can be accomplished quickly and effectively on Weaponeer, our research (Schendel, Heller, & Williams, in preparation--see Appendix C, p. 51) indicates that remediation can not. This is not to say that remediation is not possible on Weaponeer, only to say that it can not be accomplished quickly and effectively enough to warrant using the device in this manner. Weaponeer is a limited resource. Optimizing the value of time spent using this device necessitates that it be used primarily as a diagnostic tool. Only if time permits should remedial training be conducted on Weaponeer.

When Should Weaponeer be Used?

Weaponeer should be used on a continuing basis during the early periods of BRM. The idea is to detect shooting problems early and to eliminate them before they become a natural part of the shooter's behavior.

There may be some value in using Weaponeer to detect shooting problems in later stages of BRM training, but only if the shooter has enough time to correct these problems through practice. When it comes to skilled motor behaviors like firing a weapon, it does little good merely to tell the performer about a particular problem. Superficial attempts at remediation (e.g., one 5- to 10-minute session on Weaponeer) also have no noticeable impact on performance (see Appendix C, p. 51). Only through continued practice, with feedback, can a performer correct his (or her) actions.

How much practice is needed to remediate a soldier's shooting problems? Obviously, there is no simple answer to this question. Some problems take less practice to correct than others, and some soldiers have fewer problems or learn faster than others. The issue is raised here to make two important points. First, however much practice is needed, it takes more practice to correct a

performer's problems later than earlier in learning. Once a behavioral pattern becomes ingrained, it is not very susceptible to change. Second, practice with feedback is required to change behavior. Early during BRM training, repeated opportunities for practice with feedback are available (see Smith, Osborne, Thompson, & Morey, 1980 or Smith, Thompson, Evans, Osborne, Maxey, & Morey, 1980 for more information on the use of down-range feedback in BRM training). Shooting problems can be corrected quickly without consequence. Later during BRM training, shooting problems, if identified, may not be corrected before a soldier attempts to qualify. Of course, some practice may be provided on Weaponeer, but then one soldier's practice necessarily comes at the expense of another's.

How Should Weaponeer be Used?

Three or More Instructors¹

General approach. Figure 2 presents a general approach for using Weaponeer, assuming that three or more instructors are available for conducting concurrent training. Under this approach, (a) stronger shooters (if known) are assigned to the first firing order(s); (b) weaker shooters are divided evenly and rotate among three remedial training areas (foxhole supported dry fire, target box, and prone unsupported dry fire exercises); and, (c) two shooters, drawn from (b) above are rotated continuously through Weaponeer. Following

¹Of these three instructors, one is assumed to be working as the Weaponeer instructor. If an additional Weaponeer were used, an additional instructor would be required.

diagnosis on Weaponeer, weaker shooters rotate among remedial training areas to work on correcting their shooting problems. When the first firing order has completed firing, stronger and weaker shooters exchange places. Details on the application of this approach to BRM training follow.

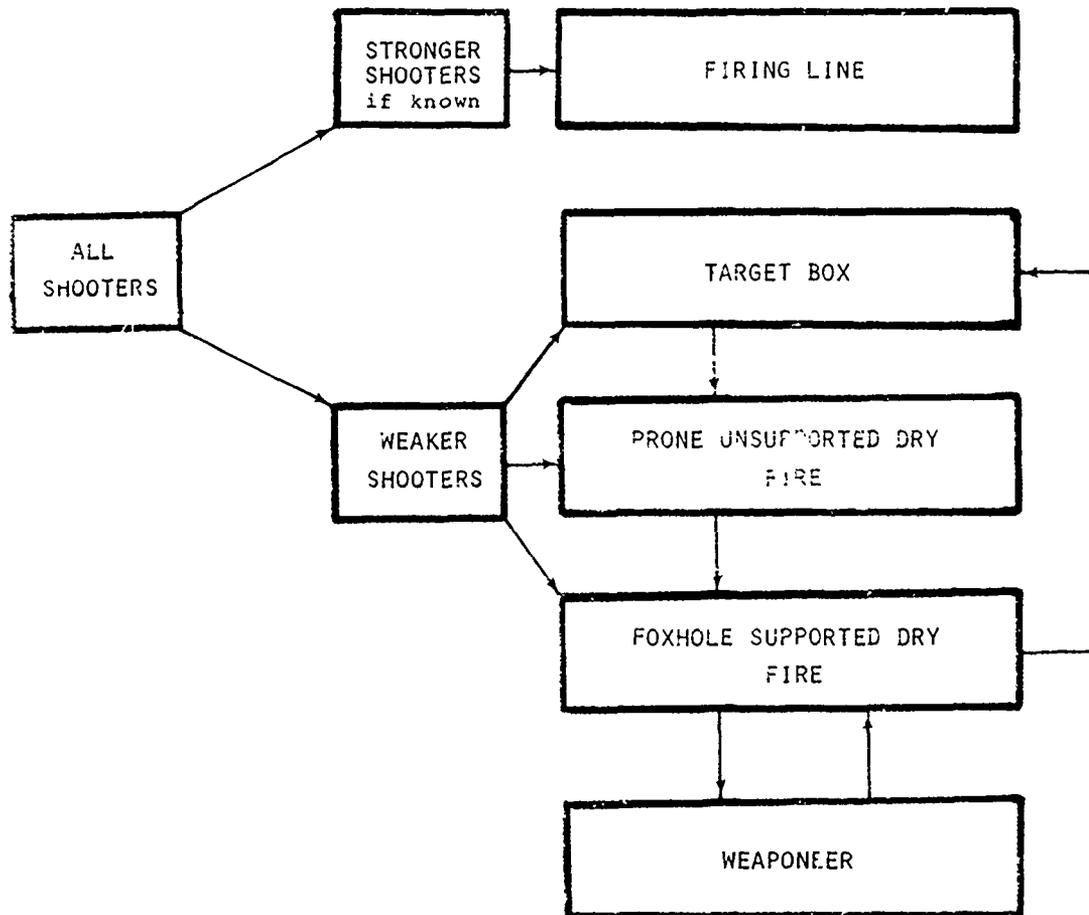


Figure 2. General approach for using Weaponeer during BRM training. Three or more instructors, one of whom is assumed to be the Weaponeer instructor, are required. Stronger shooters (if known) make up the first firing order(s), allowing weaker shooters time to practice their fundamentals in concurrent training. Two weaker shooters are rotated continuously into Weaponeer. On completing Weaponeer diagnosis, shooters return to remedial training designed to correct their shooting problems. When the first firing order is finished firing, stronger and weaker shooters exchange places.

Screening soldiers for Weaponeer diagnosis. While it would be best if all soldiers were diagnosed early on Weaponeer, this is normally not possible for larger companies or where only one Weaponeer is available. Therefore, some screening usually must occur on the firing line.

On completing firing, all soldiers should turn in their targets to be scored. This normally is done during Period 4, "Practice Firing: Zero", but performance records also need to be kept during Period 3, "Fundamentals of Shooting: Live Fire." (For more information on the current BRM program, contact USAIS, Attn: ATSH-I-V-SD, Fort Benning, Georgia 31905). During Period 3, shooting ability should be judged on two criteria: (a) tightness of each 3-round shot group; (Are shot groups small enough to fit inside a 4-centimeter circle?); and (b) general location (Do the shot groups reflect a consistent point of aim?). During Period 4, zeroing is the only important criterion. After targets have been evaluated, soldiers should be divided into two groups--those soldiers that require (further) Weaponeer diagnosis and those that do not.

Labeling soldiers requiring Weaponeer diagnosis. The next step is to label those soldiers requiring Weaponeer diagnosis. This may be accomplished by marking soldiers' helmets with chalk as they come off the firing line. Chalk marks may be placed on weaker shooters' helmets. However, it may be better to mark stronger shooters' helmets, that is soldiers who do not require Weaponeer diagnosis. This practice would make it easy to reinforce good shooting with praise. Praise builds confidence and improves morale, while focusing too critically on weak shooting can have just the opposite effect.

Routing soldiers requiring Weaponeer diagnosis. During Period 3, weaker shooters should be sent to concurrent training for Weaponeer diagnosis and remedial training. Stronger shooters also may benefit from concurrent training, although time constraints may limit their use of Weaponeer. During Period 4, the best shooters, identified during Period 3, should make up the initial firing order(s). Weaker shooters should go directly to concurrent training. This will permit weaker shooters more time to practice their fundamentals and increase the likelihood that they will achieve good results on the firing line. Also, having a firing order composed solely of weaker shooters may serve to improve the instructor-to-trainee ratio, while signalling range personnel and company cadre to provide those firing as much help and encouragement as possible. Additionally, it would permit the use of stronger shooters as coaches. Individuals who have not zeroed can be coached either on the firing line or in the concurrent training area.

Soldiers in concurrent training should rotate among the three remedial training areas. If Weaponeer is set up to support training in the foxhole supported position, soldiers sent to Weaponeer should be drawn from among those who have completed foxhole supported dry fire training. If Weaponeer is set up to support training in the prone unsupported position, soldiers sent to Weaponeer should be drawn from among those who have completed prone unsupported dry fire training. This should enable the Weaponeer instructor to spend a minimum amount of time correcting soldiers' firing positions, something that can and should be done off Weaponeer.

Initially, two individuals should be sent to Weaponeer. While one is being diagnosed, the other should watch and learn. As soon as the first soldier is

told what his (or her) problem is, the second should take his (or her) place. The first soldier should then return to the foxhole supported dry fire training area (or depending on the position of Weaponeer, the prone unsupported dry fire training area), signalling the trainer to send the next soldier to Weaponeer. Having the soldier return to the foxhole supported dry fire training area avoids the confusion that may result if soldiers were sent to concurrent training areas other than those from which they came. It also would provide the soldier the chance to start working immediately with a trainer (or coach), while doing remedial exercises designed to correct his (or her) particular shooting problem(s) (see Table 1, p. 14).

Record keeping. After a soldier has been diagnosed, the Weaponeer instructor should use the Shooter's Table shown in Appendix G (p. 80) to record any shooting problems that were noticed. At the end of the day, the Weaponeer instructor should total the number of soldiers diagnosed and the number of checks in each column. The instructor should then record these totals in a Weaponeer Instructor's Table, also shown in Appendix G (p. 81). Finally, the instructor should turn the Shooter's Table over to company cadre. Prior to the next BRM period, the Shooter's Table can be used to determine (a) who should go directly to the firing line and who should spend more time in remedial training; and (b) what shooting problems particular soldiers have. It can also be used to help keep track of weaker shooters throughout the program. Some feel that when a weak shooter (eventually) zeros his (or her) shooting problems have been solved. This is a mistake. Unless weaker shooters are identified early and helped throughout the program, chances are they are going to have shooting problems when they get to record fire.

Handling time constraints. Diagnosis on Weaponeer should involve less than 5 minutes per soldier to complete. More or less time may be spent depending on the number of soldiers that must be diagnosed, the number of problems a soldier may demonstrate, the ease of diagnosing those problems, and so on. Diagnosing an average of 15 to 20 soldiers per hour means that 60 to 80 soldiers could be diagnosed during Period 3 alone. Of course, all weak shooters in most companies could be diagnosed (and rediagnosed) if more than one Weaponeer were made available. If time is not available to diagnose all weak shooters during Period 3, arrangements sometimes can be made to use Weaponeer in the company area that evening. If this is not possible, any remaining weak shooters should be diagnosed and sent to the appropriate remedial training area prior to firing at Period 4.

Using Weaponeer at both Periods 3 and 4 should allow enough time to test and retest some of the worst problem shooters. As a result, diagnoses should be more accurate. Presumably, retesting would occur after normal Weaponeer testing had been completed and after those to be retested had worked in remedial training areas to correct their shooting problems.

Guidelines for prescribing appropriate remedial training. Prescribing and ensuring that soldiers receive appropriate remedial training is the responsibility of company personnel, not the Weaponeer instructor. Remedial training must occur during Periods 3 and 4 to give soldiers as much time as possible to correct their particular shooting problems before attempting to zero. It must then continue throughout the program to help ensure outstanding shooting at record fire.

Table 1 presents one approach toward handling particular shooting problems through the assignment of soldiers to specific remedial training areas. Note that soldiers diagnosed as having more than one shooting problem spend the majority of their time in dry fire training. Recommendations on how to conduct dry fire training as well as other remedial training exercises appear in Appendix F (p. 68).

Table 1
 Guidelines on Prescribing Remedial Training
 for Particular Shooting Problems

<u>Shooting Problems By Fundamental</u>	<u>Prescribed Training</u>
<u>Steady Position</u>	
Foxhole	Foxhole Supported Dry Fire
Prone	Prone Unsupported Dry Fire
<u>Aiming</u>	
Consistency	Target Box (or Dry Fire with M16A1 Sighting Device)
Sight Picture	Target Box (with M15A1 Aiming Card)
<u>Breath Control</u>	
	Foxhole Supported Dry Fire (or Prone Unsupported Dry Fire)

(Continued)

Table 1 (Continued)

Shooting Problems By Fundamental

Prescribed Training

Trigger Squeeze

Prone Unsupported Dry Fire (or
Foxhole Supported Dry Fire) with
Dime-Washer Exercise (Optional).
Also, see Ball-and-Dummy
Exercise (Appendix E, p. 76).

Combination of above

Foxhole

Foxhole Supported Dry Fire

Prone

Prone Unsupported Dry Fire

Two Instructors

A minimum of two instructors, one of whom operates Weaponeer and one of whom conducts remedial training, are needed to use the device reasonably efficiently. With only one instructor, soldiers' time typically is wasted waiting in line or training inefficiently. Weaponeer diagnoses tend to be rushed and inaccurate. Or, accurate diagnoses tend to take longer than they should.

Working alone, the Weaponeer instructor also is frequently forced to make training decisions that he should not have to make. For example, if a soldier is unable to assume a good foxhole supported position, general unsteadiness almost always results. This unsteadiness makes it difficult to determine if the soldier has a point of aim, trigger jerk, and/or breathing problem, or if unsteadiness is the source of all his (or her) problems. If the Weaponeer

instructor takes the time to demonstrate the foxhole supported position and correct the soldier's unsteadiness, he is wasting time doing something that can and should be done off Weaponeer. If he does not, he wastes time trying to diagnose the shooter's problem(s) accurately.

With two instructors, one instructor can check soldiers to see if they (a) know the correct sight picture, and (b) can assume a good foxhole supported position (or prone unsupported position) before they are allowed time on Weaponeer. The instructor can then help the soldier correct his (or her) shooting problem immediately or assign a stronger shooter to work with him (or her).

Summary

Getting the most out of Weaponeer means using it for diagnostic purposes and using it on a continuing basis early within the training cycle. Remediation should be conducted in concurrent training areas situated in close proximity to Weaponeer. A minimum of two instructors, one serving on Weaponeer, are required to use the device efficiently.

What to do During Diagnosis

Diagnosis begins by paying attention to shooting results. The Weaponeer instructor should always keep in mind that the goal of marksmanship training is to get soldiers to hit targets consistently. Although this may seem an obvious point, it is easy, even for an experienced instructor, to get sidetracked and emphasize shooting techniques more than results. It is important to pay attention to results first and techniques (i.e., position of feet, non-shooting hand, etc.) second. If shooting performance (the end result) is satisfactory, there is no need to correct slight deviations from standard technique.

Weaponeer aids diagnosis by providing a controlled environment for the shooter. Under these conditions, some soldiers may not demonstrate the shooting problems which appear during live-fire training. In other words, the "problem" shooter may shoot well on Weaponeer. This should indicate to the instructor that the source of the shooter's difficulties extend beyond knowledge of technique and physical ability to apply these techniques.

The ability of some soldiers to shoot well on the Weaponeer, as compared to the range, is important information. It indicates that the shooter's problem is related to the rifle or range conditions. If the soldier shoots well on Weaponeer and very poorly on the range, his (or her) rifle should be checked and fired by an expert shot. If the rifle is not defective, it is quite possible that the soldier is failing to cope with the stress of live-fire conditions. This information is sometimes disregarded by the instructor who assumes a shooting problem when none is demonstrated. This can lead to over-correction and may confuse the soldier more than help him (or her). It also may induce more anxiety in the shooter when anxiety already is the main problem.

Five-Step Program for Diagnosis

The objective of Weaponeer diagnosis is to identify the soldier's basic shooting problems in the shortest time possible. The successful accomplishment of this objective depends to a great extent on the motivation, knowledge, and skill of the Weaponeer instructor to implement the following five-step program.

Step 1: Tell the soldier to assume a good foxhole supported position.

Step 2: If excessive movement is shown by the light dot (see Figures 4 - 8, Pp. 23 - 28), check the basic techniques of steady position (see Appendix E, p. 61). The instruction received prior to Weaponeer use should greatly

facilitate this step, thereby requiring a minimum amount of time. If the soldier can not assume a steady foxhole supported position, summarize and record his (or her) problem, and send him (or her) back immediately to the foxhole-supported dry fire remedial training area.

Step 3: Check the soldier's shooting performance, fundamentals, and techniques. Once a steady position has been established, the trainer should:

(a) tell the soldier to fire one 3-round shot group at the center of mass of the 250-meter target;

(b) observe the shooter, letting him (or her) fire without interruption, looking for proper application of shooting fundamentals and their associated techniques (see Table 6, p. 71);

(c) check the tightness of the shot group (In checking the tightness of the shot group, use the clear plastic "circle" overlay found in Appendix H, p. 82. The circle is a scaled version of the 4-centimeter zeroing circle on the 25-meter zeroing target. A shot group that fits inside this circle, regardless of where it appears on the screen, is indicative of good shooting. A shot group which is well off center of mass--e.g., more than 3 "clicks"--suggests that the soldier is not using the correct sight picture. However, a tight shot group slightly off center of mass--e.g., less than 3 "clicks"--may result from differences in soldiers' zeros on Weaponeer.);

(d) replay each shot to check for problems of steadiness, aiming, or trigger jerk.

Step 4: Confirm your diagnosis, having the soldier fire three shots using replay after each shot. Using replay after each shot can provide additional diagnostic information. For example, it interrupts the soldier momentarily and

forces him (or her) to take up a new point of aim after each shot. Point of aim problems are diagnosed more easily by checking the consistency of the soldier's aim from one shot to the next. Having the soldier prepare to make three separate shots also increases the chances of detecting a breathing problem, if one is present. Breathing problems are virtually impossible to diagnose accurately using replay alone. The problem is that they tend to be indistinguishable from general unsteadiness. However, checking the light dot on the screen, while the soldier is aiming, may facilitate diagnosis of breathing problems. Breathing sometimes appears as a slow, rhythmical movement of the aiming point as the soldier prepares to shoot.²

The purpose of using replay in this fashion is to diagnose shooting problems. Although the soldier may look at the screen after each of these shots, the Weaponeer instructor should not take the time to explain the operation of the replay or how to interpret it. All the soldier needs to know is what his (or her) shooting problems are, not how you know what they are.

Step 5: Summarize and record the soldier's basic shooting problems, and send him (or her) back to concurrent training. In summarizing and recording a shooter's problems, the Weaponeer instructor must be careful not to over-analyze. It is important to recognize that good shooting results may be achieved even though minor shooting techniques are violated. Giving too much attention to the smallest errors wastes time, complicates existing problems, and generally confuses the soldier.

²The usual way to detect a breathing problem is to check the soldier's back and ribs for slight, rhythmical movements as he (or she) prepares to shoot.

Tips on the Use of Specific Weaponeer Features During Diagnosis

250-meter target. Weaponeer should be zeroed once at the beginning of the day to produce a center of mass hit on the 250-meter target. The clear plastic "target" overlay, found in Appendix H, p. 82, is provided to facilitate zeroing. To zero Weaponeer, fire a 3-round shot group at the center of mass of the 250-meter target using the standard rear sight (not the long range sight). Then, place the 250-meter target on the overlay over the 250-meter target on the Weaponeer video screen. Check to see if the shot group on the screen is centered within the scaled zeroing circle. If it is not, adjust the Weaponeer sights. Fire at least one additional 3-round shot group to confirm your zero.³

Print. Printouts are time consuming. They should not be used during diagnosis.

Recoil. It may be beneficial to set recoil at MAX. This may increase the chances of detecting a trigger jerk or flinching problem, if one is present.

Misfire. Misfire may be used to diagnose trigger jerk or flinching problems (see Appendix F, ball-and-dummy exercise, p. 76), but it is unnecessary given the ease with which trigger jerk problems normally are diagnosed on Weaponeer.

Sound (headset). Soldiers must learn to fire their weapons while wearing helmets. However, the headset on Weaponeer is too large to be worn under a helmet. As a result, the question arises whether it is better to diagnose soldiers wearing helmets (headset off) or not wearing helmets (headset on).

³For information on zeroing the tactical Weaponeer, see Appendix B, p. 48.

Until this problem with the headset is corrected, we recommend having soldiers wear their helmets during Weaponeer diagnosis. When firing live rounds, soldiers are required to wear earplugs. The sound of Weaponeer, without headset, closely resembles the sound of live fire heard through earplugs.

Replay. Figure 3 (left) shows a single shot ("A") as it would appear on the Weaponeer video screen. The diagram on the right illustrates how that shot looks on the replay. The replay shows the movement of the shooter's aiming point during the 3 seconds immediately prior to firing. This movement is depicted by a sequence of 15 light dots. In Figure 3, the dots are numbered in order showing a general right to left and up and down movement. The shot location, or last light dot, is labeled "A".

Interpreting a replay is not easy. The amount, rate, direction, and pattern of movement show great variation. We can not always be 100% certain about the meaning of a replay. On the other hand, it is possible to be reasonably certain about the interpretation of most replay patterns. It also is possible to improve accuracy of diagnosis with study and practice.

Analysis of the replay can provide the following information:

- (a) The amount of rifle movement is indicated by the number of dots which can be seen--the greater the number, the greater the amount of movement.
- (b) The rate of rifle movement can be estimated by the distance between successive dots--the greater the distance, the greater the rate of movement.
- (c) The direction of rifle movement--up, down, left, right--is displayed by the sequential appearance of dots.
- (d) The total pattern of rifle movement is indicated by the arrangement of the dots--diagonal, looping, crisscrossing, etc.

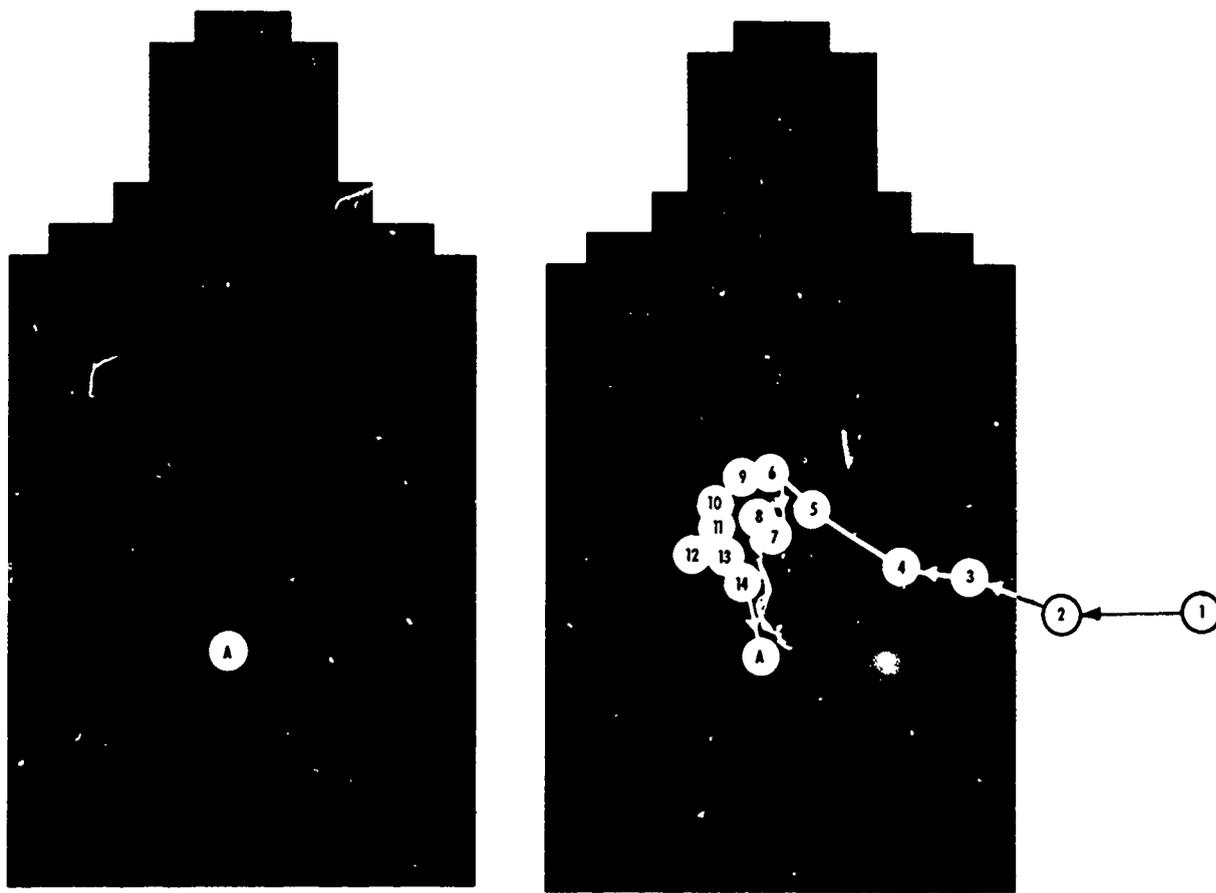
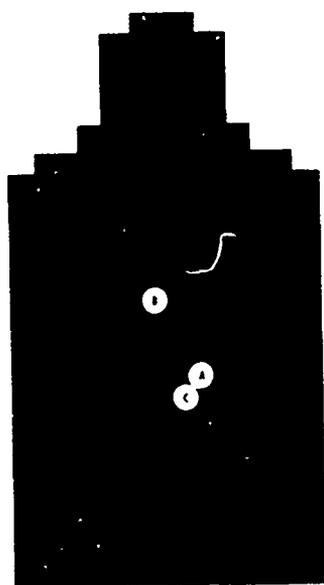


Figure 3. Single shot with replay as seen on video display screen.

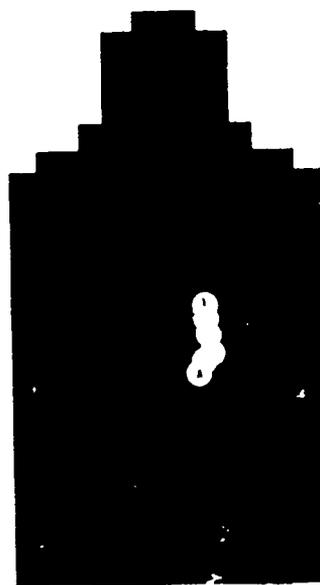
The following illustrations of 3-second replays are provided with a discussion of how to interpret them. These illustrations are provided as a guide for diagnosis.

Figure 4 shows a target with a 3-round shot group at its center of mass. The replays of shots A and B indicate that the soldier is properly applying all shooting fundamentals. The replay of shot C suggests slight unsteadiness, but

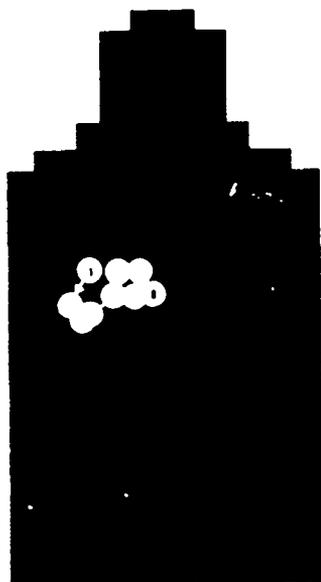
not enough to indicate a problem. The dots cluster about the center of mass of the target with little separation between them. This soldier should be reinforced with praise for good shooting.



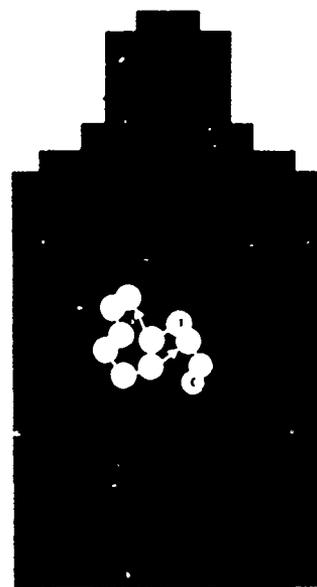
Shot Group



Shot A



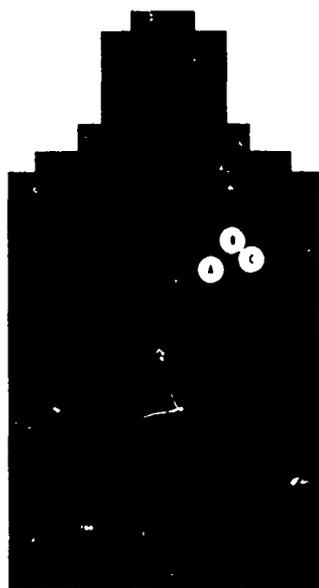
Shot B



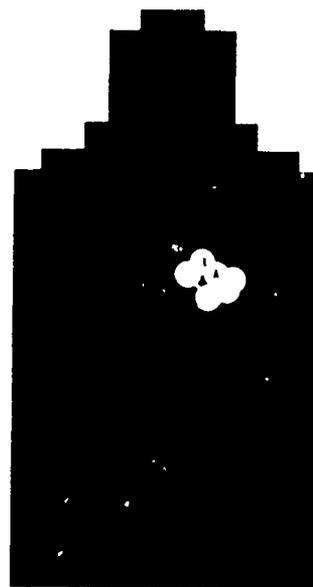
Shot C

Figure 4. Replays showing 3-round shot group at target's center of mass.

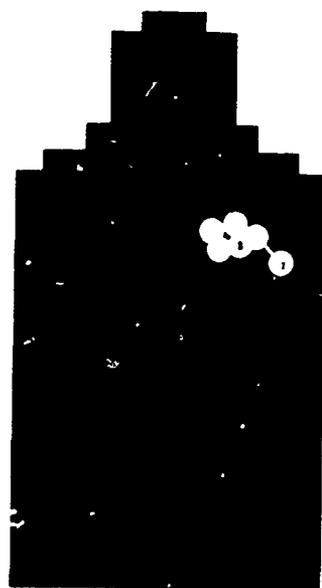
Replays of the three shots in Figure 5 suggest that the soldier has no shooting problems. Shots are well grouped. However, the aiming point is consistently high and right. This probably indicates an improper zero, but the soldier should be checked to see if he (or she) knows the correct sight picture.



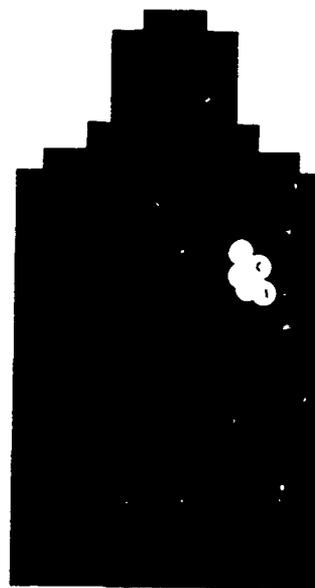
Shot Group



Shot A



Shot B



Shot C

Figure 5. Replays showing probable weaponeer zeroing problem.

Figure 6 shows a relatively tight shot group, but the replays of these shots suggest that they were the result of chance, not skill. All three shots reveal some unsteadiness and lack of consistency in point of aim. Also, the large gap between the last two dots in both shots A and B indicate that the firer has a trigger jerk or flinching problem. Trigger jerk or flinching problems are easy to diagnose on Weaponeer because their effects are easy to see. Furthermore, soldiers that have these problems tend to make them repeatedly. No trigger jerk or flinching problem is apparent in shot C. However, the dots tend to drift down just before the shot was fired. This type of pattern typically emerges when a soldier shifts his (or her) attention away from his (or her) aiming point just as the shot is fired. For example, a soldier trying to correct a trigger jerk or flinching problem may start concentrating on squeezing the trigger, rather than jerking it, and momentarily stop attending to his (or her) point of aim.

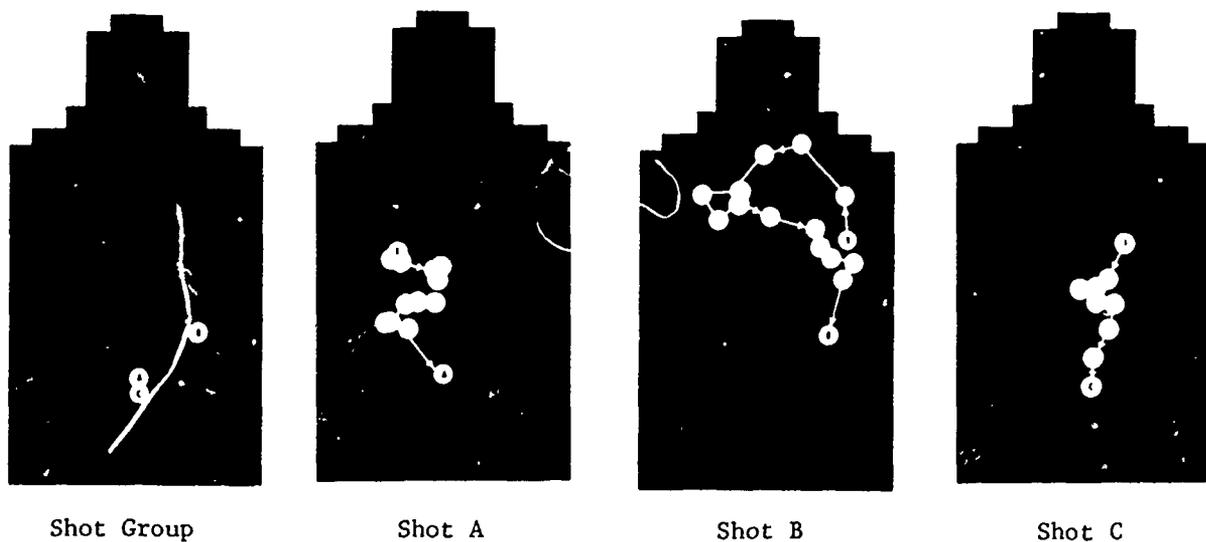
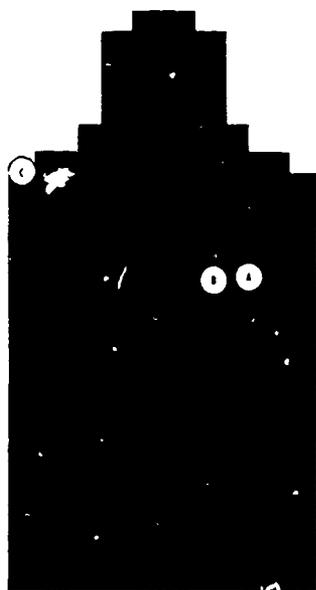
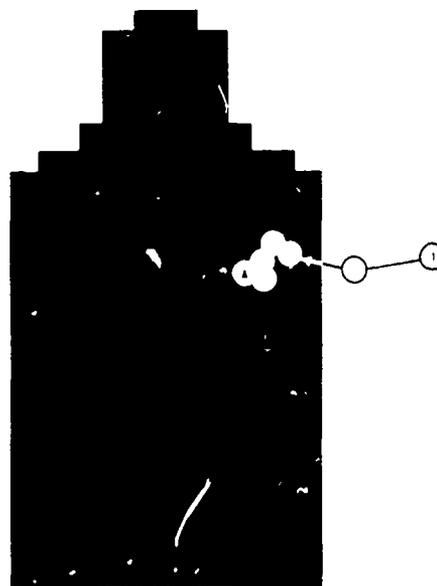


Figure 6. Replays demonstrating trigger jerk, unsteadiness, and inconsistent point of aim.

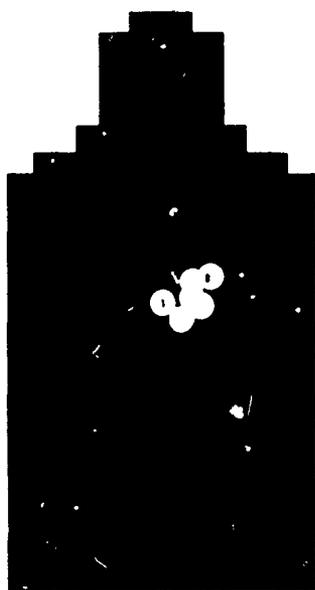
The next shot group, seen in Figure 7, illustrates a point of aim problem. Dots cluster in different locations on the target. No other problem(s) is/are apparent in the replays.



Shot Group



Shot A



Shot B



Shot C

Figure 7. Replays showing a point of aim problem.

At first glance, the replays seen in Figure 8 appear to reflect unsteadiness. This is not the case. Dots cluster together tightly immediately before the shots are fired. Replays B and C suggest that the firer moved his

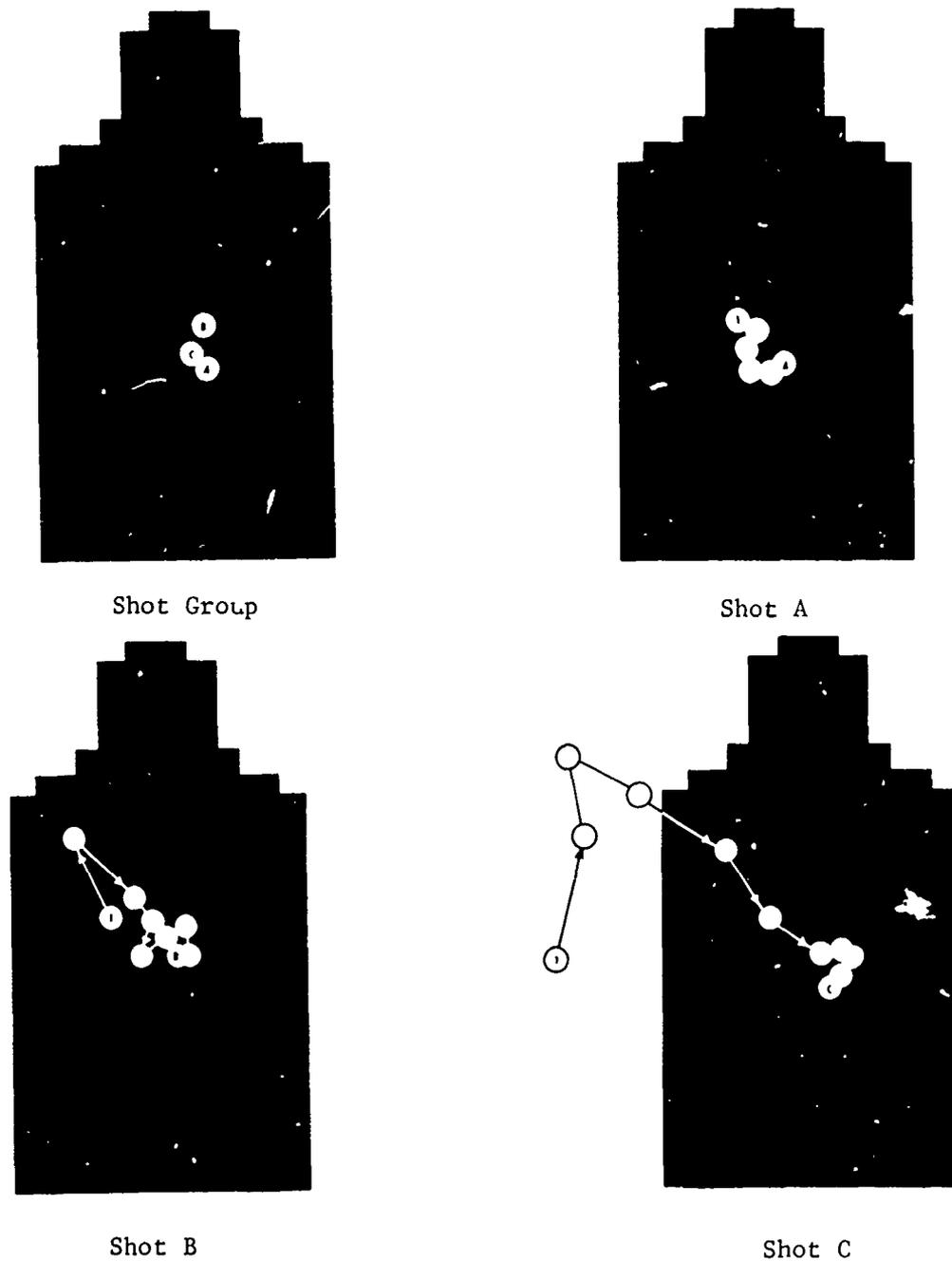


Figure 8. Replays suggesting unsteadiness when unsteadiness is not present.

(or her) point of aim rapidly to the target's center of mass, steadied the weapon, and squeezed the trigger. Replays like B and C usually are seen following a sequence of shots and do not indicate a shooting problem.

POTENTIAL OTHER USES FOR WEAPONER

Use of Weaponer to date has been restricted largely to diagnosing and remediating shooting problems during BRM training. There has been some attempt to upgrade soldiers' performance at record fire by having them shoot the random raise exercise, but few attempts have been made to develop alternative uses for the device. Several potential other uses for Weaponer are described in this section. These potential uses apply to BRM, ARM, and/or unit training, and are summarized in Table 2.

Table 2

Potential Other Uses of Weaponer in BRM, ARM and/or Unit Training

<u>BRM</u>	<u>ARM</u>	<u>Unit (Reserve & NG)</u>
o Proficiency Testing Weaponer Instructors	o Diagnosing Advanced Shooting Positions	o Maintaining Readiness
o Diagnosis in the Prone Unsupported Position	o Demonstrating Automatic Fire	o Predicting Record Fire Performance
o Substitute for Live- Fire training	o Moving Target Engagement Training	
o Substitute for Missed Training		

BRM Training

Proficiency Testing Weaponeer Instructors

It takes a good deal of skill and knowledge to use Weaponeer effectively. To ensure that individuals selected to serve as Weaponeer instructors are qualified, some preliminary testing is recommended. In terms of firing skills, it is essential that the Weaponeer instructor know how to apply the four fundamentals of rifle marksmanship (see Appendix E, p. 61). In particular, the Weaponeer instructor must be able to zero Weaponeer and confirm that zero quickly and accurately. This guide can provide the knowledge needed to use Weaponeer effectively. Following the study of this guide, the prospective Weaponeer instructor should know: (a) how to operate Weaponeer (or tactical Weaponeer), (b) how to use Weaponeer in conjunction with concurrent training, (c) how to spot violations of the four fundamentals of rifle marksmanship, (d) how to perform the five-step program for diagnosis, and (e) how to fill out the Shooter's Table and Weaponeer Instructor's Table found in Appendix G (p. 79).

Diagnosis in the Prone Unsupported Position

BRM training emphasizes two firing positions--the foxhole supported and prone unsupported positions. Virtually all Weaponeer diagnosis is currently being conducted in the foxhole supported position. Since firing from the prone involves skills that differ from those involved in firing from the foxhole, and since 50% of the rounds fired in record fire are shot from the prone, it would be beneficial to use Weaponeer to diagnose firers in the prone unsupported position. Perhaps the most efficient approach toward conducting this diagnosis

would be to work with soldiers after they begin showing signs of mastering the foxhole supported position (e.g., Period 5). The foxhole supported position is seen as having initial priority because it is the position from which soldiers zero.

Substitute for Live-Fire Training

Another potential use of Weaponeer during BRM training is as a substitute for live-fire training. There are occasions when training on a range is not possible. This may be due to inclement weather conditions, for example. Alternatively, training on Weaponeer may be perceived as being highly desirable for safety or cost reasons (e.g., ammunition). In such cases, Weaponeer might be used to provide simulated live-fire training.

It should be evident that any extensive use of Weaponeer for substitute training necessitates the use of considerably more Weaponeers than the Army now possesses. For example, if each soldier were given 20 minutes of Weaponeer time, it would take 10 Weaponeers and 8 hours to train a company of 240 soldiers.

Substitute for Missed Training

A related use of Weaponeer would be as a substitute for missed training. This, of course, would involve relatively small numbers of soldiers and could, therefore, be conducted with fewer Weaponeers. Given the current high demand for the device, it probably should not be tried until more Weaponeers become available.

ARM Training

Diagnosing Performance from Advanced Shooting Positions

Weaponeer can be set up to allow soldiers to fire in a variety of advanced shooting positions. These include the foxhole unsupported, standing, kneeling, and prone positions. Weaponeer would provide a good means for diagnosing shooting problems from these positions.

Demonstrating Automatic Fire

Weaponeer is capable of automatic fire and may be effective in demonstrating the problems involved in aiming automatic fire (see Dyer, Mroczkowski, & Tull, 1977). Demonstrations probably would be best conducted in small groups, with some time allowed for individual practice following the demonstrations.

Moving Target Engagement Training

Spartanics, Ltd., the manufacturer of Weaponeer, has developed a moving target Weaponeer which may prove an important aid for moving target training. The Moving Target Rifle Marksmanship Trainer (MTMT) is similar in appearance to Weaponeer, except that it includes 50-, 100-, 150-, and 250-meter scaled silhouette targets capable of simulating movement rates of 0, 1, 2, or 3 meters per second.

As suggested, an important problem in all marksmanship training is to provide soldiers with precise knowledge of shooting results. This problem is particularly difficult to overcome when training soldiers to shoot moving targets. At least initially, misses tend to outnumber hits. MTMT's feedback capability makes it an excellent tool for detecting, and possibly, correcting problems soldiers experience when engaging moving targets.

Unit Training

Use of Weaponeer in unit marksmanship training is particularly relevant since live-fire ranges are often inadequate or unavailable. This is particularly true within U.S. Army, Europe (USAREUR) where only a few outdoor facilities exist capable of satisfying marksmanship training and record fire requirements (e.g., Wildflecken, Baumholder, Hohenfels). Typically, reserve and National Guard units also must endure time and cost burdens because of the need to transport and billet troops at remote training locations.

Maintaining Readiness

One potential use of Weaponeer at the unit level would be to maintain readiness. Marksmanship skills, like other skills, require practice. Refresher training on a simulator is one way to maintain skills or even improve performance. Little is known about how to use Weaponeer for refresher training. However, if performance is going to improve significantly, it is likely that Weaponeer must be made regularly available to troops, not just on an occasional basis.

Predicting Record Fire Performance

Another potential use of Weaponeer in units is as a predictor of record fire performance. Our research (Appendix C, p. 49) strongly suggests that commanders may be able to use Weaponeer to predict which soldiers will qualify and which soldiers will fail to qualify at record fire. If this turns out to be the case, weak shooters can receive remedial training in advance of going to record fire. If predictions are accurate enough, performance on Weaponeer also may be used as a substitute for (some) record fire. Used in this manner, significant time and cost savings are likely to result.

SUMMARY

This guide was written for all personnel involved with the use of Weaponeer. This includes those concerned with marksmanship training and those involved in Weaponeer purchase decisions.

Problems affecting the use of Weaponeer are described. These include: (a) limited supply of Weaponeers and high demand for their use; (b) over-reliance on Weaponeer as a cure-all for shooting problems; and (c) lack of a standardized set of procedures for using Weaponeer. An approach for overcoming these problems is then recommended. It involves using Weaponeer on a continuing basis as an aid to diagnosis during the early periods of BRM training. Soldiers diagnosed on Weaponeer engage in remedial training exercises off Weaponeer to correct their shooting problems.

Detailed procedures for using Weaponeer with conventional marksmanship exercises to diagnose and remediate BRM soldiers' shooting problems are presented. Other potential uses of Weaponeer during BRM, ARM, and unit training also are reviewed. Appendices include a description of Weaponeer and tactical Weaponeer, a summary of the research which has been conducted to test and evaluate Weaponeer, and an overview of how Weaponeer currently is used Army-wide.

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APPENDIX A

Major Components and Operation

What are the Major Components of Weaponeer?

Rifle. The Weaponeer rifle is a standard M16A1 which has been modified and is non-restorable. Recoil is simulated by the operation of a recoil rod (see Figure 1, p. 2) which attaches to the barrel of the rifle. The sound of the rifle is transmitted through a headset (see Figure 1, p. 2).

Target assembly. The target assembly is connected to the range (see Figure 1, p. 2) and contains three targets. They are a scaled 25-meter zeroing target, a scaled 100-meter E-silhouette target, and a scaled 250-meter E-silhouette target.

Console. The console contains the control panel, a video display screen and a printer. A remote control box may be used to operate some major functions of the console.

How Does Weaponeer Work?

Weaponeer uses no live ammunition. It operates on 115 volts AC, 60 Hertz and functions as follows. A target sensor mounted on the rifle barrel receives infrared light from a light emitting diode contained on each target. When the rifle is aimed and fired, this sensing system provides information on target acquisition and shot location which is processed by a computer in the console. This shooting information is displayed on a video screen and may be reproduced on a target printout.

How Do You Operate Weaponeer?

Rifle. The Weaponeer rifle is loaded and fired in the same way as the standard M16A1 rifle. Three types of magazines may be used. These include two "unlimited" fire magazines (computer memory is limited to 32 shots), a 20-round magazine, and a 30-round count magazine which may be set to limit the rounds fired from one to 30.

The upper right-hand side of the console control panel contains the dials and pushbutton switches for the recoil, sound, and misfire functions (see Figure 9, p. 39). The recoil force may be varied from an energy of zero to a force about 40% greater than the normal recoil of the standard M16A1 rifle. Sound also may be varied in intensity from 115dB up to a level of 135dB. Pressing the misfire button causes the rifle to simulate firing a defective round. No recoil or sound results, but the shot is recorded. Immediate action must be performed to clear the system and permit further firing.

Target assembly. The left-hand side of the console control panel contains the dials and pushbutton switches for the operation of all target functions. Targets are displayed one at a time by depressing the appropriate button. The silhouette targets (1 and 2) may be programmed to fall when hit by pressing the kill button. Exposure time may be varied from 2 to 30 seconds for the 100-meter target and from 4 to 30 seconds for the 250-meter target. In addition, a random raise exercise may be initiated which automatically causes a target individually, or a 50/50 random mix of targets 1 and 2, to raise 1 to 8 seconds after dropping.

Console. The console contains the control panel, a video display screen, and a printer.

The control panel, seen in Figure 9, contains the dials and pushbuttons which energize and operate the various features of Weaponeer.

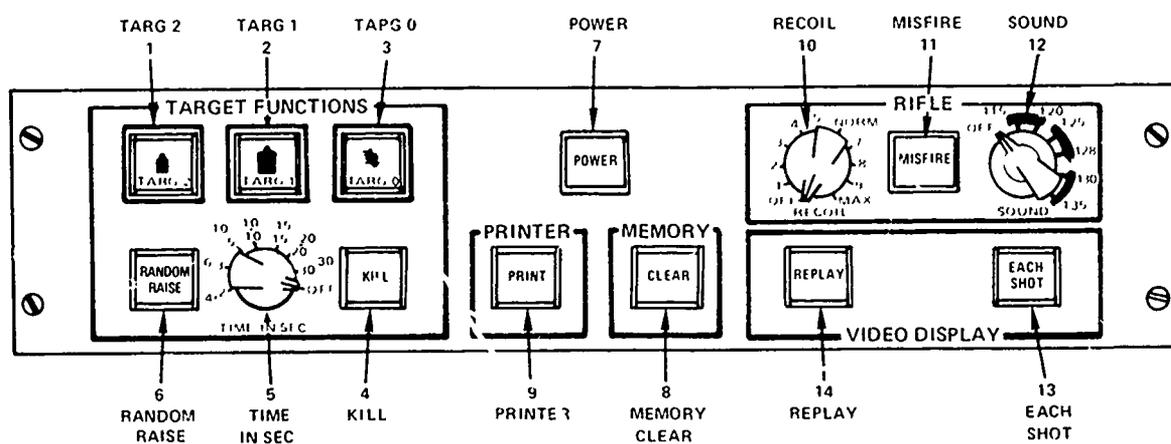


Figure 9. Control panel.

The remote control box, seen in Figure 10, may be used to operate some of these same features while working directly alongside the shooter.

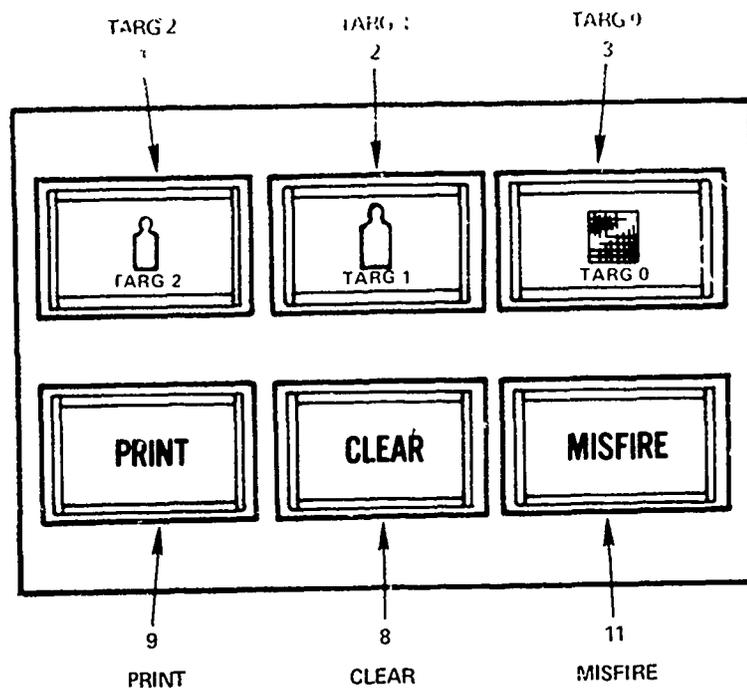


Figure 10. Remote control box.

The name and the function of the controls found on the control panel and remote control box are summarized in Table 3. The Weaponeer instructor should acquire a thorough knowledge of the basic functions and operations of Weaponeer presented in this section before proceeding to other sections of this guide.

Table 3

Name and Function of Weaponeer Controls

<u>Name</u>	<u>Function</u>
<u>Target Functions</u>	
Target 2	Pushbutton switch that controls the 250-meter target.
Target 1	Pushbutton switch that controls the 100-meter target.
Target 0	Pushbutton switch that controls the zeroing target.
Kill	Pushbutton switch that enables the target to drop when hit.
Time in sec	Rotary switch that sets time (in seconds) for target exposure. The outside time (green) indicates exposure time for target 2; the inside time (black) indicates exposure time for targets 1 and 0.

(Continued)

Table 3 (Continued)

<u>Name</u>	<u>Function</u>
Random Raise	Pushbutton switch that enables any target individually, or targets 1 and 2, randomly selected, to raise automatically 1 to 8 seconds after a target drops.
<u>Power</u>	Pushbutton switch that energizes Weaponeer (circuit breaker for target assembly on side of assembly).
<u>Memory Clear</u>	Pushbutton switch which, when pressed, erases the target memory.
<u>Printer Print</u>	Pushbutton switch that causes the printer to print the target displayed on the video screen along with information on the firer's performance. The printer can be stopped by pressing the memory clear switch or repressing the print switch.

(Continued)

Table 3 (Continued)

<u>Name</u>	<u>Function</u>
<u>Rifle</u>	
Recoil	Dial that sets the recoil force.
Misfire	Pushbutton switch which, when activated, causes the rifle to misfire. There is no recoil or sound but the shot is recorded. Immediate action must be performed to continue firing.
Sound	Dial, marked in dB, that sets level of sound in headset. The use of sound levels above 120dB should be limited. The cautions (limit of number of rounds to be fired at each setting) are marked on the sound dial.

(Continued)

Table 3 (Continued)

<u>Name</u>	<u>Function</u>
<u>Video display</u>	
Each shot	Pushbutton switch that enables the individual shots to be displayed. Press switch to observe next shot.
Replay	Pushbutton switch that enables the replay of the last 3 seconds of the first shot in memory. Pressing each shot advances the machine to the next shot, then pressing replay displays last 3 seconds of that shot. Only the first three shots may be replayed. If more than 13 shots have been fired, only the first two may be replayed (Naval Training Equipment Center, 1979; Spartanics, Ltd., 1976).

The video display screen shows the shooter's aiming point which appears as a dot, or ball of light. As shown in Figure 11, the screen also displays the selected target and the location of hits (and misses) up to 32 shots. Two unique features of the video display are the replay and each shot controls. When activated, the replay feature shows the movement of the rifle (point-of-aim) 3 seconds prior to firing, while the each shot feature displays the location of each shot fired in the order it was fired.



Figure 11. Illustrative video display

The video display uses the letters shown in Table 4 for scoring.

Table 4

Letters for Scoring on the Weaponeer
Video Display Screen

T.....Target on display: 0 is zeroing target, 1 is 100-meter target, 2 is 250-meter target.

N.....Number of hits. (For zeroing target, all shots on the screen are counted as hits.)

M.....Number of misses.

L.....Registers any shot fired after the target drops. Also, if the time in sec function is on and no shot is fired before the target drops, a late shot is scored.

E.....Shot number when using each shot.

S.....Total number of shots.

The printer provides a printout of the shooter's performance. Printouts for the target on display are produced by pressing the print button.

Figure 12 provides an illustration of printer displays for the 100- and 250-meter targets. Note that scores appear at the bottom of the printout just as they do in the video display.

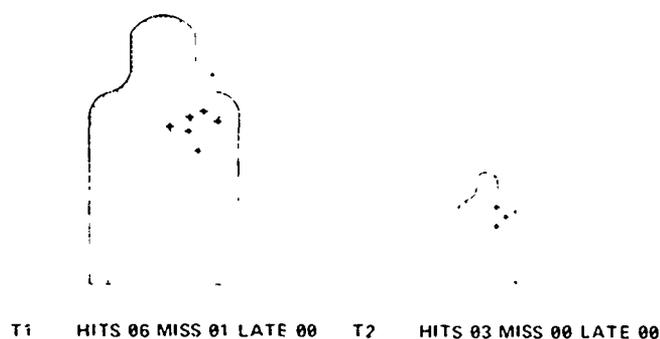


Figure 12. Illustrative printer displays for the 100- and 250-meter targets.

APPENDIX B

Tactical Weaponeer

The tactical Weaponeer differs in few respects from the original Weaponeer. These differences are in the target assembly and console control panel.

Target Assembly

The target assembly on the tactical Weaponeer contains four targets instead of three. They are a scaled 25-meter zeroing target, a scaled E-silhouette target, with superimposed grid lines, like the Army's current 25-meter live-fire zeroing target. This target replaces the Canadian bull target used on Weaponeer. When using this target to zero, place the rear sight on long range. Then, adjust the sights using two clicks for each grid line square (twice the correction for one grid box on the live-fire zeroing target).

Control Panel

Operation of the tactical Weaponeer differs slightly from the operation of the original Weaponeer. The two, scaled 250-meter targets are controlled by a single, two-function pushbutton switch. Exposure time may be varied from 1 to 30 seconds for the 100-meter target and from 2 to 30 seconds for the 250-meter targets. By pressing the random raise button and more than one target button, the tactical Weaponeer will randomly select (raise) one of the enabled targets and hold it up for the period selected on the timer, or until a kill occurs. When a target falls, a 1- or 2-second delay occurs before another target appears. Additionally, the random raise button may be used to initiate the "Q Kill" mode; a mode that provides kill feedback by dropping a target immediately after a hit then reraising the same target within 1 or 2 seconds. This mode is activated by pressing one target, the kill button, and the random raise button.

APPENDIX C

Testing and Evaluation of Weaponeer

Overview

Three major studies of Weaponeer were conducted in 1976 and 1977. In 1976, the Physical Sciences Laboratory of the Naval Training Equipment Center (NTEC) conducted a test of the mechanical reliability of Weaponeer. Their final report (Long, 1976) was completed in August 1976. In October 1977, the United States Army Infantry Board (USAIB) (Stair et al., 1977) completed the concept evaluation test of Weaponeer and Lasertrain systems. The USAIB research included tests of mechanical functioning as well as tests designed to assess Weaponeer's training potential. The third major study of Weaponeer also was conducted in October 1977. The United States Marine Corps, Camp Pendleton, examined the effects of Weaponeer on cost reduction and remedial training for nonqualifiers in their marksmanship program.

Data collection for research on the diagnostic and remedial capabilities of Weaponeer was completed in August 1981 by the Army Research Institute (ARI), Fort Benning, GA. ARI, Fort Benning also has completed the first phase of field experiments on the use of Weaponeer to predict soldiers' record fire performance.

The following sections summarize the procedures, findings, and limitations of testing done to date on Weaponeer.

Safety and Mechanical Reliability of Weaponeer

As part of the Army's procurement process, NTEC conducted tests to assess Weaponeer's acoustical and optical safety and its mechanical accuracy and reliability. It was concluded that, aside from some minor deficiencies,

Weaponeer performed as intended. While sound and recoil did not perfectly simulate the live fire of the M16A1, other features, such as aiming and scoring, were reported to perform exceptionally well.

USAIB also conducted tests of Weaponeer's reliability and maintainability, physical and operational characteristics, safety, adequacy of operating instructions, ease of operation, and human factors aspects. USAIB found Weaponeer safe for its intended use and highly reliable with no major deficiencies or shortcomings.

Weaponeer's Training Potential

As part of the USAIB study, tests were conducted to determine whether Weaponeer could be used to train soldiers effectively in basic rifle marksmanship skills and whether the system could be used to conduct remedial training. Results were positive. USAIB reported that Weaponeer training was as effective as live-fire training in promoting performance on the firing line. They also reported that instructors were able to detect and correct errors in firing position, breath control, trigger squeeze, and aiming point by observing both the firer and Weaponeer's video screen.

Unfortunately, in examining Weaponeer's training potential, USAIB did not include a "no-training" control group, a group having the same amount of pre-experimental training as the experimental groups, but lacking any additional training. Without this group, it is not clear whether the additional training provided experimental groups had any effect on subsequent live-fire performance. That is, all groups may have performed equally because all groups continued to perform at pre-experimental levels. The report also states that Weaponeer is effective in facilitating the detection and correction of firing errors, but it

does not detail how instructors used specific features on Weaponeer to remediate shooting problems.

The Marine Corps (1978) study posed a further test of Weaponeer's capacity to remediate weak shooters. The performance of recruits undergoing the standard Marine remedial training program was compared with the performance of those who received remedial Weaponeer training.

Training on Weaponeer was carried out over a 7-week period and involved a total of 168 soldiers. Each Marine received approximately 30 minutes of "hands on" training, while additional time was spent observing and listening to instruction.

Results appeared to support Weaponeer's use in remedial training, at least under certain conditions. Of those receiving remedial training on Weaponeer (n = 168), 89.9% qualified. Only 78.1% of those receiving the standard program of remediation (n = 151) were able to qualify. The report indicated that weaker shooters appeared to benefit more from Weaponeer remediation than more highly skilled shooters.

The Marine Corps study attempted to determine the effect of receiving Weaponeer remediation on marksmanship performance. It did not deal with the question of precisely what procedures of Weaponeer remediation are most effective. Also, lack of information on methodology and research design makes it unclear whether performance gains by individuals receiving Weaponeer training were the result of training on Weaponeer per se or other factors such as more or better individualized instruction.

In April, 1981, ARI, Fort Benning (Schendel, Heller, & Williams, in preparation) began field research to determine the relative value of diagnosing

and remediating shooting problems on Weaponeer. It was hoped that findings from this experiment could be used to aid in the development and standardization of Weaponeer training programs designed to intergrate with the current BRM POI.

Subjects consisted of 291 initial entry soldiers undergoing BRM training during the zeroing period (Period 4) at Fort Benning, Georgia. Subjects were selected at random from those soldiers who failed to zero in the first 18 rounds.

Nonzeroers were taken from the firing line to a neutral area where they were tested for eye-hand dominance and visual acuity. After testing, soldiers were assigned randomly to one of seven groups. Experimental subjects (Groups 1 - 6) received various diagnostic or remedial programs on Weaponeer but received no other training prior to returning to the firing line; subjects in the control group (Group 7) remained in the neutral area while experimental subjects were trained on Weaponeer, receiving no training of any sort prior to returning to the firing line.

Specifics on how Groups 1 through 6 were trained on Weaponeer appear below: Soldiers in Group 1 were shown the correct sight picture, individually zeroed on Weaponeer by adjusting the rifle sights, diagnosed using shot by shot feedback with replay, and verbally remediated. Soldiers in Group 2 were treated the same as those in Group 1 with the added condition that remediation continued until the soldier put three consecutive shots in a scaled zeroing circle. Those in Group 3 were zeroed by using an adjustment procedure which involved moving the rifle so that point of aim coincided with center of mass of the target. The soldier was then told to use this sight picture. He then received diagnosis and verbal remediation. Soldiers in Group 4 were treated the same as those in Group

3 with the added condition that remediation continued until the soldier put three consecutive shots in the zeroing circle. Those in Group 5 were shown the correct sight picture, and received diagnosis and verbal remediation only. Soldiers in Group 6 were treated the same as those in Group 5 with the added condition that they fired to the three shot criterion with the zeroing circle placed anywhere on the screen. After the experimental treatment, all soldiers, including the control group (Group 7), returned to the firing line where they were given an additional 24 rounds to attempt to zero. Soldiers in the six experimental groups were measured on the number of rounds fired on Weaponeer and total time spent in Weaponeer training. All groups were measured on the number of rounds to zero on the firing line.

Key findings were as follows:

(a) Groups 1, 3, and 5, who were diagnosed using Weaponeer and verbally remediated, averaged 5.24 minutes and 5.77 shots on Weaponeer. Groups 2, 4, and 6, who received additional remedial training on Weaponeer, averaged 7.18 minutes and 9.09 shots on Weaponeer.

(b) None of the experimental groups (Groups 1 - 6) performed appreciably better on the firing line than the control group (Group 7).

(c) More cross-dominant soldiers failed to zero in the firing line than soldiers whose dominant eye and hand were on the same side.

Use of Weaponeer to Predict Record Fire Performance

Two problems which the Army faces in conducting record fire are the low availability of appropriate range facilities (i.e., USAREUR, reserve units) and high costs. These problems prompted the investigation of the use of Weaponeer to predict record fire (Schendel & Heller, in preparation).

Sixty-nine initial entry soldiers undergoing BRM training at Fort Benning, Georgia served as subjects for this research. Subjects were divided randomly into three groups, each being tested twice on a 32-shot scenario. Soldiers receiving the "8-24" scenario, fired eight shots at the scaled 100-meter and 24 shots at the scaled 250-meter targets. Soldiers receiving the "24-8" scenario, fired the reverse pattern. Soldiers receiving the "Random" scenario fired 32 shots at a 50-50 random mix of the two targets. The scaled 100-meter target always was presented for 2 seconds, and the scaled 250-meter target always was presented for 4 seconds. All firing was done from the foxhole supported position. Soldiers rested briefly between the first and second set of 32 shots on a scenario and were provided feedback on the results of their performance only on completing testing.

Record fire occurred 24 to 48 hours after Weaponeer testing. The course-of-fire consisted of 14 F-type (prone) silhouettes seen at 50 (n = 5) and 100 (n = 9) meters, and 26 E-type silhouettes seen at 150 (n = 10), 200 (n = 8), 250 (n = 5), and 300 (n = 3) meters. The first half of this course was shot from the foxhole supported position; the second half from the prone unsupported position.

Results indicated that:

(a) Weaponeer performance is a good predictor of record fire performance. Among the three scenarios tested, the 8-24 scenario proved the best predictor of record fire performance.

(b) Weaponeer's ability to serve as a predictor is enhanced when a soldier's firing position is taken into account. Correlations were higher between performance on Weaponeer and the first half of record fire than between

performance on Weaponeer and the second half of record fire. This effect occurred under each of the scenarios tested and appeared to be due, primarily, to the fact that soldiers fired from the foxhole supported position on Weaponeer and during the first half of record fire.

(c) Weaponeer's ability to serve as a predictor also is improved when soldiers are afforded a second set of 32 shots on the device. That is, correlations generally were higher between performance during the second set of 32 shots on a scenario and record fire performance than between the first set of 32 shots and record fire performance.

More research is being planned to confirm and extend these findings. In this research, an attempt will be made to manipulate the strength of the relationship between Weaponeer performance and record fire performance. In particular, soldiers tested on Weaponeer will (a) fire both from the foxhole supported position and from the prone, and (b) receive varying amounts of training on the device prior to firing the 8-24 scenario.

APPENDIX D

Current Status of Weaponeer

Where are the Army's Weaponeers Presently Located?

Currently, the Army has 28 Weaponeer devices at 11 training installations throughout the United States. The location of these installations and number of Weaponeers each presently uses is listed in Table 5 below.

Table 5

Current Army-wide Distribution of Weaponeers

<u>Installation</u>	<u>Number of Weaponeers</u>
Fort Benning, Georgia	3
Fort Bliss, Texas ⁴	4
Fort Dix, New Jersey	3
Fort Gordon, Georgia	2
Fort Hood, Texas	4
Fort Jackson, South Carolina	3
Fort Knox, Kentucky	2
Fort Leonard Wood, Missouri	3
Fort Lewis, Washington	2
Fort McClellan, Alabama	1
Fort Sill, Oklahoma	1
TOTAL	28

⁴Fort Bliss has 4 Weaponeers which were purchased for testing in 1976. Not all of these devices are currently operated or maintained.

How is Weaponeer Used?

In order to determine how the Army is currently using Weaponeer, we conducted a telephone survey of Weaponeer instructors from eight Army posts. These posts included Forts Benning, Dix, Gordon, Hood, Lewis, Leonard Wood, McClellan and Sili. This survey was conducted in January 1981.

All posts used the Weaponeer in BRM training to diagnose and remediate shooting problems. Other uses such as early screening of all initial entry soldiers to identify weak shooters, training of marksmanship instructors, or reinforcement training for record fire were less frequently reported.

An analysis of the use of specific Weaponeer features revealed that replay, each shot, printer and recoil were used by all surveyed. Only 50% of those surveyed reported using the kill mode, and the automatic and prone position were used in just two of the eight cases. Figure 13 summarizes the reported use of 12 specific Weaponeer features by the eight posts participating in the survey.

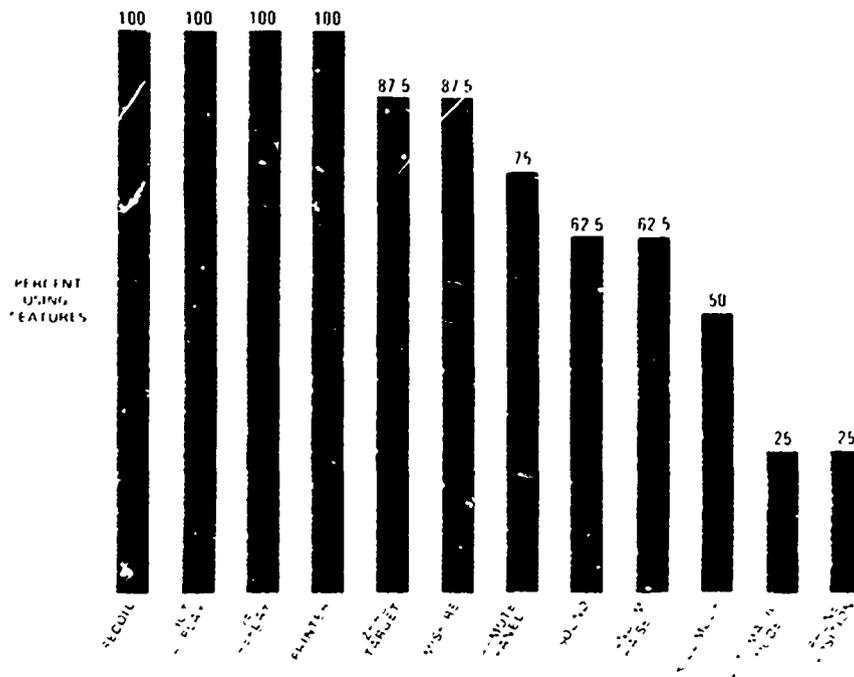


Figure 13. Results of survey on current use of specific Weaponeer features.

How is Weaponeer Used at Fort Benning?

In January 1981, an in-depth analysis of Weaponeer utilization at Fort Benning also was conducted in order to gain greater knowledge of the procedures and problems of Weaponeer training.

Fort Benning currently operates and maintains three weaponeers. One of these devices has been assigned to the Infantry Training Group (ITG), one to the 1st Infantry Training Brigade (ITB), and one to the 2nd ITB. All three Weaponeers can be made mobile by mounting them in trailer trucks, although typically one of them is set up in a permanent facility on the zeroing range where Period 4 is conducted.

As elsewhere, use of the Weaponeer at Fort Benning has been restricted almost entirely to BRM training. At the time of this study, the devices were being used in four training periods. These were Period 4, "Practice Firing: Zero"; Period 6, "Downrange Feedback"; Period 9, "Zero and Timed Fire"; and Period 10, "Combat Firing".

Like other posts, the primary use of Weaponeer at Fort Benning has been to diagnose and remediate shooting problems. Due to time constraints, Weaponeer's use has been restricted to the worst problem shooters.

A second use of Weaponeer at Fort Benning has been "reinforcement" training. The intent of this training is to strengthen and improve fundamental shooting skills, especially as they apply to the demands of record fire. BRM soldiers receiving reinforcement training on Weaponeer may or may not have shooting problems.

Structured observations were made of three Weaponeer instructors as they worked with 26 initial entry soldiers during BRM training at Fort Benning.

These observations were made to determine (1) the extent of Weaponeer use in diagnosing shooting problems, and (2) the type of shooting problems which were most frequently diagnosed.

Findings on the extent of Weaponeer use in diagnosis showed that these instructors diagnosed 24% of all shooting problems without using any Weaponeer features. In these cases, diagnoses were made solely by observing the shooter. Twenty-five percent of the shooting problems identified were diagnosed by a combination of observing the shooter and using one or more Weaponeer features. The remaining 51% of the problems were diagnosed on the basis of Weaponeer feedback alone. Overall, then, the three instructors who were observed used the Weaponeer to diagnose 76% of all shooting problems. These findings are summarized in Figure 14.

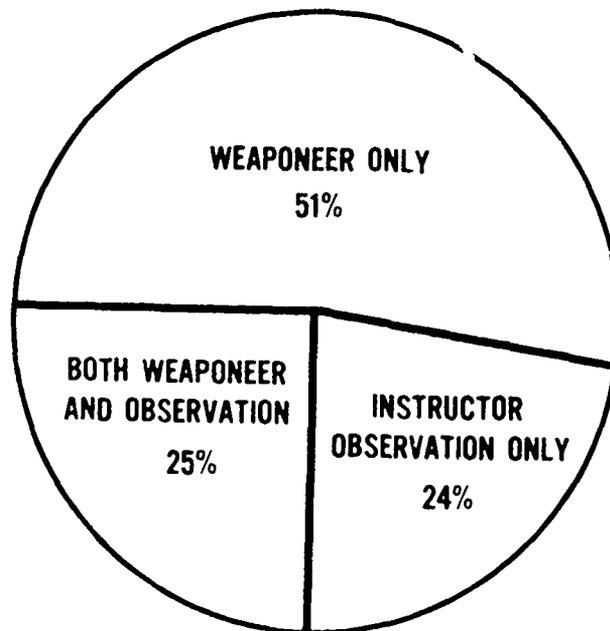


Figure 14. Method of diagnosing shooting problems presented as a percent of all shooting problems diagnosed.

Observations also were made on the type of problems which the Weaponeer instructors identified. Subsequent analyses revealed that the most frequently diagnosed shooting problems were aiming (40%) and steady position (32%). Trigger squeeze was diagnosed in 7% of the cases and breathing in 5%.

Analysis of records kept by a Weaponeer instructor over a 6-month period, along with other observations, indicate that difficulties with trigger squeeze (or flinching) and breath control probably account for a larger proportion of shooting problems than reported above. Trigger squeeze or flinching problems are probably much more frequent. This discrepancy may be due to the small number of soldiers included in the structured observation (26), instructor interpretation, or a combination of these factors. The relatively high proportions of aiming and steady position problems, on the other hand, are consistent with other observations.

These findings illustrate three points which have been made previously. First, they suggest that Weaponeer can be used to diagnose problems that can not be diagnosed by observation alone (Weaponeer was used to diagnose 76% of all problems). Second, they illustrate the types of shooting problems that can be diagnosed using Weaponeer. And, third, they support the need for a more standardized approach toward diagnosing shooting problems.

APPENDIX E

The Four Fundamentals of Rifle Marksmanship

If trainers are going to diagnose shooters' problems, they must know what to look for. Knowing what to look for requires a good understanding of the four fundamentals of rifle marksmanship--steady position, aiming, breath control, and trigger squeeze. A summary of these fundamentals will be presented here. For a more complete discussion, obtain a copy of the Basic Rifle Marksmanship Trainer's Guide. This guide is available through USAIS, Attn: ATSH-I-V-SD, Fort Benning, Georgia, 31905.

Steady Position

Steady position is the first shooting skill that a soldier should learn. One key to holding the weapon steady is to fire from a stable position. The stability gained from using the foxhole supported position makes it easy for the novice firer to master shooting skills quickly.

Foxhole supported position. In order to assure that a soldier is in a good



Figure 15. Foxhole supported position.

foxhole supported position (see Figure 15), check to see that he (or she) is leaning forward so that his (or her) body weight is supported by the firing side of the foxhole (right handed - right side; left handed - left side). The front of the weapon should be fully supported by the sandbags. The non-firing hand should be placed between the rifle handguard and the sandbags and should support no part of his (or her) weight. It should be totally relaxed. The rear of the weapon should be firmly supported by the firing hand and the pocket of the firing shoulder. The firing hand and shoulder are steady because they have straight-line bone support to the firing elbow, which should be firmly planted on the ground outside the foxhole. The non-firing elbow should be positioned to provide for maximum stability.

In summary, rear support of the weapon is gained from (a) the firing hand, (b) the firing shoulder, and, (c) the elbows. Front support of the weapon is gained from the sandbags.

Prone unsupported position. The prone unsupported position (see Figure 16) is another relatively, stable firing position. To assume this position, the soldier grasps the handguard of the rifle with the nonfiring hand. The nonfiring elbow is placed as far as possible under the rifle. Stockweld, rifle



Figure 16. Prone unsupported position.

butt in shoulder, placement of the trigger finger, and grasping the handguard are the same as for the foxhole position. Feet are spread a comfortable distance apart, and the body is positioned directly behind the rifle.

Since the prone position is not as stable as the foxhole position, a small "wobble area" will exist. Wobble area is the small area of movement covered by the tip of the rifle during aiming. Because of this wobble area, the inexperienced firer tends to jerk or snap shots off as soon as a correct sight picture is obtained. The soldier must understand that some wobble area is natural, and that by applying constant pressure to the trigger, he (or she) reduces the tendency to jerk shots.

Aiming

A good firing position places the aiming eye close behind the rear peep sight (tip of nose near or touching the charging handle). The shooter looks through the round hole in the peep sight making sure the tip of the front sight post is centered in the rear peep hole. For correct sight alignment, see Figure 17.



Figure 17. Correct sight alignment.

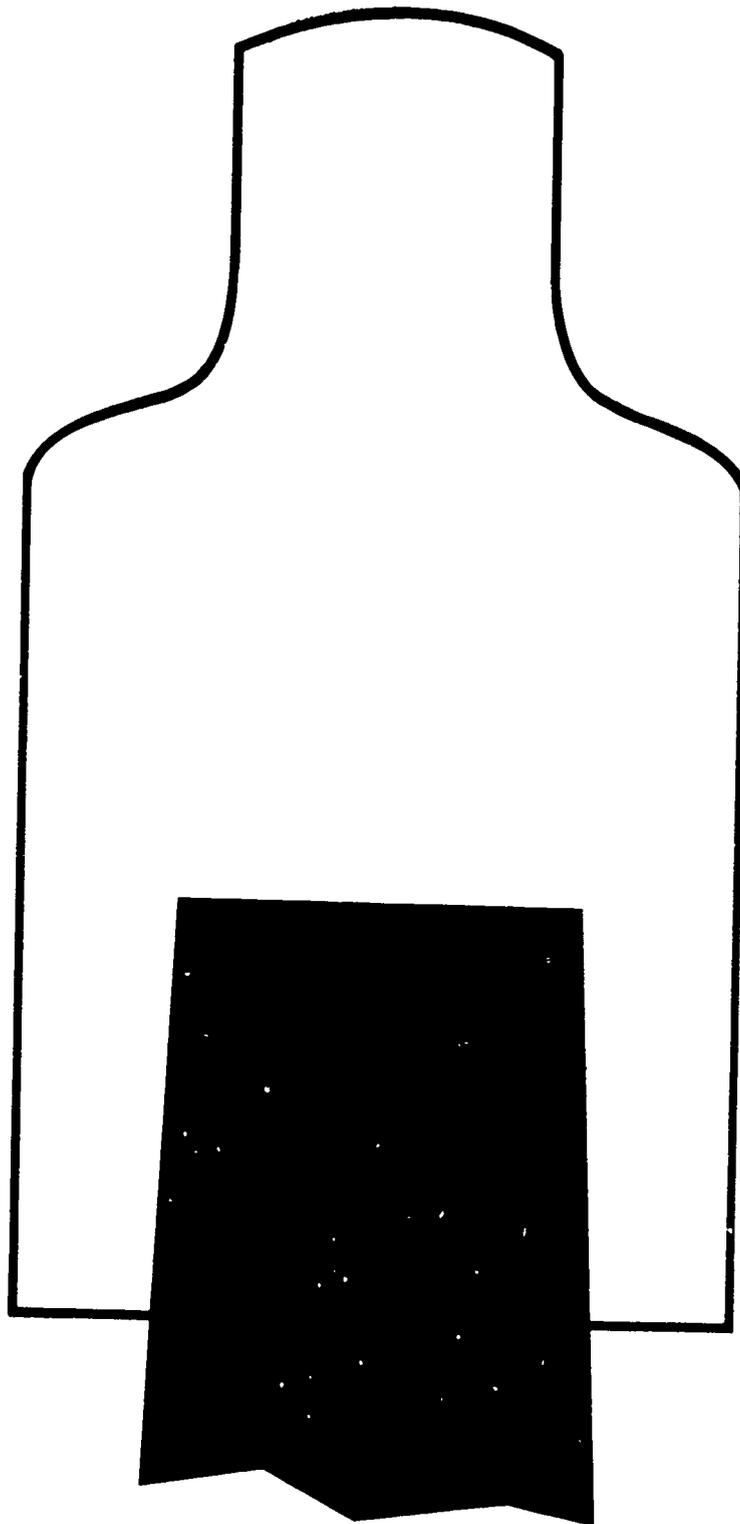


Figure 18. Correct point of aim for a 100-meter target.

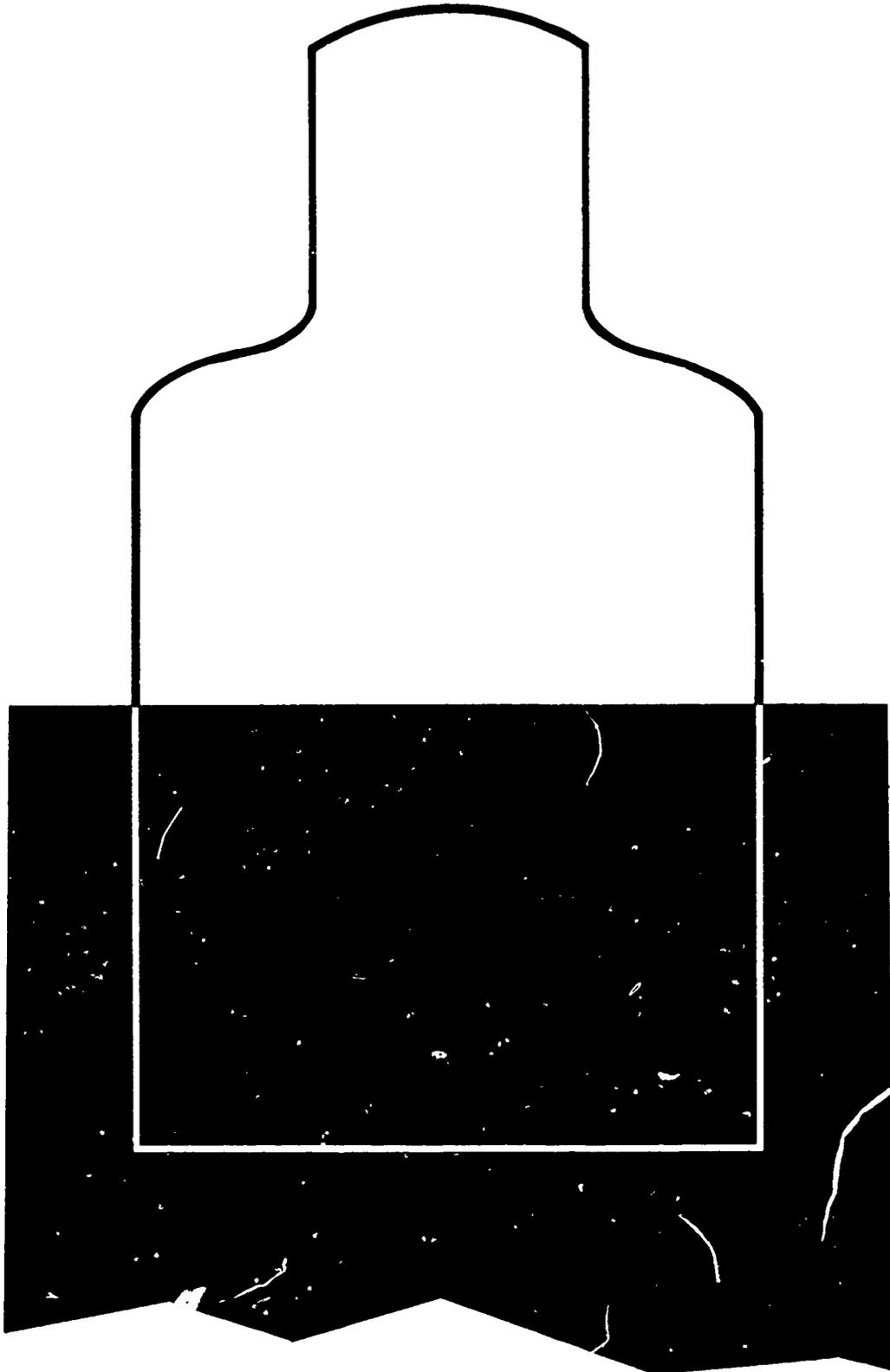


Figure 19. Correct point of aim for a 250-meter target.

To obtain correct point of aim, the soldier must place the tip of the front sight post on the aiming point with the focus of the eye directed to the tip of the front sight post. Using this technique, minimum aiming error will result, and the natural ability of the eye will provide for good sight alignment.

In brief, the primary aiming rule to train soldiers is to place the tip of the front sight post on the center of mass of the target (see Figure 18 and Figure 19).

Breath Control

The weapon can not be maintained in a steady position with the tip of the front sight post on the target if the soldier is breathing at the instant the weapon fires. The novice shooter should be taught to inhale, then exhale normally, and hold his (or her) breath at the moment of natural respiratory pause. The shot must then be fired before feeling any unpleasant sensations. Eventually, with practice, breath control will become a natural part of the firing process.

Trigger Squeeze

Trigger squeeze is important for two reasons. First, any sudden movement of the finger on the trigger will disturb the lay of the weapon and cause the shot to miss its intended point. Second, it is important that the exact moment of weapon firing be a complete surprise to the firer. The normal, unconscious reflex action of the novice firer to compensate for the noise and the slight punch in the shoulder is such that he (or she) frequently will miss the target if he (or she) knows the exact moment the weapon will fire.

Proper trigger squeeze should start with relatively heavy pressure on the trigger during the initial aiming process. For example, for a trigger that

requires 8 pounds of pressure, 4 to 5 pounds should be applied during the initial aiming process. Additional pressure should then be applied after the front sight post is steady on the target and breathing has ceased.

Summary

The fundamentals a soldier should have in mind when moving toward the firing line are to establish a steady position, put the front sight post on the target, stop breathing, and squeeze the trigger. This simple procedure will ensure target hits at all ranges.

It is important that the soldier not be distracted from these four marksmanship fundamentals. These are the factors that have major influence over the strike of the bullet. For the trainer, this means that too much emphasis on other points probably will degrade the entry level soldier's shooting performance.

APPENDIX F

Standard Methods of Diagnosis

One of the best ways to reduce the unnecessary demand for Weaponeer is to identify shooting problems where they occur--the firing line. This means spending time analyzing shot groups and observing shooters.

Analyzing Shot Groups

During shot group analysis, the shooter fires three shots at the target. These shots are then triangulated and analyzed. In the past, a shot group analysis card (GTA 21-14) was used for diagnosis, but a study of the information contained on this card revealed many inaccuracies. As a result, the use of the Shot Group Analysis Card was discontinued in marksmanship training and was replaced by a more valid form of analysis.

The current approach to shot group analysis recognizes that the diagnosis of shooting problems is a complex process. Examination of shot groups alone can not pinpoint the source of the problem. The danger is to assume too much from too little information.

Valid shot group analysis uses the size of the shot group as the primary

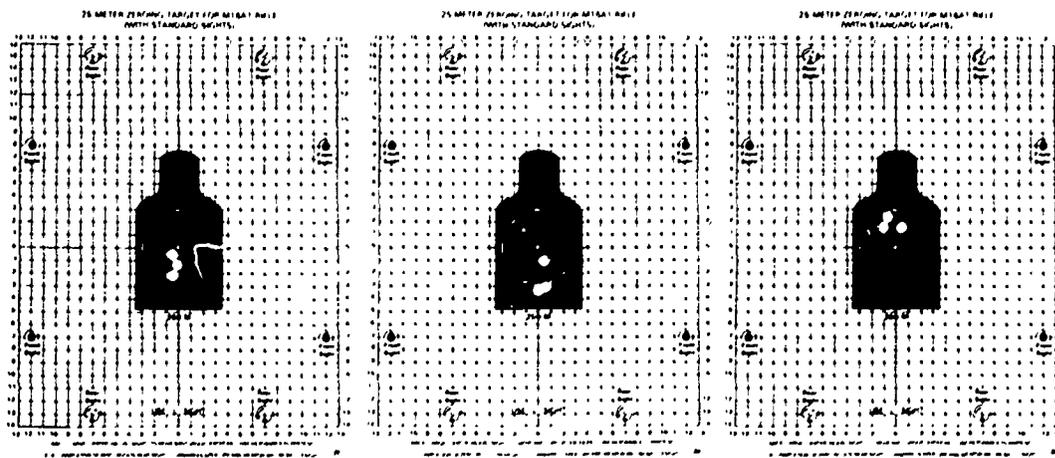
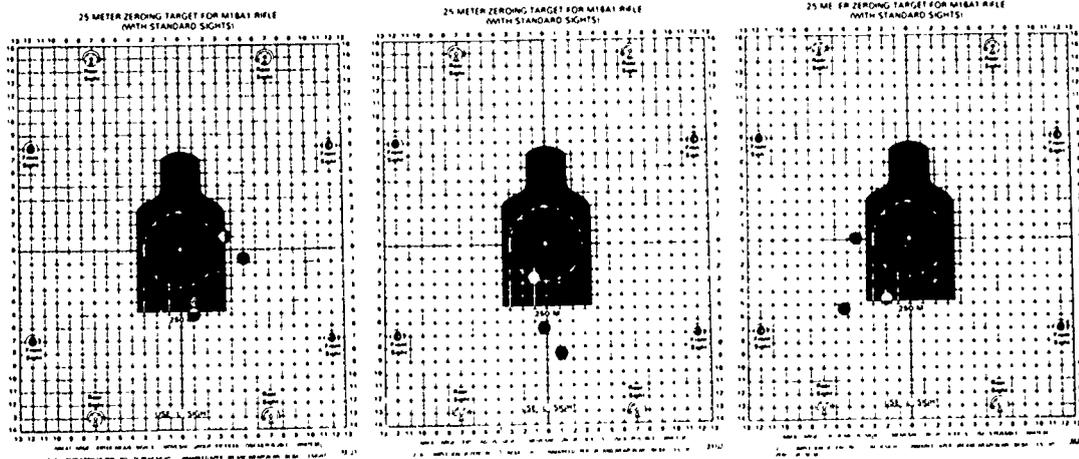


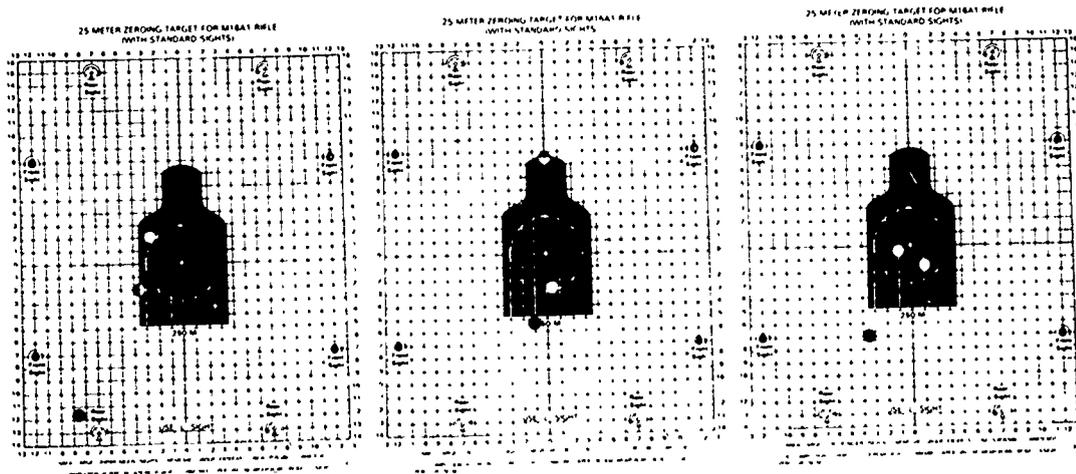
Figure 20. Good shot groups from initial entry soldiers.

index of shooting errors. Figure 20 shows what can be expected from initial entry soldiers who correctly apply basic shooting fundamentals. Note the "tightness" of these shot groups.

Figure 21 provides two series of shot groups. The first, or top series, shows examples of shot groups which indicate the inadequate application of some



Check all fundamentals



Check for trigger jerk

Figure 21. Problem shot groups from initial entry soldiers.

or all shooting fundamentals, while the second, or bottom series, probably indicate improper trigger squeeze. (Note how one shot appears to have been jerked away from the others on each target in the bottom series.)

The results of shot group analysis can tell you if the soldier has a shooting problem. In addition, it provides a broad indication of what to look at, that is, trigger squeeze in particular, or all shooting fundamentals in general.

Observing the Shooter

The next step is to observe the shooter in action. Look for violations of the four fundamentals of rifle marksmanship--steady position, aiming, breathing, and trigger squeeze. It is possible to observe gross violations, for example, looking over the rear sight, extreme unsteadiness or flinching. One difficulty of making accurate observations, however, is to see what happens the instant the weapon is fired. Also, many violations are relatively subtle involving only slight infractions. These are impossible for even an expert to see.

The trainer can not always see breathing, trigger jerk, etc., but it is possible to observe violations of standard shooting techniques which may cause violations of shooting fundamentals and lead to poor results. There are a number of standard shooting techniques which are typically taught in BRM training. Experience has shown that application of these basic techniques results, for the vast majority, in good shooting.

Table 6 lists a number of standard marksmanship techniques and the shooting fundamentals and common errors with which they are usually associated. This checklist provides information on what to look for when observing a shooter.

Table 6
 Checklist of Diagnostic Keys for BRM
 (What to Look for During Diagnosis)

Shooting <u>Fundamental</u>	Standard <u>Technique</u>	Common <u>Error</u>
Steadiness (foxhole sandbag supported)	Use of sandbag to support front of rifle.	Supporting front of rifle with non-firing hand and arm muscles; grasping of handguards.
	Use of non-firing hand to guide rifle.	Same as above; use of non-firing hand to change point of aim.
	Use of firing hand to pull and hold rifle butt into shoulder.	Use of firing hand to change point of aim.
	Use of firing shoulder to support rear of rifle.	Shoulder flinch at instant of firing.

(Continued)

Table 6 (Continued)

Shooting <u>Fundamental</u>	Standard <u>Technique</u>	Common <u>Error</u>
	Use of firing elbow to support rear of rifle.	Unstable placement of firing elbow on ground.
	Legs locked at knees and spread, leaning into foxhole, weight on chest.	Unbalanced position, weight on feet.
(prone unsupported)	Use of non-firing arm and hand to support front of rifle.	Excess muscle tension.
	Placement of non-firing elbow as far under rifle as possible.	Placement of elbow far outside of rifle.
Aiming	Stockweld, or mating the cheek with the rifle.	Inconsistent stockweld.

(Continued)

(Table 6 (Continued))

Shooting	Standard	Common
<u>Fundamental</u>	<u>Technique</u>	<u>Error</u>
	Placing nose on (or close to) charging handle.	Inconsistent placement of eye.
	Blinking or refocusing eyes without changing stockweld.	Aiming too long (blurring vision); not keeping stockweld.
Breath Control	No breathing at moment of natural respiratory pause.	Holding breath too long; breathing at instant of firing.
Trigger Squeeze	Moderate pull at first then continuous squeeze (instant of firing is a surprise).	Trigger jerk or instantaneous application of pressure.

Concurrent Training

Up to this point, we have discussed two steps in detecting shooting problems. Step one is to analyze shot groups and deduce the general problem(s) which they indicate. The second step is to observe the shooter in action. This step involves looking at the shooter's application of the four fundamentals and techniques associated with them. The primary difficulty in observing the shooter is to detect subtle violations of shooting fundamentals and the techniques associated with them. Minor deviations in the application of shooting fundamentals are virtually impossible to see, and yet they can be important in producing poor shooting results.

This difficulty has long been recognized by those who have been concerned with marksmanship training. As a result, a number of training exercises have been developed to facilitate the detection and correction of particular shooting errors. These include dry fire, the dime-washer exercise, ball-and-dummy exercise, M15A1 aiming card, M16A1 sighting device, target box exercise and combinations of the above.

Dry fire. Dry fire is a very effective technique for teaching marksmanship skills. It offers the soldier a chance to become thoroughly familiar with the feel of the rifle, including the action of the trigger, and allows him (or her) to overcome any fear of the weapon he (or she) may have developed. Dry fire exercises also are relatively easy to conduct and are safe and cost efficient since they do not use live ammunition.

Numerous training aids may be used during dry fire. However, some of the most effective training is conducted without benefit of training aids, using only the rifle and a target.

Initial practice should utilize various scaled silhouettes, perhaps located at different angles from the firer to allow for practice in scanning and engagement of targets at various locations within an assigned sector.

The key to dry fire training is to allow the soldier to work at his (or her) own pace and to develop the techniques for proper application of the four fundamentals, with assistance being provided by competent supervisory personnel as required. While no number of shots should be specified, hundreds of iterations should be fired.

Dry fire exercises are most valuable when feedback is provided by a coach or instructor. Feedback not only acts as a source of error information, it increases motivation for practice. In general, people feel like practicing when they receive feedback; they rapidly become bored and stop practicing when they do not.

On completing dry fire training, the soldier should be confident that he (or she) can hold the rifle in a steady position, that he (or she) understands the aiming process, that breath control has become second nature, and that he (or she) can squeeze the trigger without knowing the precise instant the hammer will fall.

Dime-washer exercise. This exercise can be used to diagnose and remediate problems related to steadiness and trigger squeeze. The exercise is carried out in two-soldier teams. One soldier assumes a supported or unsupported firing position and is instructed to cock the rifle and aim at the target. When the

firer is on target, the assistant balances a washer or dime on the barrel so that it does not touch the flash suppressor. After balancing the washer, the assistant tells the firer "ready" and closely observes the firer during the trigger squeeze.

If the washer drops from the barrel during the trigger squeeze, the assistant informs the firer of the cause. The rifle is then recocked and the exercise repeated.

Ball-and-dummy exercise. This exercise is used to diagnose trigger jerk. The soldier is provided a magazine loaded with a random selection of live and dummy rounds. Any movement of the body or rifle that can be detected when the firing pin hits a dummy round is a clear message that proper trigger squeeze is not being applied.

M15A1 aiming card. The M15A1 aiming card is a cardboard device designed to demonstrate rifle sight alignment and point of aim.

The front of the card has an opening (the rear sight aperture) through which two inserts are visible:

1. the front sight post and blades;
2. a silhouette scaled to the size of the front sight post.

Both are independently movable. Thus, the front sight post can be moved to the center of the aperture, independently of the silhouette which can be positioned above the front sight post. The trainer can demonstrate that sight alignment is the process of locating the tip of the front sight post in the center of the rear sight hole.

The M15A1 also provides for demonstration of the proper relationship between the front sight post and the silhouette. As is the case with sight

alignment, placement of the aiming point should be demonstrated by the trainer who is monitoring the soldier's grasp of aiming fundamentals.

M16A1 sighting device. This device, sometimes referred to as the Belgian sight or cheater device, is metal with a tinted square of glass that, when attached to the rear of the rifle's carrying handle, permits a trainer to observe a firer's aiming point.

Target box exercise. The purpose of this exercise is to teach and to permit the soldier to practice sight alignment and consistent placement of the aiming point. The exercise requires: (a) a rifle rest, (b) a target paddle on which is printed a scaled, E-silhouette target, (c) a target box on which is attached a plain piece of paper, (d) a pencil, and (e) the firer and an assistant.

The firer places the rifle firmly in the rifle rest and, without moving the rest, assumes a modified prone firing position alongside of it. While looking through the rifle sights, the firer motions the assistant to move the target paddle in line with the sights. It is important to ensure that the target box is 15 meters from the firer, since the silhouette on the target paddle is scaled to depict a 25-meter target viewed at 15-meters.

With the firer and target box in position, the assistant sits on the box and holds the target paddle anywhere against the sheet of paper. Care must be taken not to move the target box or paper attached to it. The firer obtains correct sight alignment. With one hand, he (or she) motions the assistant to move the target in the desired direction. When the silhouette appears in proper position above the front sight post, the firer gives the signal to mark the paper. The assistant marks through the small hole in the paddle. The paddle is

then removed and the assistant marks the spot #1. The paddle is once again placed at a different starting point against the sheet of paper, and the exercise is repeated two more times. After the third "shot", the three points are triangulated and labeled as shot group #1. The exercise is repeated as many times as necessary to achieve shot groups that will fit into a 1-centimeter circle.

During this exercise, the trainer should not only observe the firer as the rifle is sighted, but also discuss the importance of shot group size and placement. Only when the trainer is satisfied that the firer is proficient in sighting the weapon, should the firer and the assistant exchange roles.

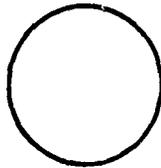
APPENDIX G

Shooter's Table

Weaponer Instructor's Table

APPENDIX H

Scales Zeroing "Circle" Overlay



Scales Zeroing "Target" Overlay

