Research Report 1364

Evaluation of the Basic Rifle Marksmanship Program of Instruction

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This report presents an evaluation of a new Basic Rifle Marksmanship Program of Instruction, addresses learning techniques, highlights requirements for efficient implementation, reviews target development, and discusses marksmanship variables that require additional research to obtain optimum shooting performance.

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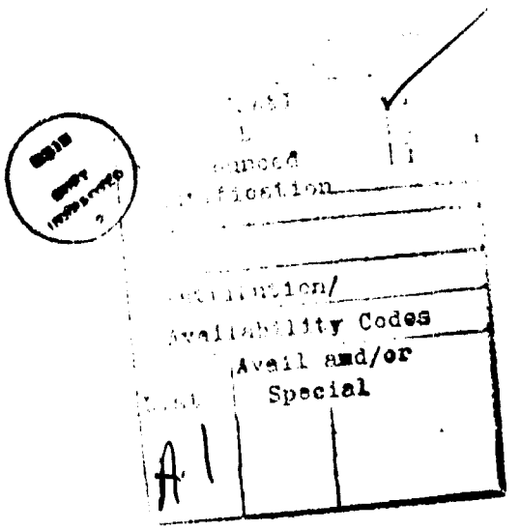

FOREWORD

So that the products developed for Army training attain their maximum potential usefulness, appropriate steps must be taken to insure an efficient and successful implementation. The transition from "paper" to "practice" is often not as direct and routine as the original researchers/developers may have hoped. The present paper describes a follow-on, implementation effort for a product that was jointly developed by the Army Research Institute for the Behavioral and Social Sciences (ARI), Fort Benning Field Unit, and the Mellonics Systems Development Division of Litton Systems, Inc.: The Basic Rifle Marksmanship Program of Instruction. In the present effort, ARI and Litton worked closely with the training cadre, the Committee Group, and the Directorate of Training Development at the U.S. Army Infantry Center to make any needed changes in targets, training aids, etc., to insure a smooth and appropriate implementation. In addition, evaluation data are reported which indicate a highly successful product.

EDGAR M. JOHNSON
Technical Director

EVALUATION OF THE BASIC RIFLE MARKSMANSHIP PROGRAM OF INSTRUCTION

EXECUTIVE SUMMARY

Requirement:

To evaluate the Basic Rifle Marksmanship (BRM) Program of Instruction (POI) developed by Litton Mellonics under contract number DAHC 19-77-C-0011.

Procedure:

The new BRM program was implemented within the First Infantry Training Brigade, Fort Benning, GA, in January 1980.

In order to assess the implementation process, record fire scores were collected and analyzed for several months prior to and following the implementation. Also, steps were taken to facilitate the implementation procedure:

- Various targets were developed as needed for the new POI.
- All periods were reviewed in order to assure that proper transitions had been made from past marksmanship doctrine to current marksmanship doctrine.
- All bleacher and concurrent training pitches were reviewed for content and period to period cohesion.
- All training aids, devices, posters, and charts were systematically reviewed and updated in order to be consistent with the new POI.
- All BRM training was assessed from a learning and cognition standpoint and suggestions were made to bring all instruction in line with established principles of learning and cognition.
- The organization and management of training was studied and changes were suggested to increase organizational efficiency.

Findings:

The new program results in highly significant improvements of basic marksmanship skills, as measured by scores obtained on the record fire course. The problems encountered in the implementation process and the solutions derived are both reported in this document.

Utilization:

The information in this report is applicable to marksmanship program developers, marksmanship instructors, and all personnel responsible for marksmanship training. The findings and suggestions should prove to be valuable guidelines for subsequent implementation at other Army Training Centers.

EVALUATION OF THE BASIC RIFLE MARKSMANSHIP PROGRAM OF INSTRUCTION

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EVALUATION OF THE BASIC RIFLE MARKSMANSHIP PROGRAM OF INSTRUCTION

INTRODUCTION

Two basic approaches have been employed by the US Army to teach basic marksmanship: the Known Distance (KD) approach and the Trainfire approach. The Known Distance approach, used by the Army until the late 1950's, was characterized by firing at bulls-eye targets located at selected known distances (200, 300 and 500 yards) on an open range. The location of each bullet strike was marked with spotters by individuals in the "pits".

Through analysis of combat actions in Korea, it was found that many soldiers had difficulty applying the firing skills they had learned on the Known Distance range to the engagement of combat targets. With the recognition of the importance of the transfer of skills learned in training to those used in combat, it was considered necessary to examine the realism of then current training in this respect. Trainfire was an attempt to develop and evaluate a rifle marksmanship training program designed for maximum rapid transfer to combat conditions. The original Trainfire program as implemented had 80 hours of instruction, with many hours of field firing at pop-up targets but also many trips back to the 25 meter range where exact bullet strike locations could be examined. Since the adoption of the Trainfire concept, the field fire orientation of basic rifle marksmanship has changed little. However, major changes occurred in the amount of time allowed for training, the number of rounds of ammunition allocated for live firing, and the quality of downrange feedback. In general, the trend was to reduce either hours, rounds, or both from each phase of training. The time allocated to the fundamentals of shooting at 25 meters was reduced considerably and, except for zeroing, all knowledge of precise bullet strike was lost from the program.

Even a casual observation of soldiers undergoing the most recent Trainfire program (37 hours of instruction time) revealed major problems. The soldier was overloaded with knowledge requirements, was given inadequate time for skill practice, was given only one opportunity to master a complex zeroing procedure, and was expected to develop shooting skills without precise knowledge of performance. Additionally, the quality and quantity of instructor personnel were inadequate.

An overview of all research on marksmanship conducted by Litton Mellonics and the Army Research Institute at Fort Benning since March 1978 is contained in a summary report.[1]

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[1] Smith, S., Osborne, A. D., Thompson, T. J., & Morey, J. C. Summary of the ARI-Benning Research Program on M16A1 Rifle Marksmanship, ARI Research Report 1292, June 1980.

A new Basic Rifle Marksmanship (BRM) Program of Instruction (POI)[2] was developed under a previous contract (DAHC 19-77-C-0011). The new POI was designed to develop and improve skills by using a natural progression from basic shooting fundamentals through to rapid engagement of combat-like targets, with each period serving as a building block for subsequent periods. The program contains several diagnostic check points so that early problem detection and correction can occur. In general, the features of the new POI are:

- o Simplified marksmanhip fundamentals which focus only on the factors that contribute most to hitting targets.
- o Simplified zeroing targets that result in fewer zeroing errors and promote an understanding of the zeroing process.
- o Firing at scaled targets on the 25-meter range, that provides for skill practice in engaging silhouette targets, with accurate feedback on hits and misses.
- o Downrange feedback (75 and 175 meters) that allows a check of the zero at distant targets and provides knowledge of bullet trajectory, effects of wind, effects of gravity, and includes effective practice in hold-off.
- o A revised qualification course that increases the minimum hits required to qualify from 43% (17 of 40) to 58% (23 of 40).

The First Infantry Training Brigade at Fort Benning, Georgia, implemented the new POI during the first part of 1980. The POI in its draft form was recognized immediately as having positive training potential and was informally accepted as the primary marksmanhip training document for the Brigade. Due to the success of the program (when compared to the previous program) the decision was made to officially adopt the new BRM POI. The POI was officially approved by the Infantry School (proponent for marksmanship) in June 1980.

The POI having been accepted by the proponent agency, this current effort was directed at an evaluation of program implementation at Fort Benning with the goal of making refinements to the program, upgrading training procedures, developing materials and aids and providing assistance to facilitate Army-wide implementation.

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[2]Osborne, A. D. & Morey, J. C. Basic Rifle Marksmanship Training Program. Litton-Mellonics Working Paper, July 1979.

DIFFERENCE IN OLD AND NEW POI

A listing of periods, hours, and rounds for the old[3] and new[4] programs is in Table 1. Several aspects of the new program were evaluated in a previous report.[5] A detailed review of lesson content and supporting research data reveal several significant differences between the two programs that may have an impact on training effectiveness:

Simplified Fundamentals. The old POI contained no clear-cut fundamentals of marksmanship. Soldiers were presented about 20 items with each given the same relative emphasis. The most important items were not highlighted and emphasis was given to items that had no major influence on bullet strike. Through detailed study, analysis, weapons firing, and field experimentation, these 20 items were reduced to four critical items that have major influence over hitting or missing combat targets: steady position, aiming, breath control, and trigger squeeze. These four fundamentals of marksmanship are emphasized throughout the new POI.

More Valid Shot Group Analysis. The Shot Group Analysis Card used in the old POI was found to be invalid. The card has been deleted and a new shot group analysis procedure has been developed for the new POI.

Dry Fire. The first time a soldier experienced the basic firing position, in the old POI, was when he came on line to fire the first live rounds. The new POI allows for mastery of the four shooting fundamentals in a relaxed, inexpensive, no safety restrictions environment prior to shooting live bullets.

Zero Target. The old target was confusing, difficult to use, and provided no indication of relevance to downrange performance. The development and testing of a revised Canadian bull zero target are discussed in a previous marksmanship report.[6] The new silhouette zeroing target (discussed in a subsequent paragraph) is simple to use and provides relevance to downrange performance while eliminating the confusion to the soldier of not hitting where he aims. It also eliminates the problem of learning how to aim at a Canadian bull and then having to switch to a silhouette.

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[3]US Army Infantry School, M16A1 Rifle Marksmanship Training Program of Instruction, April 1977

[4]Osborne and Morey, op, cit.

[5]Thompson, T. J., Smith, S., Morey, J. C., & Osborne, A. D. Effectiveness of Improved Basic Rifle Marksmanship Training Programs. ARI Research Report 1255, September 1980.

[6]Smith, S., Thompson, T. J., Evans, K. L., Osborne, A. D., Maxey, J. L. & Morey, J. C. Effects of Down-range Feedback and the ARI Zeroing Target in Rifle Marksmanship Training. ARI Research Report 1251, June 1980.

Table 1

COMPARISON OF OLD AND NEW BRM PROGRAMS

	(Old)		(New)	
Subject	Hours	Rounds	Hours	Rounds
Mechanical Training	4	0	4	0
Fundamentals	6	18	8	9
Zero	4	24	8	18
Practice Firing: Scaled Silhouette			2	18
Downrange Feedback			8	30
Field Fire	8	78	8	78
Zero Confirmation and Scaled Silhouette Firing			4	32
Practice Record	4	40	4	50
Record Fire	5	40	4	40
Automatic Firing	3	45	2	21
Protective Mask Firing			2	20
Night Firing	3	89	3	30
Totals	37	334	57	346

Zero Criterion. The zero requirement (25 meters) was tightened from 5.2 cm to 4 cm. A 4 cm zero is required to hit all silhouette targets out to ranges of 300 meters.

Instructor Ratio. The new program recommends a higher instructor to student ratio than had recently been possible.

Rifle Quality Checks. A previous report[7] notes that normal rifle serviceability checks did not identify all bad shooting weapons. It is recommended in the new POI that all suspect weapons be fired by an experienced marksman and that records be maintained for each rifle.

25 Meter Practice Firing. The old POI used the 25 meter range only for zero firing. The new POI provides for practice firing after initial zero, giving the good shooter a chance to improve.

Scaled Silhouette Firing. A feature of the new POI is the engagement of silhouette targets at 25 meters - scaled to represent targets at 75, 175, and 300 meters. This allows feedback to improve shooting skill, confirms weapon zero, provides for practice at different range targets and provides a good diagnostic check to determine if the soldier is ready for field fire.

Diagnostic Check Points. The new POI contains several diagnostic check points to insure fundamental skills are mastered before moving to more complex training.

Downrange Feedback. This exercise provides knowledge of bullet strike beyond 25 meters - something that was not in the old POI. It allows for confirmation of zero at ranges of 75 and 175 meters and provides a learning experience for the effects of wind and gravity while providing for practice in hold-off. The testing of this procedure is included in a previous report.[8]

Confirmation of Zero. It has been found that many soldiers cannot shoot well enough to obtain a precise zero during the initial zeroing period. This period in the new POI allows the slow learning soldier to obtain an initial zero, the average soldier to refine his zero, and the good shooter to get additional skill practice.

Timed Fire. This exercise provides practice in rapidly engaging scaled silhouettes representing targets at 50, 100, 150, 200, 250 and 300 meters on the 25 meter range, with precise feedback on each bullet hit and miss. Practice in adjusting point of aim is a built-in feature of this period.

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[7]Osborne, A. D., Morey, J. C., & Smith, S. Adequacy of M16A1 Rifle Performance and Its Implications for Marksmanship Training. Litton-Mellonics, ARI Research Report 1265, September 1980.

[8]Smith, Thompson, et. al., op cit.

Record Fire. Record fire represents a significant increase in marksmanship standards: From 17 to 23 of 40 to qualify and from 28 of 40 to 36 of 40 to receive an expert badge. Six of the 40 targets were moved to a closer range; however, target exposure time was reduced by an average of 30%.

NBC Firing. The new POI requires firing while wearing the protective mask.

Firing Positions. The new POI requires dry fire practice from various positions that may be required in combat: prone supported, kneeling, kneeling supported, standing, and opposite shoulder.

Instructor's Guide. The new POI is supported with an instructor's guidebook.[9]

EVALUATION OF LEARNING TECHNIQUES

As part of the BRM POI evaluation, all periods of instruction were observed to determine if sound learning principles were being used. The observations and suggested changes resulting from a period by period review are contained in Appendix A. This review was conducted with a learning, motivation, and cognitive emphasis. The following are some general program modifications that may enhance understanding and comprehension of important training material by initial entry training soldiers:

o Decrease personnel turnover or provide some vehicle (e.g., package of written materials) for smooth and consistent personnel transitions. Perhaps instructor quality could be kept at a high consistent level by screening potential range cadre for marksmanship knowledge and ability.

o Clarifying the responsibilities of the committee cadre and the company cadre would enhance the spirit of cooperation between these two instructor populations.

o The trainee/instructor ratio should be reduced so that instructors can provide individual instruction and performance feedback. The actual ratios should differ from period to period (e.g., a high density of instructor core is necessary for the zeroing period and a lower density of instructors is needed for the dry fire period).

o Having BRM concurrent with BIVOUAC during an early and difficult adjustment period may result in trainees who are less than optimally receptive to acquiring new information.

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[9] Osborne, A. D. Basic Rifle Marksmanship Instructor's Guide. U.S. Army Infantry School, Coordinating Draft (prepared by Litton-Mellonics and US Army Research Institute), January 1980.

o All trainees needing corrective lenses should be issued their glasses before BRM.

o Several slides, posters, and other visual aids must be updated in order to be consistent with the new POI. Also, there are several areas where new training aids should be developed. All slides and posters should stand alone (i.e., tell a story by themselves). They should be simple, straight forward, clear, consist of actual pictures when possible, and not cluttered with extraneous detailed information.

o The disassembly chart should be revised. The locations of the parts of the chart should correspond to their actual location on the weapon. Also, arrows should be included to depict where the part came from and numbers to indicate order of disassembly.

o Provide an outline for each period and for each personnel assignment, listing major tasks and responsibilities. These outlines should be specialized for bleacher instructor, range commander, safety NCO, concurrent training NCO, range assistant instructor (AI), and tower operator.

o Develop an individualized "Shooter's Book," and provide copies to all entry level soldiers. This book would be a more direct method for dissemination of marksmanship information. Precise pictures and diagrams and simple wording would aid those trainees with a reading or language problem. Space should be provided for keeping records of performance for each period. This book would also provide some cohesion for the trainee who has missed a period.

o Trainees need to get fundamental definitions in the bleacher pitch and in the "Shooter's Book." A basic understanding of fundamental terminology is essential for cognitive acquisition.

o Questions from the trainees must be encouraged. Questions should be repeated so that the entire group can hear. Answers should also be delivered so the entire group can hear.

o Proprioceptive and kinesthetic feedback are necessary for motor learning. Therefore, all motor tasks (e.g., firing the weapon, loading the weapon, assembling the weapon, cleaning the weapon, etc.) must be practiced. Modeling can and should be effectively utilized at the initial stage. However, in order to achieve asymptotic performance, the key is motor practice and more motor practice.

o On the range, the AI should check out each individual trainee assigned to him before the trainee is allowed to leave the target. The AI should give reinforcement to those who are doing well and corrective feedback to those who are not. Giving praise to others (if they deserve it), has the desirable effect of increasing the morale and motivation of both the person who gives the praise and the person who receives it.

o Emphasis should be placed on feedback, marking shots and the importance of shot group size. Again, feedback is necessary for learning. The more immediate the feedback, the better the learning.

o Use an eye chart during initial training in order to identify vision problems.

o Maintain a zeroed "master weapon" on every range to use for demonstrations and for the trainee whose weapon is suspect.

o Improve and increase the use of the Weaponeer.

o Most of the trainees who have trouble mastering marksmanship seem identifiable at a very early stage. The trainees should be given remedial help before bad responses become more ingrained.

o Provide more training for trainers. The Basic Rifle Marksmanship Instructor's Guide is an excellent step forward, but perhaps even more could be done (e.g., short courses for new cadre, a TEC lesson for marksmanship instruction, etc.).

o In order to maximize comprehension, smooth transitions must be made between periods. Trainees should be given a general overview of the entire program initially. Also, at the beginning and end of each period, trainees should be reminded of what came before and what will follow.

o Concurrent training time should be fully utilized by having trainees practice motor responses and rehearse cognitive information.

o The amount of novel serial information that the average person can retain and manage is limited. For verbal information, the amount is thought to be 7 ± 2 units of information. For motor responses, which take more time to be performed, the amount of information is probably less. Therefore, whenever a serial string of motor responses is presented to trainees, the number of steps should be small (e.g., two or three at maximum).

CONSIDERATIONS FOR POI IMPLEMENTATION

The evaluation of the BRM POI included detailed observations and evaluation of all training, operational, and support requirements associated with program implementation. Observations and recommendations concerning the use of training aids are addressed as a separate area.

It is considered important that all soldiers understand the purpose of each period of instruction and what is to be accomplished each training period. Accordingly, recommended charts reflecting the purpose of each period are provided. Observations and recommendations concerning POI implementation are included in Appendix B.

An important part of this task was to assist in the development of a well coordinated, refined program at Fort Benning, to be used as a model for Army-wide implementation of the new Basic Rifle Marksmanship Program of Instruction at eight other Army Training Centers conducting Initial Entry Training.

SILHOUETTE ZEROING TARGET

Throughout the research effort on marksmanship, the complexity of information presented to the trainee has been of concern. Using the Canadian bull zeroing target required that sights be adjusted so bullets would hit 2.4 cm below point of aim at 25 meters. Many soldiers were confused by this procedure. Some confusion could obviously be eliminated if the initial firings were conducted so that bullet impact was the same as point of aim.

The results of a previous firing test[10] revealed that using the M-16 long range sight at 25 meters and adjusting bullet impact to coincide with point of aim would produce a good 250 meter battlesight zero when using the regular sight.

The Canadian bull presented another training problem, in that when zeroing was completed (the soldier having learned to aim at the bottom of the target) all subsequent firing was at silhouette type targets (with a center of mass aiming point). During previous testing it was found that the quality of zero did not deteriorate when a scaled silhouette target was substituted for the Canadian bull.

The ability to shoot at scaled silhouette targets and hit where the rifle is aimed has an important training implication. The new silhouette zeroing target, Figure 1, was tested with several companies of the First Infantry Training Brigade and approved by the United States Army Infantry School.

The use of the new target allows the role of the 25 meter range to be expanded beyond that of merely providing for the zeroing of weapons. Additional exercises are included based on scaled silhouette targets, which are designed to provide the same visual perception when viewed at 25 meters as actual targets viewed at range. Additionally, using this procedure eliminates the requirement to transition from the Canadian bull to silhouette targets.

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[10] Osborne, Morey and Smith, op, cit.

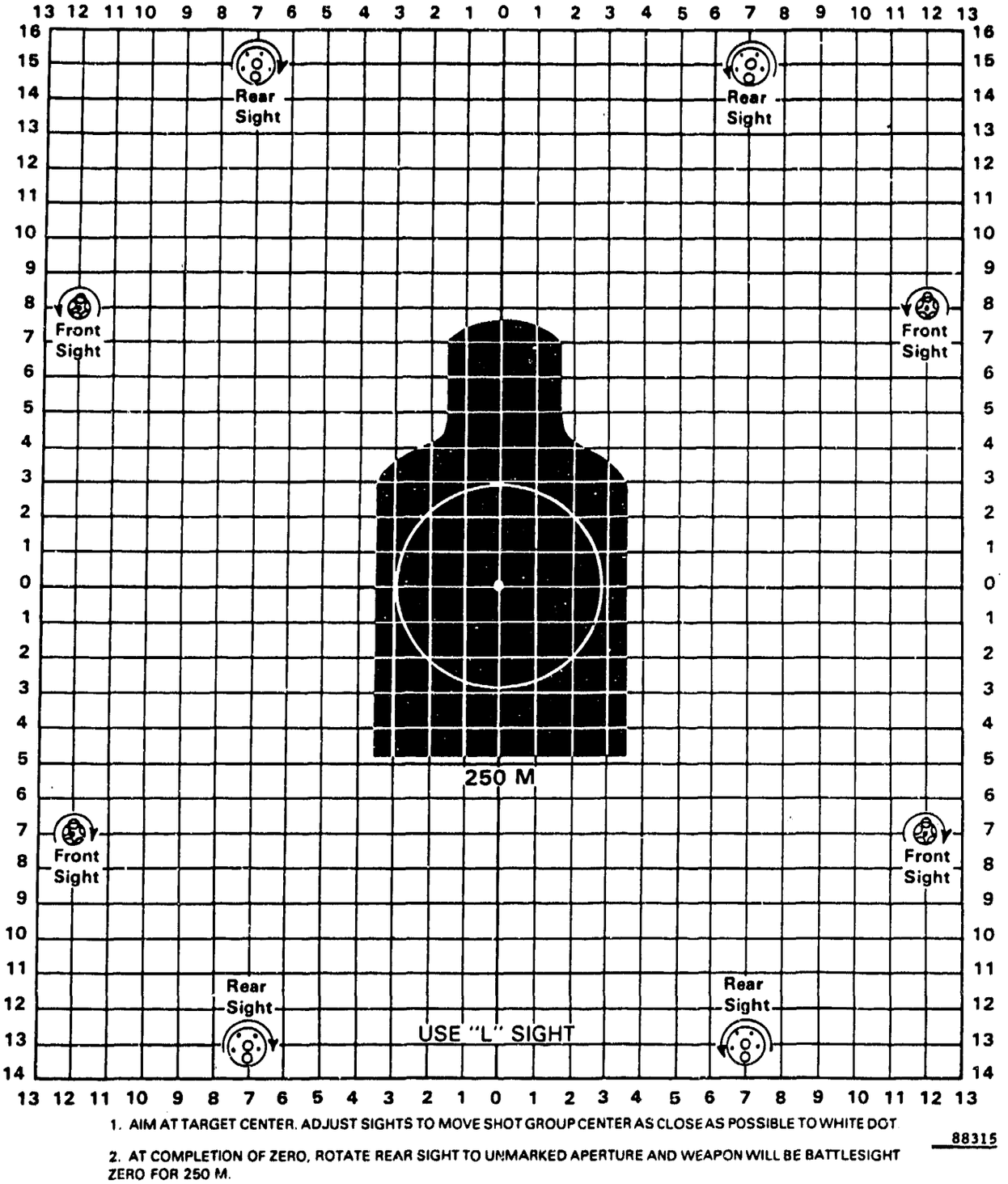

Figure 1. 25 meter zeroing target for M16A1 rifle (with standard sights). (This figure has been reduced.)

TARGET DEVELOPMENT

The POI evaluation identified the need for improving some targets and the development of several new targets.

The revised targets are used in the BRM program and have undergone field testing within the First Infantry Training Brigade:

o Silhouette Slow Fire Target, Figure 2. A 4 cm circle was added to this target to provide a more precise measure of shooting performance and to facilitate continuation of the zero process. (Actual target size, 18x23 inches.)

o Silhouette Timed Fire Target, Figure 3. The 4 cm circle was added to this target to allow evaluation of using optimum point of aim. (Actual target size, 18x23 inches.)

o 175 Meter Feedback Target, Figure 4. A circle which reflects expected shot group size and an "X" which indicates optimum point of aim at 175 meters was added to this target. (Actual target size, same as "E" silhouette.)

o 75 Meter Feedback Target, Figure 5. This target was developed for Period 6 of BRM, to be used in conjunction with the 175 meter target. (Actual target size, same as "F" silhouette.)

In concert with the Infantry School, new targets were developed to allow for the use of the low light level sight system (LLLSS). When a rifle is equipped with the LLLSS, the standard front sight and the standard rear sight are replaced. The LLLSS front sight is larger than the standard sight post with a split in the middle that contains luminous material. The standard rear sight consist of two apertures, each two milimeters in size. One aperture is used for the 250 meter battle sight zero, while the other (long range sight) extends the zero out to 375 meters. Using the long range sight at 25 meters provides for the point of aim and point of impact being the same when a rifle is zeroed. The low light level sight has a 2 millimeter aperture and a 7 millimeter aperture. The two millimeter aperture is used for daylight firing (regular sight) and the 7 millimeter aperture is used for night firing. Therefore, the long range sight capability is lost. These targets allow the use of silhouette targets with the regular sight by displacing bullet strike 2.4 cm below point of aim:

LLLSS Zero Target - Figure 6
LLLSS Slow Fire Target - Figure 7
LLLSS Timed Fire Target - Figure 8

Additionally, scaled silhouette targets were developed for use by Reserve Components or other units that have limited range facilities. The target in Figure 9 is used on 25 meter ranges and the target in Figure 10 is scaled for use on the standard 50 foot range.

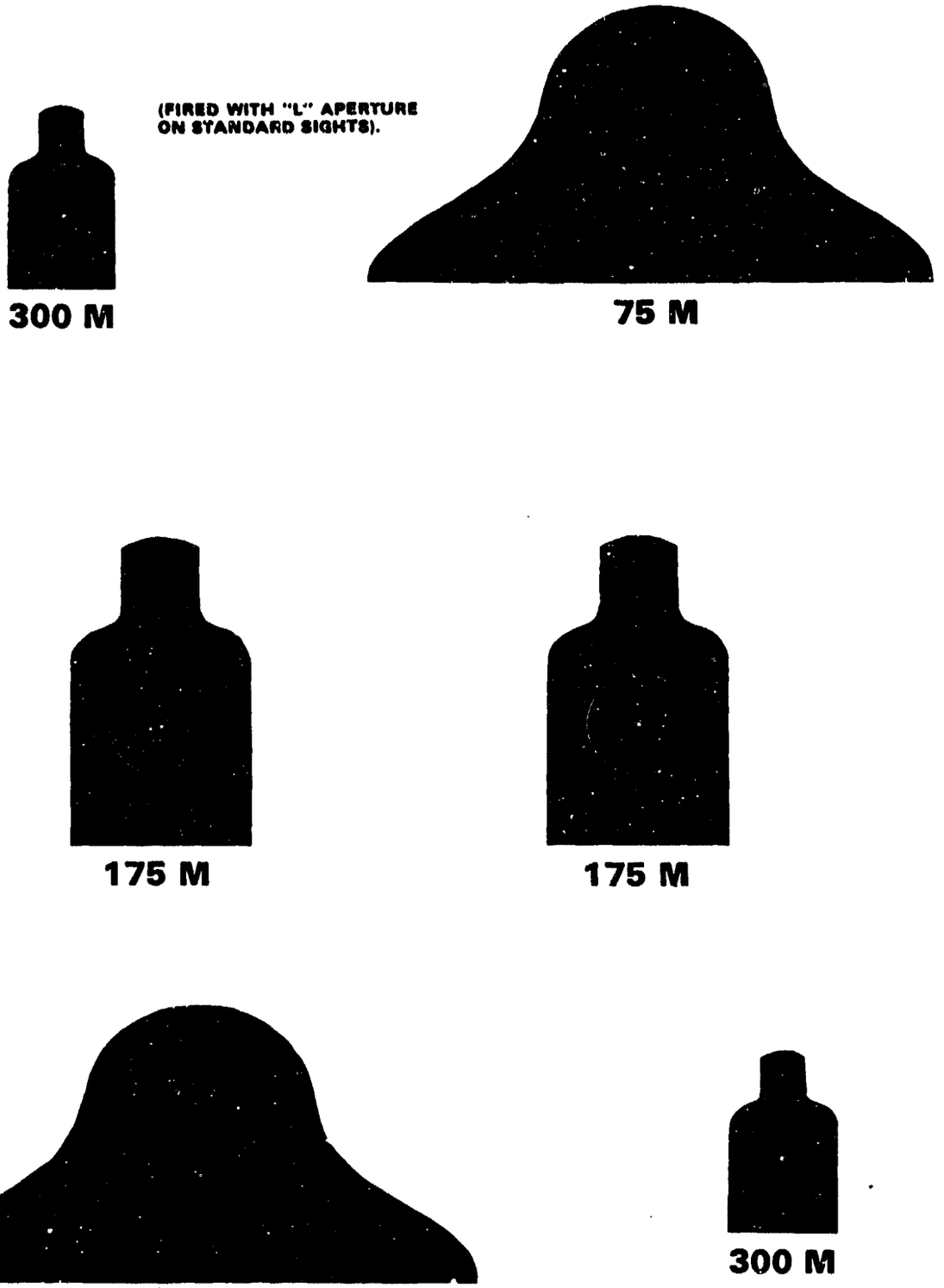

Figure 2. 25 meter scaled silhouette slow fire target. (This figure has been reduced.)

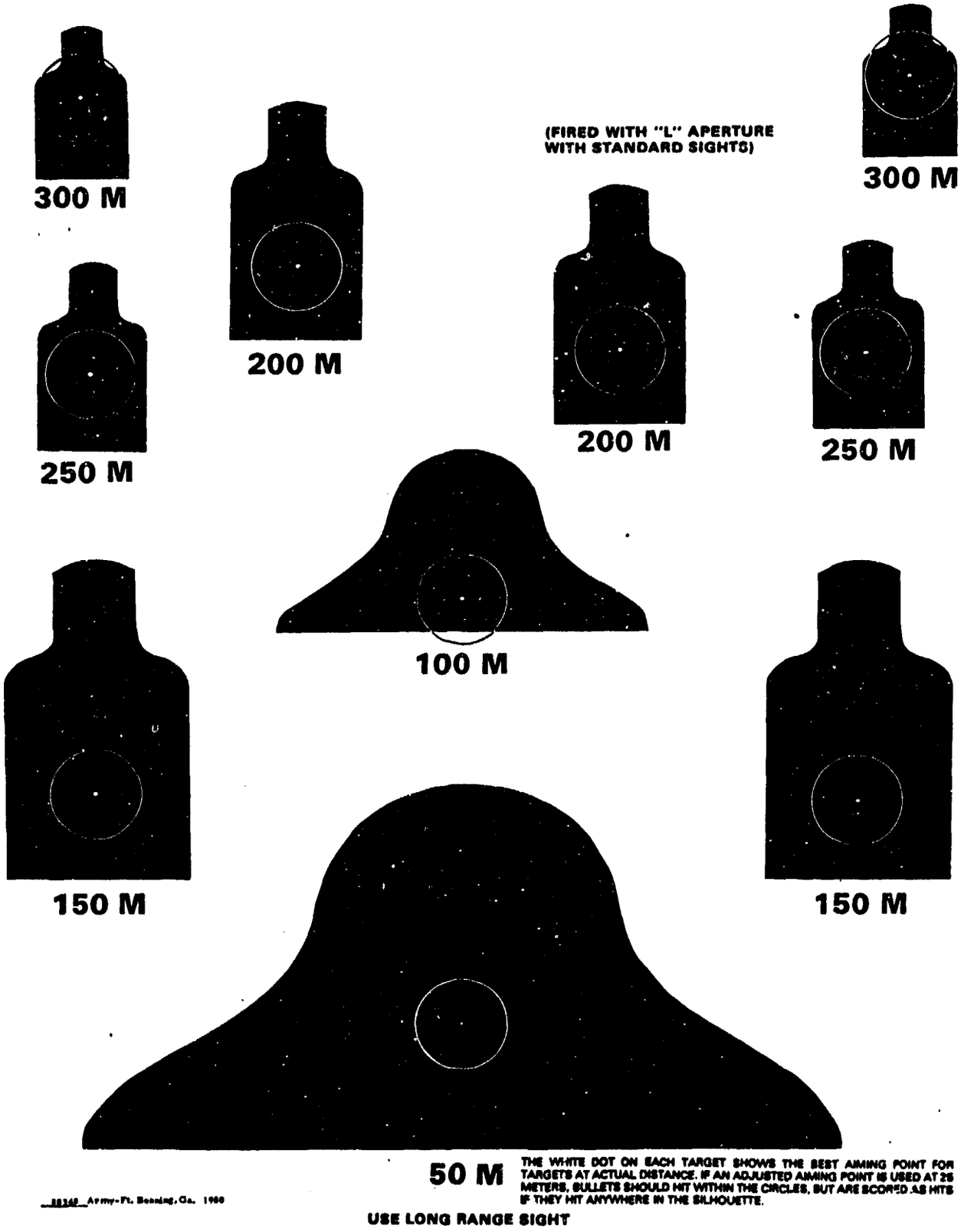

Figure 3. 25 meter scaled silhouette timed fire target. (This figure has been reduced.)

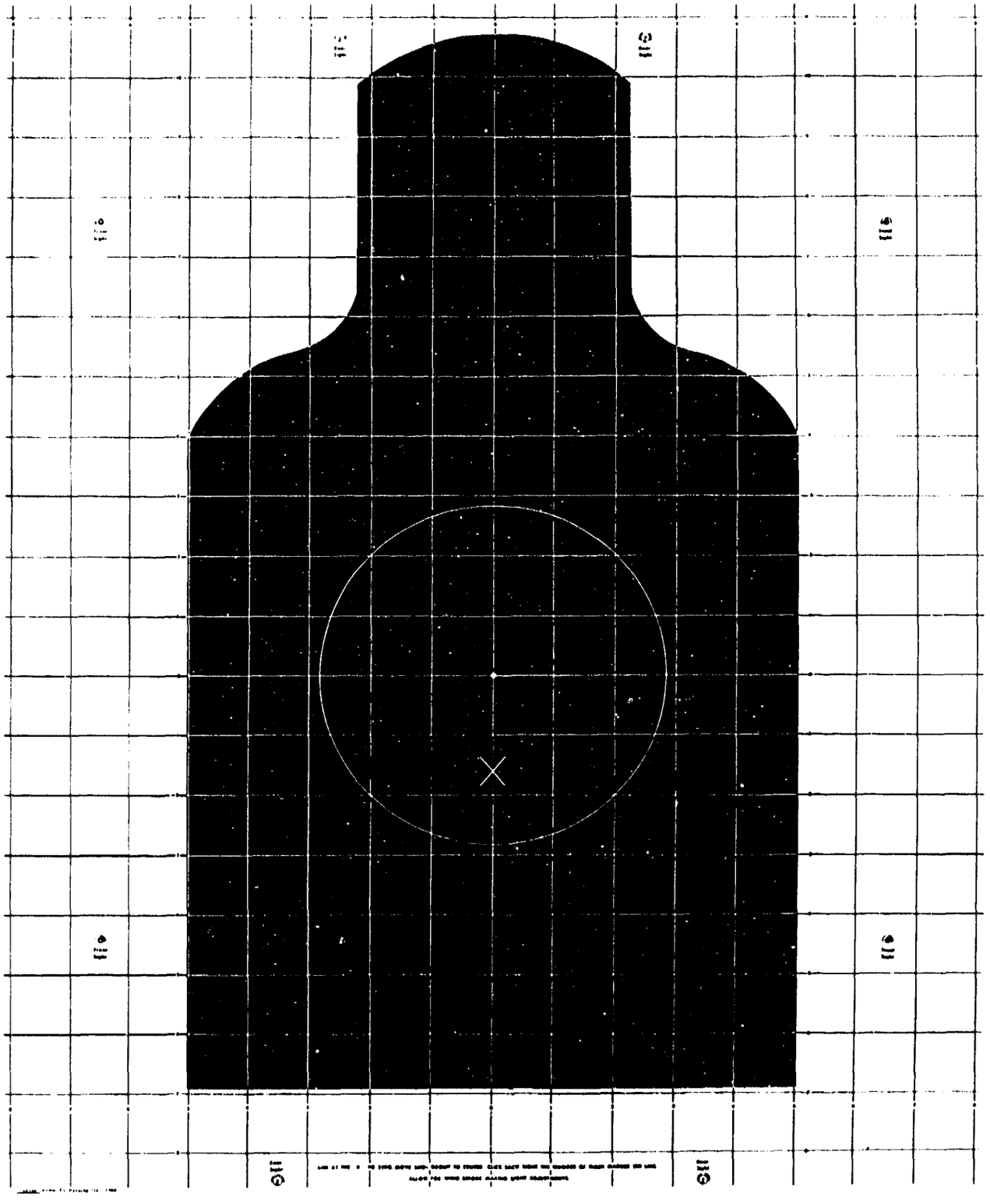

Figure 4. 175 meter feedback target. (This figure has been reduced.)

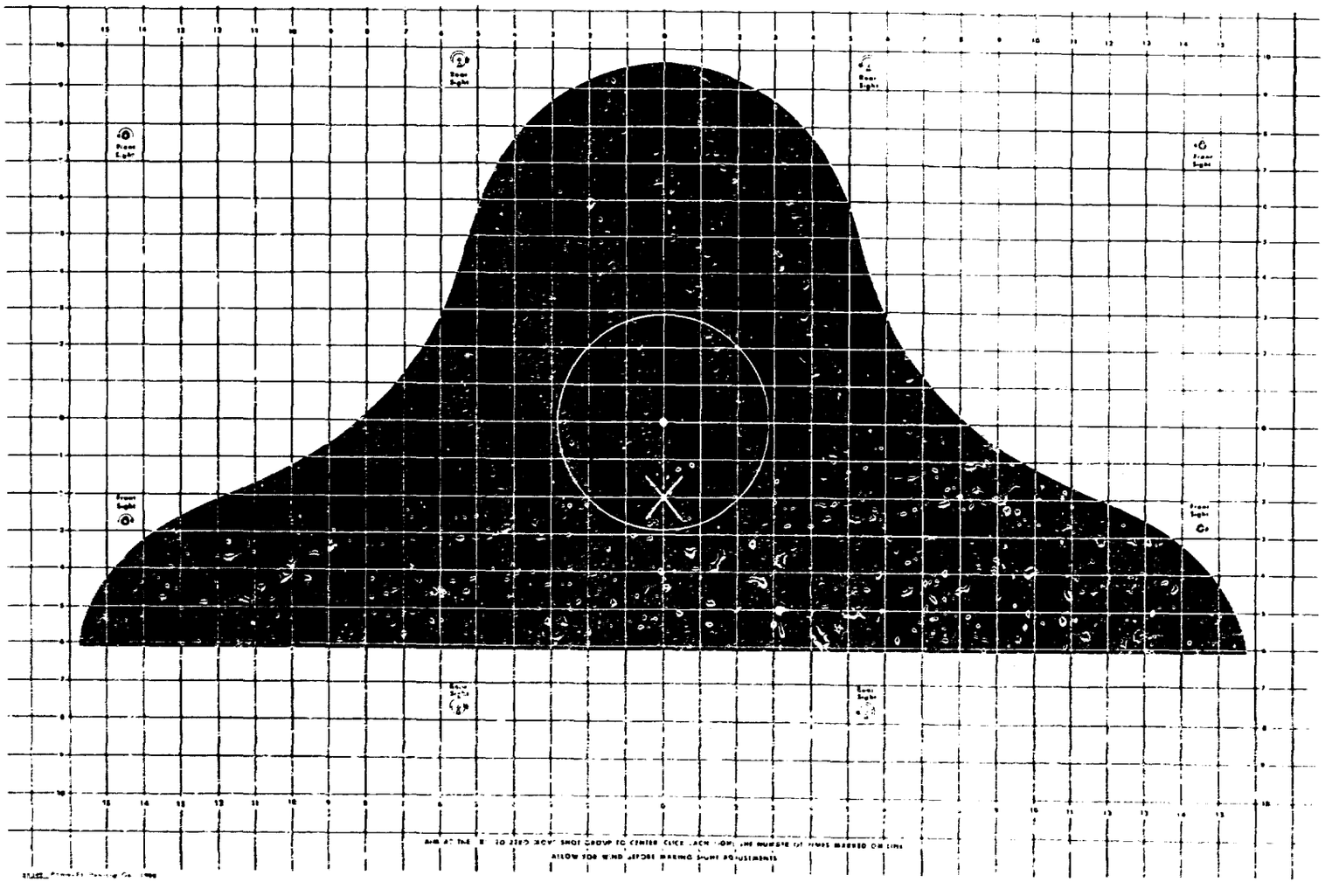

Figure 5. 75 meter feedback target. (This figure has been reduced.)

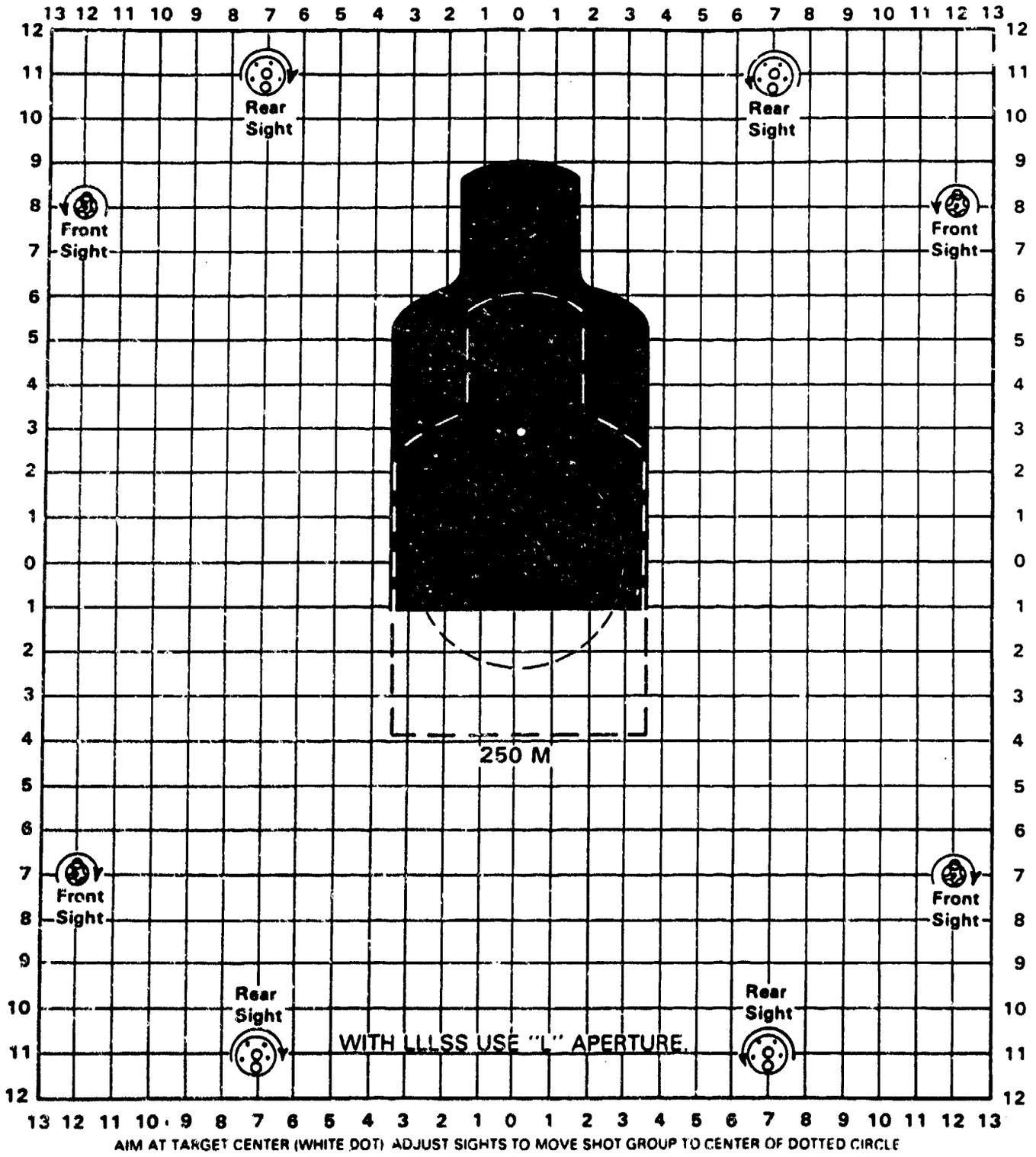

Figure 6. 25 meter zeroing target for M16A1 rifle with low level sight system (LLLSS). (This figure has been reduced.)

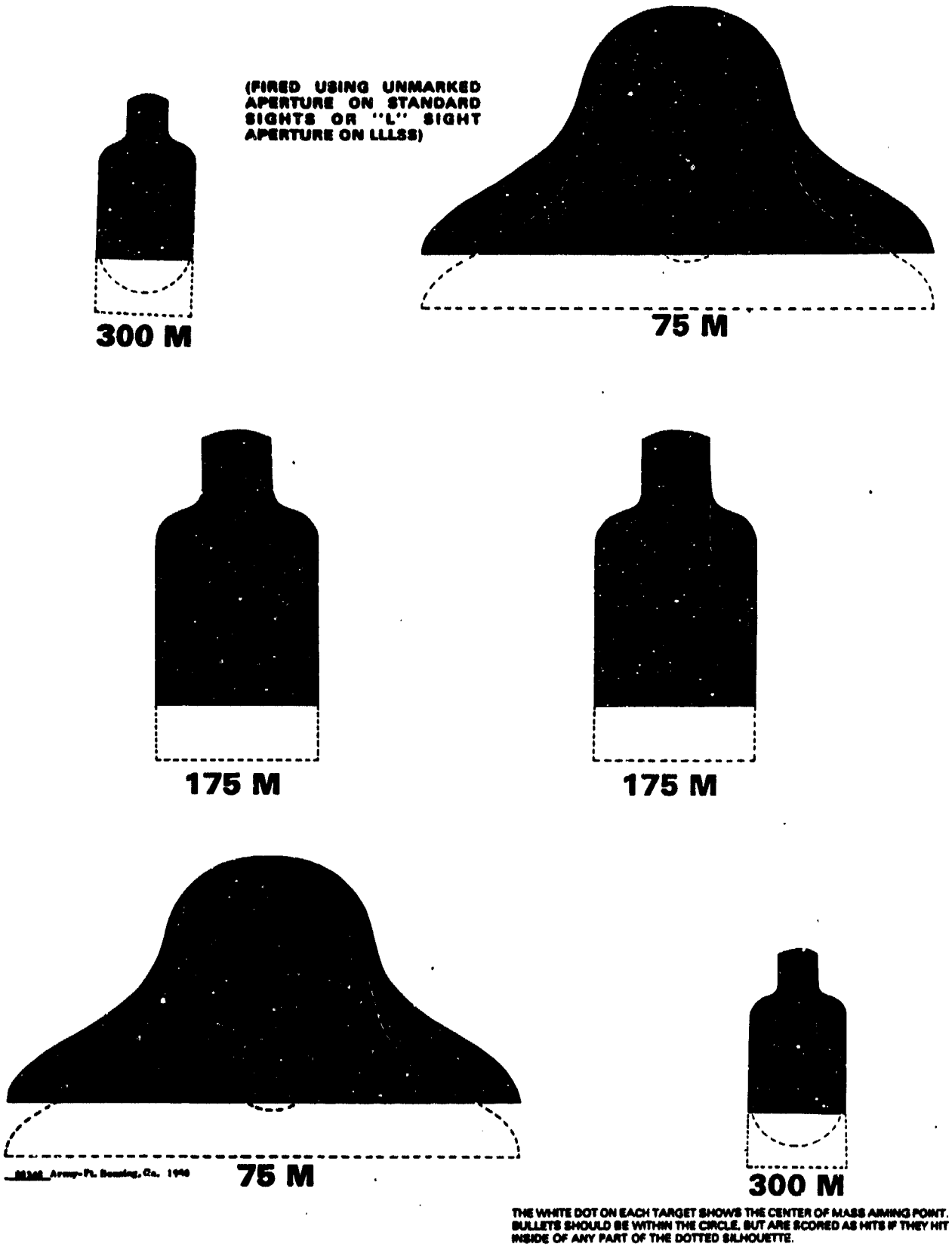

Figure 7. 25 meter scaled silhouette slow fire target. (This figure has been reduced.)

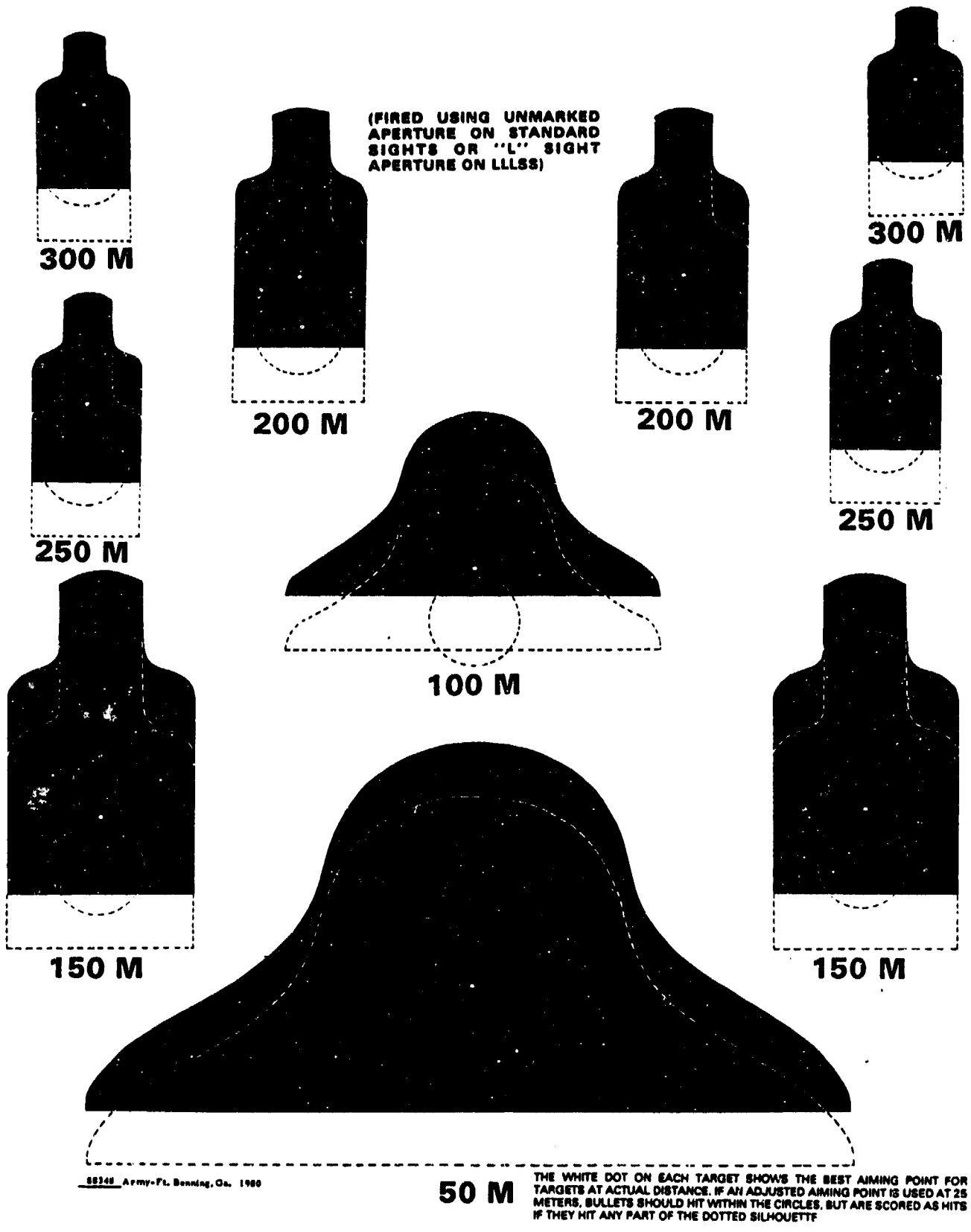

Figure 8. 25 meter scaled silhouette timed fire target. (This figure has been reduced.)

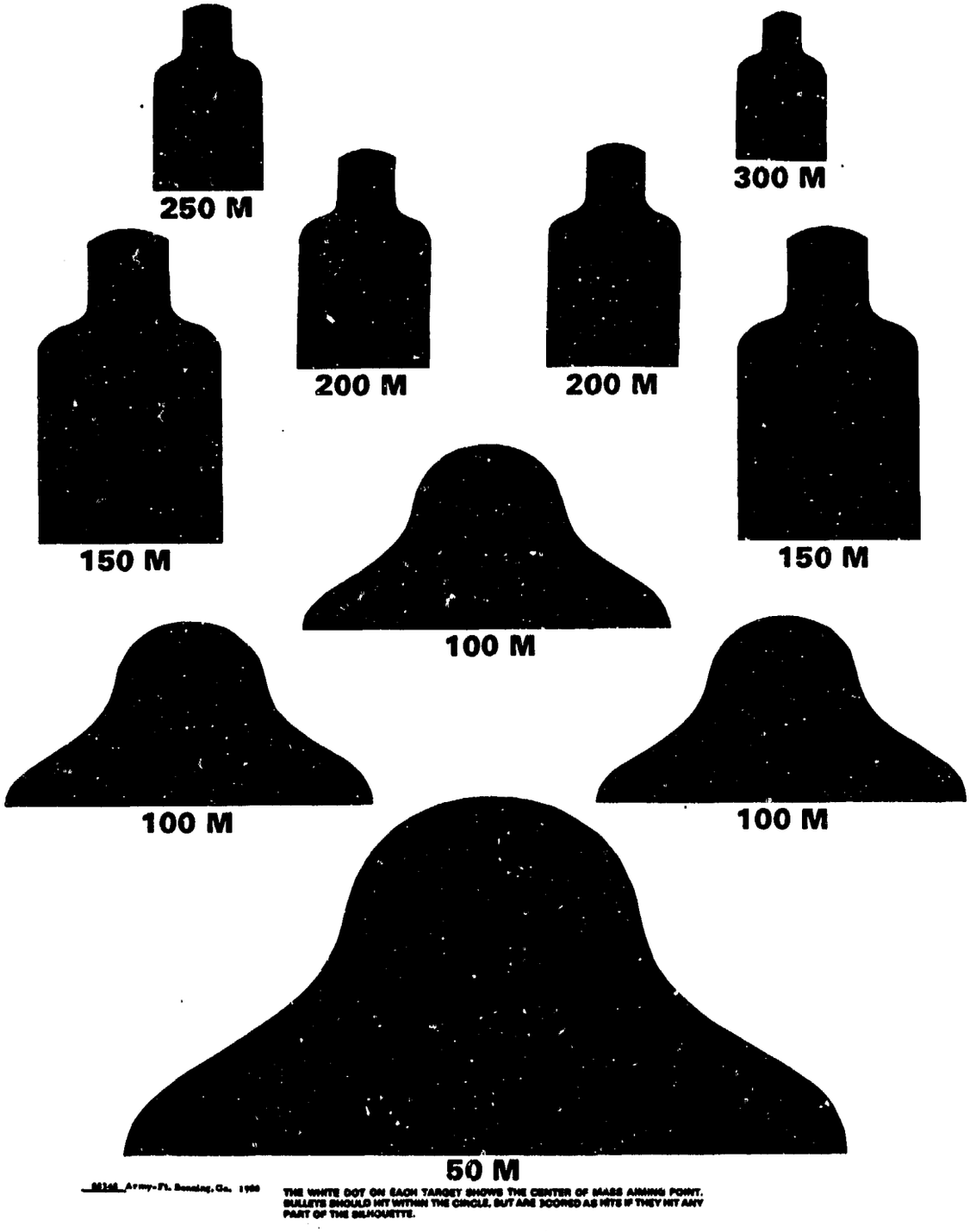

Figure 9. 25 meters alternate course "C" record fire qualification. (This figure has been reduced.)

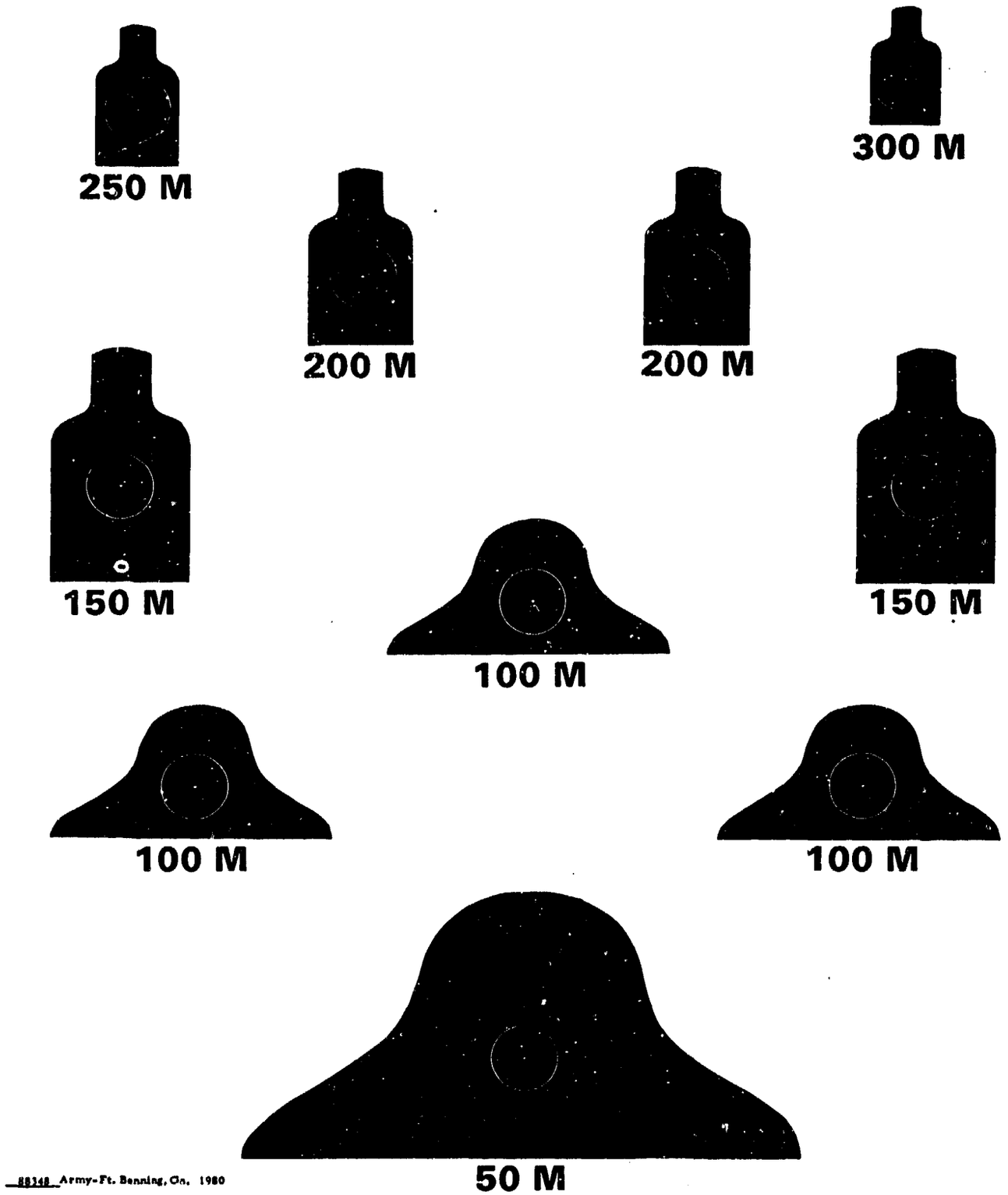

Figure 10. 15 meters alternate course "C" record fire qualification. (This figure has been reduced.)

ANALYSIS OF PROPOSED CHANGES TO RECORD FIRE

The record fire course of the new BRM POI was designed to increase standards and better reflect combat marksmanship requirements while instilling confidence in the man-weapon system. Several aspects of the program were developed based on experience gained by actual participation in the old marksmanship program, by observing several thousand trainees undergoing marksmanship training, conducting firing adequacy tests of typical M-16 rifles used by trainees and several field tests of various training procedures. The record fire course was designed to give appropriate consideration to trainee potential, rifle capability, proven principles of learning, threat analyses and training constraints. However, the record fire scorecard required field validation. This record fire course has undergone several months of field validation with several thousand soldiers of the First Infantry Training Brigade, Fort Benning, Georgia. All available data support the validity of the record fire course and no required changes are indicated.

However, the Infantry School proposed three changes to the record fire course: reduced exposure time, more rounds than targets and rapid magazine change. The findings of a subjective analysis indicate that each change may have a negative impact on the BRM program and that the combination of the three changes may be detrimental to the goals of BRM.

Reduced Exposure Time

The following times are total times (sec) for all targets on the record fire course:

	Foxhole (20 targets)	Prone (20 targets)
37 hour program (Old POI)	130	145
57 hour program (New POI)	98	106
Proposed 57 hour program	70	66

These times in the proposed program are not considered adequate for the novice firer to apply proper shooting fundamentals.

More Rounds Than Targets

The proposed change provides 25 rounds in two magazines for the engagement of each firing table (20 targets from the foxhole supported position and 20 targets from the prone unsupported position). It takes only 40 rounds to hit 40 targets. Providing 10 extra rounds may indicate a lack of confidence in the weapon or the soldier's ability to hit targets. With insufficient exposure time to properly engage each target with one round, with 25 rounds for 20 targets a shot must be fired an average of every 2.8 seconds from the foxhole and every 2.6 seconds from the prone, unsupported position. This time of 2.6 seconds per target includes

target acquisition time and a magazine change. The current Army-wide program (old 37 hour POI) allows 7.3 seconds per target and does not require a magazine change. The soldier may be influenced to shoot the first shot fast so he will have time to shoot again if he misses. This does not appear to be consistent with the objective of teaching basic shooting fundamentals. If the soldier puts a steady front sight on the target and takes time to squeeze the trigger, research data indicate that a second shot will probably not be necessary.

Rapid Magazine Change

A rapid magazine change is an integral part of combat marksmanship and it should be part of the BRM program. Accordingly, it was included in concurrent training of the original 57 hour program. Changing magazines is a very simple task; however, it would be problematic in BRM record fire. It appears likely that a magazine change required at a random location in BRM record fire, while a scenario of short exposure targets continues, would be too complex for many soldiers this early in their training. Again, this requirement may take the focus away from good basic shooting fundamentals.

The combination of these three changes in BRM is considered too complex for the average man and woman, with three weeks in the Army and no previous shooting experience. There is concern that when the BRM program is implemented at nine Army Training Centers, limited training time and unqualified instructors coupled with a complex record fire course will result in failure to teach basic shooting fundamentals. To enhance combat marksmanship, basic shooting fundamentals should be the primary focus of BRM.

In view of the above, it was recommended that the proposed record fire not be favorably considered and that the record fire course that had undergone several months of successful field testing be retained.

ADDITIONAL WORK REQUIREMENTS

Improved Marksmanship Guide

The Basic Rifle Marksmanship Instructor's Guide[11] was developed under a previous contract (MDA 903 79 M 7322). Five hundred copies of the Guide were printed and distributed to drill sergeants of the First Infantry Training Brigade and marksmanship instructors of Committee Group, Fort Benning, Georgia. All user comments have been very favorable, however, observing personnel using the guide and observing marksmanship training have provided ideas for making the guide easier to use and for including information that will promote a fuller understanding of some basic marksmanship training procedures. Improvements would include more

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[11] Osborne, op, cit.

sketches and pictures, a more detailed discussion of firing positions, an appreciation for the benefits of dry fire and additional information on the zeroing process. An index and glossary are needed. It is suggested that this revision be scheduled as soon as practical.

Shooting Book Development

It is recommended that an individual trainee marksmanship book be developed. This book would provide basic shooting information to the trainee and provide a precise record of his performance on all periods of instruction. It is believed that the trainee could maintain this book within the current time allocated for each firing order. The book would be an invaluable diagnostic tool for the trainer because the trainer cannot possibly remember past performance of each soldier or the special instructions he previously provided. A shooting book would also provide important marksmanship information to the individual soldier. Assistance has been provided to ARI for the development of a draft shooting book.

Field Manual Update

The M16 Field Manual, FM 23-9, has been outdated by the new training program and the Basic Rifle Marksmanship Instructor's Guide. This manual is scheduled to be updated by the Infantry School.

Training Extension Course (TEC) Update

A review of available TEC lessons reveals no lessons addressing current marksmanship fundamentals or training procedures. This medium could be a source of marksmanship information for all soldiers. All existing lessons should be reviewed for correctness and adequacy and needed new lessons prepared.

Training Film Development

This medium should be considered to provide such things as a program overview, understanding of weapon functioning and capability, trajectory, and basic shooting fundamentals. Films can help train the trainer and are excellent means to standardize and improve many parts of general marksmanship training (especially when so many trainers are not marksmanship specialists).

Improved M16A1 Rifle Serviceability Checks

Current rifle serviceability checks identify all rifles that are unserviceable due to safety considerations. Some rifles that are unserviceable due to factors that cause rifles to shoot inaccurately are also identified; however, all bad shooting rifles are not identified by current checks. The problem, discussed

in a previous research report,[12] should be addressed by appropriate Army agencies.

Improved Rifle Maintenance Training

Current maintenance training appears to be inadequate because many rifle malfunctions are observed. The dependable functioning of the rifle is considered to be an important aspect of an effective marksmanship program and a soldier's responsibility. An improperly maintained weapon or magazine can be the cause of a malfunction. Ideally, all firing should be conducted using the magazines issued to each individual soldier. Additionally, research needs to be conducted to determine what factors will cause malfunctions in a combat environment. Limited firing tests have indicated that a total lack of maintenance may result in better weapon operational dependability than the type of maintenance currently being performed.

Improved Target Maintenance

One important aspect to an effective marksmanship program is to have dependable target mechanisms. Hit/miss information is a very crude form of feedback for the efficient acquisition of marksmanship skills. Therefore, it is very important that trainees have a high level of confidence that field fire and record fire targets will fall when hit. Adequate resources should be committed to maintain targets in a high state of repair.

Alibi Procedures *

Alibi targets are normally provided due to target malfunctions or weapon malfunctions. The trainee should not be penalized for a target malfunction; however, the trainee can be fairly penalized for a weapon malfunction. Currently, target and weapon malfunctions can be used to improve marksmanship scores because alibi targets are usually provided at close range. It is suggested that a no-alibi policy could result in the following:

- Each firing order would take less time.

- Each lane with an inoperable target would be closed - taking more time to fire a company but forcing better target maintenance.

- Each target not fired at due to a simple weapon malfunction would be listed as a miss - forcing better weapon maintenance.

Trainees with legitimate alibis would be allowed to refire the course. Consideration should be given to the establishment of an Army-wide alibi policy.

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*During record fire, when a pop-up target cannot be engaged because the target or rifle malfunctions, additional targets (alibi targets) are exposed to allow the soldier a fair chance of hitting all targets.

[12] Osborne, Morey, & Smith, op. cit.

Training with Pre-zeroed Weapons

If initial marksmanship training could be conducted with a mechanically zeroed weapon, several training benefits could result. A dry zeroing device, designed to allow a zero to be placed on the M16 rifle without firing, was tested. The device was determined to be ineffective for M16 application due to the variability (between guns) of M16 front and rear sights in relationship to the barrel. A procedure for issuing zeroed weapons should be investigated.

Feasibility of Five Round Shot Group

A five round shot group has been found to provide information to overcome the effects of weapon/ammunition variability and therefore provide better information upon which to make sight changes than does a three round group.

Accordingly, a limited test was conducted with five companies of the First Infantry Training Brigade. This test did not show improved record fire performance. Therefore, no change to the current three round shot group was recommended. However, it is believed that this may have resulted from using five round groups too early in the program. If an individual can't shoot, it is logical that a five round group can't provide any more information than a three round group. A five round shot group is currently used on the downrange feedback range and appears to be producing good results. Additional study is required to determine if a five round shot group may be appropriate for confirmation of weapon zero or some other firing task later in the POI.

Development of Automatic Fire Fundamentals

All soldiers are given familiarization training on how to fire the M16 in an automatic role.

The fundamentals currently used for automatic fire were derived from the semi-automatic fundamentals and have not been tested. Testing is required to insure that appropriate fundamentals of automatic fire have been identified. There are two basic automatic fire positions, one is contained in FM 23-9 and the other is in the BRM POI. Initial testing of the two positions, in a semi-automatic mode, indicates that the position described in the FM is more advantageous. Additional firing needs to be conducted to determine the optimum automatic fire position and to confirm basic automatic fundamentals.

Procedures for Firing with Protective Mask

All soldiers must be prepared to employ the rifle effectively while wearing a protective mask. Additional research is required to insure that optimum target engagement techniques have been developed. For example, the problem of adjusting point of aim to allow for correction of parallax errors due to cant of rifle is not addressed in current literature.

CONCLUSIONS

All training evaluations must rely heavily upon the demonstrated terminal performance of the personnel who have been trained. The graph in Figure 11 reflects a 10 company moving average of record fire scores from January 1979 to July 1980 (137 companies) within the First Infantry Training Brigade, Fort Benning, Georgia. (Raw scores are in Appendix C)

All scores were manually collected from the same range and the inherent scoring errors are assumed to be relatively constant. The new record fire course is different from the old course in two aspects. First, six targets were moved closer to the firer (resulting in a higher hit probability for six targets). Second, the average exposure time of all 40 targets was reduced by 30% (making it somewhat more difficult to hit each target). Additionally, the minimum hits required to qualify were increased from 43% to 58% and the hits required for an "expert" rating were increased from 70% to 90%. While the new record fire course clearly represents a higher marksmanship standard, it appears that the average trainee will score two to three points higher on the new record fire course than he would have scored on the old record fire course.

Due to the piecemeal-type implementation and normal variability among companies, a 10 company moving average (each company averaged with the nine preceding companies) was used in Figure 11 to show the dramatic increase in marksmanship scores that occured as a result of the new marksmanship program.

The Committee Group instructor personnel were trained and initial preparations for program implementation were completed in late 1979. The POI was formally initiated in early 1980. There was a total of nine companies that received the new POI before the new record fire course was implemented. In order to statistically analyze the improvement due to the new POI, a regression line was constructed using the seven prior blocks of nine companies. The resulting linear prediction equation was:

$$Y' = .24X + 21.99$$

where Y' = predicted record fire score

and X = temporal block with $X = 0$ being 8 blocks prior to the implementation of the new record fire course.

This equation accounts for 62% of the variance with $r = .79$ and $s_{est} = .40$. Using this equation to predict the performance of the one block of companies that received the new POI and the old scorecard, it was found that the actual performance was 3.62 z units higher than predicted. This represents a highly significant increase ($p < .001$) in performance. In addition, it should be noted that the above test is a conservative measure of improvement. In fact, improvements were taking place in the base line data prior to program implementation (probably due to the new program's cadre training that was taking place), and also after the new record fire course was implemented (probably due to the company and committee personnel adapting to and refining the new instruction and the availability of supporting training aids).

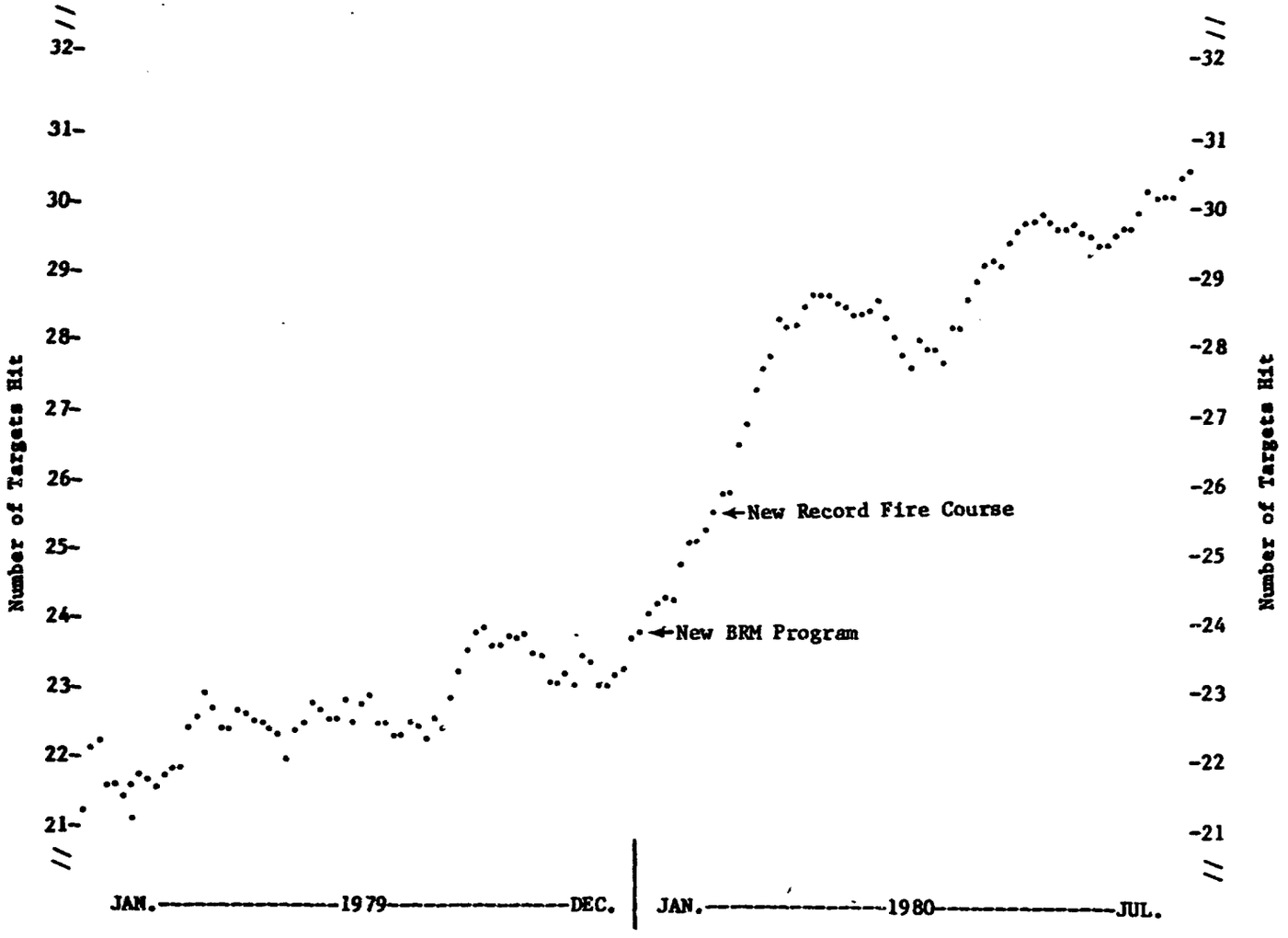

Figure 11. Record fire scores. Represented are the record fire scores (company average) of the 137 companies (approximately 25,000 soldiers) trained by the First Infantry Training Brigade, Fort Benning, Georgia, during the period January 1979 through July 1980. Each dot represents a company average, averaged with the previous nine companies—a 10 company moving average.

Appendix A

Evaluation of Learning Techniques

The suggestions and recommendations in this appendix are the results of a period by period review of the Basic Rifle Marksmanship (BRM) Program of Instruction (POI). This review was conducted with a learning, motivation, and cognitive emphasis.

Period 1, Introduction to Rifle Marksmanship and Mechanical Training

The introductory period to BRM should set the stage for the entire program. Besides the content matter to be taught (maintenance and cleaning of M16A1 rifle), the trainee should be given a brief overview of the entire program including each period's goals and objectives. Also, there should be a strong positive motivational element woven into Period 1. The trainee should finish the first period motivated to do well, convinced that the M16A1 is an excellent weapon, and enthusiastic to master the marksmanship task. These goals can be accomplished by addressing the following points.

An overall outline of the BRM program along with the logic of transitions should be provided. It is a well known learning principle that learners do better at learning specifics if they are first provided with a look at the general framework. Also, range layout and types of targets should be described in order to provide less confusion and more efficiency in the later periods.

The high quality of the weapon and the importance of marksmanship should be emphasized in order to generate confidence in the weapon and motivation for BRM.

Potentially negative information such as weapon malfunction, should be neutralized by describing them as rare, especially if the weapon is properly maintained. This would be desirable because of the enhancement of motivation and confidence in the weapon.

Clear definitions of new terms should be provided. It should not be forgotten that what is well known to the trainer is completely new to the trainee. It is highly frustrating to try to learn new verbal conceptual information when one doesn't know the terms the instructor is using. Examples of words that should be defined:

zero	shot group	reducing stoppage	rodding
meter	triangulate	center of mass	trajectory
projectile	aperture	malfunction	holdoff
range point	peep sight	"E" silhouette	berm
range tower	stoppage	"F" silhouette	

To facilitate learning in the poor reader and poor English trainees, heavy use of modeling, slides, charts, training aids, and pictures is recommended. All charts and slides should tell a story and be empirically validated as clear and to the point.

"Hands on" should be encouraged. Motor responses are best learned through motor practice. Motor practice provides the proprioceptive and kinesthetic feedback necessary for mastering complex motor learning.

In demonstration of assembly and disassembly, close-up demonstrators should be used (1 demonstrator per 20-25 trainees). Also, steps should be presented slowly (1-3 at a time), and then allow the trainee to catch up. Retention of 7-10 motor responses is nearly impossible for a subject unfamiliar with the task.

Each trainee should assemble and disassemble his weapon several times in Period 1. Research on serial learning indicates that knowledge of A to Z does not necessarily mean knowledge of Z to A.

Most trainees will not be adept at estimating distances, especially in meters. Therefore, slides should be shown of personnel targets which are 100m, 200m, etc. To enhance learning, material should be made meaningful. For example, a distance of 100 meters might be described as about equivalent to the distance of a football field from goal line to goal line.

Cleaning should be practiced in Period 1. Again, motor tasks are best learned with motor practice.

The marksmanship badges should be pushed as incentives for high performance. Incentives have been proven to be extremely effective motivators.

Questions should be encouraged, repeated over the PA system, and thoroughly answered. Active instructor - trainee interactions facilitate training.

A motivation pitch should conclude the period. Trainees should be complimented on their successes that day, informed of the tasks in Period 2, and motivated for the next challenge. Some learning theorists believe reinforcement is necessary for learning. In the training context, reinforcement could be provided with praise, recognition, positive feedback of results, badges, etc.

Period 2, Fundamentals of Shooting: Dry Fire

In all periods, the main purpose of the period as well as a motivational pitch should be presented at the beginning and end of the session. Also, transitions should be made from the last period and to the next period.

The Four Basic Fundamentals of Marksmanship should be emphasized. Research has shown that a progression of easy to difficult will yield maximum learning.

Details of range information should be presented.

All of the dry fire training aids should be described, explained, and demonstrated in the bleachers. Modeling is an effective first step for motor acquisition.

Without details of gravity effects, the trainees should be told about the long range and short range sights and when to use each. The specific details of wind and gravity are difficult to learn and should come later, after fundamentals are mastered.

Period 3, Fundamentals of Shooting: Live Fire

All live fire ranges should be provided with master weapons which are pre-zeroed and virtually guaranteed not to malfunction. These weapons should be used in two cases: for all demonstrations, and for trainees who are completely missing the target to determine if their weapon is the source of the problem. Some provisions must be made for the frustrated learner who has fired many shots and is still not on paper.

The logic of the size and distance of the 25m silhouette target should be explained. Although it will become clear later in the field fire periods, the logic of the shape and size of the targets is not entirely obvious at this early point in training.

Instructions for immediate action and remedial action should be explained and kept constant for all periods. It is important that instructors be familiar with the entire program so that they don't assume a particular topic was taught earlier and so that topics are always taught consistently.

Instructions for triangulating and numbering shot groups should be given and kept constant for all relevant periods. The size of the shot group is one of the key features and cannot be over emphasized.

The importance of using the long range sight should be emphasized on all 25m ranges. At some point, the logic of using the long range sight should be conveyed, otherwise, there is an obvious contradiction to the trainees.

In any live fire period, trainees who are not hitting paper should be given some remedial help (e.g., check for long-short range sight error, given master weapon, tested on eye chart, Weaponeer, etc). Even with high trainee/instructor ratios, it is unthinkable to provide no individual assistance to the few who are doing very poorly.

Multiple targets are used on all of the 25m ranges. The trainees need to be cued on each firing which target to fire at. This procedure will reduce confusion and frustration.

Firing a tight shot group is the main purpose of Period 3. This fact should be promulgated throughout the period.

Period 4, Practice Firing: Zero

On all ranges, the assistant instructor (AI's) should provide instruction when possible. Also, they should check out each of their assigned trainees before the trainee leaves the target area.

All AI's on all ranges should be told to give less weight to highly disparate shots when advising trainees about the slight changes. Disparate shots have the psychological effect of being weighed too heavily. This could result in an over-compensating sight adjustment.

The zeroing procedure is highly important. Trainees should not be rushed. Lack of a proper zero could greatly influence the trainee's performance in the entire program. This information should be communicated to the trainees. As in most motor tasks, accuracy should come before speed.

It would be highly desirable if each trainee could get feedback not only from seeing where his bullet struck, but also some honest verbal feedback from the AI's. Trainees who are doing well should be told so; trainees who are doing average should be encouraged; and trainees who are doing poorly should be given remedial assistance.

In concurrent training, motor learning tasks should be demonstrated and practiced by the trainees. This is much more effective than talking about motor tasks.

The Weaponeer should be utilized to its maximum capacity. Following are some suggestions concerning the use of the Weaponeer:

o Keep the Weaponeer in use because it is the most important diagnostic device available.

o Stop after every shot group and review bullet strikes and 3 sec replay.

o If there is an immediate tremendous improvement from the range performance, then either a weapon problem or a vision problem may be indicated.

o The trainer should normally observe and critique the trainee's observable behavior during the firing process. The trainer can critique point of aim later, during the replay.

o The relevant functions and capabilities of the Weaponeer should be explained to the trainee prior to its use.

The basic principles involved in the effects of wind and gravity should be introduced without overwhelming the trainee with details. This is a very difficult assignment and should probably be given by one of the best instructors. Heavy use of charts and diagrams would facilitate this difficult conceptual learning task.

Period 5, Practice Firing: 25-Meter Silhouette

This is the trainees first exposure to targets which contain multiple silhouettes representing personnel targets at different ranges. Therefore, great care must be taken to explain the concept and rationale to the trainee.

This is the first period that uses a score card. It is important that the score card is thoroughly explained in all periods in which score cards are used.

Firing at the three left silhouettes on one target and then the three right silhouettes on the same target can become quite confusing given there are typically two targets posted. Again, carefully prepared, slowly spoken, and clearly enunicated information from the range tower could eliminate confusion.

It is recommended that after each three round shot group, in the foxhole supported position, the trainees move down range to inspect their targets. If shot group errors are substantial and in a consistent direction, then sight changes are in order. While firing from the prone unsupported position, the target should be checked only after all three targets have been engaged (due to time constraints) and no sight changes should be made (due to the instability of the position).

Period 6A, Downrange Feedback: 75 and 175 Meters

This is the first period in which trainees will engage "standard" targets at actual range. Also, this is the first and only period in which trainees are able to receive precise performance feedback from actual size and actual range targets. Therefore, it is crucial that the importance of this period be stressed, both in the bleachers and from the tower. Here again, as in all the periods, it is important that the bleacher pitch provide a smooth transition from the last period and to the next period.

Speakers should be placed down range so that the range tower can help in the instruction process. The trainees should be reminded over and over what the purpose of the period is and what to look for.

The use of spotters and pasters should be fully explained in the bleachers and fully exercised during the period.

Because this is the first range the trainee encounters that is more than 25m, it is important to review the effects of wind and gravity, especially on windy days. Also, holdoff techniques should be explained.

Trainees who aren't zeroed should be given special attention and a chance to zero their weapon.

Trainees should be told to place their sight on short range. This should be checked by the AI's.

Period 7, Field Fire: Single Targets and Target Detection

This is the first exposure to the field fire pop-up arrangement that will be central to the upcoming record fire scenario. Period 7, along with periods 8, 9 and 10, should be presented to the trainee as an important warm-up sequence to the ultimate record fire.

This is the first time strict time limitations are placed on the trainee. Both speed and accuracy are very important in the upcoming record fire exam and in any combat situation. Therefore, the logic, rationale, and importance of the timed fire procedure should be explained in detail.

In the bleachers and in concurrent training, target detection should be emphasized. This is another very important component of both record fire and actual combat. Scorers should be told not to prompt shooters about which distance is coming up next.

All ranges (especially the field fire ranges), should be very clearly laid out. Lane boundaries and the correct target should be clearly marked to avoid frustration and incorrect feedback.

Period 8, Field Fire: Single and Multiple Targets

In this period, trainees are exposed to timed multiple targets in a way that is completely analagous to record fire. Again, trainees should be made aware of the gradual changes that are preparing them for record fire.

Steps should be taken to insure that alibi shots are really due to defective weapon, targets, or rounds. Otherwise, trainees will take easier alibi targets in lieu of difficult distant targets.

Period 9, Zeroed and Timed Fire (25-Meter Silhouette)

There are two major purposes for this period and both should be made clear to the trainee. First, they are given a final chance to confirm their zero before going to record fire. This should give them added confidence in their weapon and in their mastery of marksmanship. Second, the trainees are exposed to a strictly timed multiple silhouette target that places them under a stress similar to record fire and combat fire. Also, they are given one final opportunity to receive precise feedback about where the bullets went. This rationale should be fully explained to the trainees during the bleacher pitch.

As internal pressure and concern about record fire builds in the trainees, less external pressure needs to be exerted. Rather, reassurance and reinforcement for their performance is preferable.

In all periods, the company cadre and the committee cadre should work cooperatively toward the same end: excellent rifle marksmanship. It is important

in the later periods that the company cadre be able to quickly identify individuals having trouble and work with the committee cadre in correcting the problems.

The concurrent training areas should be far enough from the firing line so that the noise does not interrupt instruction. Similarly, the bleachers should be far enough away from roads so that traffic noise does not interfere with training.

On all feedback ranges, trainees should be given adequate time to study their shot groups, triangulate, etc. Ample time must be provided for the trainees to absorb and interpret the feedback available.

Since trainees have just come from actual distance ranges, they should be reminded to place their sight on long range. Again, the AI's should check on the sights and provide any other relevant performance feedback.

Period 10, Combat Firing (Record Range)

The primary purpose of this period is to give the trainee a perfect preview of what will occur in record fire. It is therefore quite important that the range physically resemble the record fire range, the scoring resemble record fire scoring, the target detection task resemble the record fire task, etc. In Period 10, there are two significant changes from all previous range experiences which both concern the physical plant of the record fire range. First, the record fire ranges at Fort Benning are situated on gradually upward sloping grades while all previous ranges were on flat terrain. Second, the record fire ranges have distinct lanes with trees, bushes, and tall grass creating a natural forest appearance, while all previous ranges have been quite different in appearance. Although both of these changes contribute to a potentially realistic rural combat environment, they do represent a dramatic change from the ranges the trainees have experienced. First, depth perception is different from flat terrain to hilly terrain. Second, the problem of target detection becomes much more difficult on the record fire range than it had been on the relatively barren field fire ranges. All of these facts combine to make practice record fire a very important transitional period of instruction.

Since the trainees have been shooting at 25m targets, they need to be reminded to return to the short range sight. The AI's should check all trainees.

Period 11, Record Fire

It is quite important that the record fire period be conducted in a smooth professional manner. The trainees will probably be in a highly nervous and apprehensive state of mind. Any delays, problems with the equipment, personnel mix-ups etc., will probably trigger more anxiety and frustration. It is important that every soldier does well in record fire not only because it demonstrates the successful products of a good POI, but also because it will increase the confidence of the trainee in his weapon, his ability to master the marksmanship task, and ultimately his own self-efficacy as an Infantryman.

Because record fire is so important, there are potential problems in using other trainees as scorers. The best answer here is to automate the scoring system.[13] Of course, this could lead to more mechanical equipment problems. Perhaps a combination with trainees and machines both scoring all lanes would be best. In this manner, the equipment could validate the scorers and the scorers could validate the equipment. That is, highly discrepent scores would indicate either human or machine errors, and both could then quickly be checked.

On all automated ranges, the equipment must be kept in top shape. Preventive maintenance is the key. The frustration of faulty equipment at this point is highly disruptive to the trainees.

Company recognition and marksmanship badges should be given as soon as possible upon completion of BRM training. Immediacy of reinforcement is important for increasing learning, motivation, and morale.

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[13] Smith, S. How to Remotely and Automatically Score TRAINFIRE Record Fire and Field Fire Ranges. ARI Draft Research Report, September 1979.

Appendix B

Considerations for Implementation of the Basic Rifle Marksmanship (BRM) Program of Instruction (POI)

The suggestions and recommendations in this Appendix are the results of a period by period review of the BRM POI, with emphasis on items that are important for implementation of the new program.

INSTRUCTION PRESENTATION AND MANAGEMENT

Bleachers

Bleacher pitch prepared: Not only should the instructor give a briefing on the purpose of each period (i.e., why you are here) but also on the previous period(s) (how does what you did/learned relate to what you are going to do/learn). The bleacher pitch should also carry the idea of motivation. Words such as "fail", "no-go", and "bolo" should be less emphasized and words "go" and "expert" stressed. It is most important that confidence be instilled in the mind of every trainee.

Visual aids prepared: All charts required by the POI need to be used. In addition, each period of instruction should have charts explaining (1) the purpose of the period, (2) the four fundamentals of marksmanship, and (3) adjusted point of aim (or point of aim, depending on the period). Each visual aid must be fully explained at a level the trainees can understand. Too much technical data should be avoided. All questions should be answered as time permits, even if they are unrelated to the current period. If a question arises on a topic that was covered during the lecture, statements such as "Were you asleep when I covered that?", "I see you were not paying attention", etc., should be eliminated. Such statements will serve to halt or greatly limit legitimate questions. If people are going to be embarrassed they won't risk asking questions.

Demonstration needs: Not only should all necessary visual aids be present, but also the smaller items used to explain (or that relate to) the larger. This would include things such as magnetic spotters to demonstrate shot groups and a pointer to point out specific areas on interest. When an assistant is used to demonstrate, he should be smartly dressed and competent. When it comes to live fire demonstrations, the demonstrator should be an expert marksman (i.e., no targets should be missed and, when appropriate, targets should be brought back and shown to the trainees). Errors by any of the training personnel will reflect back to the trainees and they may have thoughts similar to, "If he (a supposed expert) can't do it, how do they expect me to?" Use of a prezeroed weapon of known quality is suggested.

Tower

Tower pitch: Pushing the trainees (e.g., "hurry up", "it doesn't take all day to fire your shot group" or "let's go AI's, hurry them up") should be eliminated. Instead, motivational statements and praise are recommended. Phrases

such as, "take your time...", "remember your fundamentals", "you can do it", "good shooting", etc. should be the standard. In many of the periods, the trainees move downrange to spot targets, triangulate shot groups, change sights, etc. When this occurs, the tower should be giving constant positive feedback as to what the purpose is of a trainee being downrange. It is also the tower's responsibility to announce wind conditions; especially when in excess of 5 miles per hour.

Aids for tower/firing line: An excellent aid for the firing line is a plastic device that is inserted into the chamber (chamber lock). When the bolt is allowed to go forward, a portion of the device called the "flag" sticks out, thus showing at a quick glance the weapon is cleared. The time required to fire again will be cut in half (AI's will not have to physically pick up the weapon and inspect the chamber). More rods should be available on the firing line. Ideally, each AI on the firing line should have a rod in his possession. Many times, weapons located the farthest from the point where the rods are kept will malfunction and require rodding. When this occurs, firing ceases until a rod is secured, the weapon rodded, and the rod returned. The time wasted would be cut to a fraction if the AI closest to the malfunctioning weapon had a rod in his possession.

Range Preparations

Preparations for firing: If nails are required to make sight changes, the range personnel should make sure every target frame has one. At times a different sight (long vs. short) is used. Making sure the soldier's weapon is correctly set should be done while the company is in the bleachers and not depend on individual adjustments while on the firing line. The AI's must be made aware of the purpose of the period and what is expected of them on the firing line and, if trainees are to move to their targets, what their responsibilities are downrange. The trainees must know what the purpose of the period is before movement to the firing line.

Target requirements: Black and white 3" spotters are needed for the purpose of enabling the trainee to see what his shot group looks like from the firing line during Period 6 (downrange feedback). Also needed in great quantities are black and white pasters. These items are for the purpose of covering target hits and again are used mostly in Period 6. One of the biggest problems exists in the area of marking targets, i.e., triangulating shot groups. First, getting the trainees to mark their targets as accurately as possible must be stressed. It must be stressed to the training personnel that triangulation of shot groups is the only acceptable way. Next, each trainee should be required to have in his possession a ball point pen and a felt tip pen. Red shows up well; especially when the shot group is in the black portion of the target. Finally, each shot group should be numbered as to whether it was the first, second or third. Normally, nails are required at each target frame for the purpose of changing sights. The first problem in this area is the insufficient number of nails. The range personnel must insure that all frames have nails and nails needing replacement (bent, broken, etc.) are changed. The second problem with nails are how they are used. If too

much pressure is placed on the detent pin then (1) the trainee will not be able to change his sights because the detent pin is locked to the bottom, thus preventing the sight from rotating, and (2) if this happens, the trainee will undoubtedly attempt to force the sight to turn, perhaps damaging the sight spring, thereby causing damage to the sight. Until a better tool is developed, the trainees should be informed - while still in the bleachers - the proper method of using the nail so as to prevent damage to the sights.

Firing point preparations: The POI recommends that the firing line be divided into four sections and that each firing order contain an equal number of personnel from each platoon. For example, if a range has 32 firing points, personnel of the 1st platoon would fire on points 1 to 8 under the supervision of the 1st Platoon cadre, personnel of the 2nd platoon would fire on points 9-16 under the supervision of 2nd platoon cadre, etc. Using this procedure, platoon cadre are more likely to remember individuals who are having difficulties and help them prior to the next period of instruction. All targets should function. All firing ranges should be inspected for any malfunctioning targets or targets needing replacing before any firing begins. Waiting to spot malfunctioning targets during training is unacceptable. Sufficient ammunition should be at each ammo point to insure each firer has his specified amount. All AI's and safety personnel should be at their assigned positions on the firing line before the trainees take their assigned firing point. Before movement to the firing line, all trainees should be checked to make sure they have all the necessary equipment (magazines, earplugs, etc.) for firing.

Sound system requirements: More loudspeakers are needed on the firing line. Four additional speakers at every range would greatly improve the understanding of instructions by all personnel on the firing line. In addition, some type of backup system is needed in case the main system fails. A series of speakers located downrange is desperately needed during Period 6 (downrange feedback). At the very minimum there should be four speakers at 75 meters and four more at 175 meters. Withour these extra sets of speakers there is no way the tower can give instructions to the trainees downrange. Without this capability, the effectiveness of Period 6 will be degraded.

Concurrent Training

Scripts prepared: It is important that the AI's know and understand the content of not only their concurrent training station, but the content of the others as well. Each range should have a list containing: (1) what the concurrent training stations are, (2) how they should be taught, (3) a list of the training aids required, and (4) what the trainee is expected to get out of it (this is, perhaps, the most important of the four). Scripts should be prepared with a list of everything the AI will talk about. This should include everything from "Good Morning, men" to "What questions do you have concerning ...". The AI should also be honest with the trainees. If a question is asked that the AI does not know the answer to, then he should so state. Responding with "See me after class" or "That has nothing to do with what I'm teaching here" will not fool the trainees. Following concurrent training the AI should make an effort to find out what the answer is, for it may well be asked again.

Signs in area for instruction and remedial use: Duplicates of charts used both in the introductory instruction and concurrent training should be posted in the trainee's break and/or dining area. Any chart(s) attached to trees in a concurrent training area that is not relevant to that particular station should be relocated to another area (they serve only as a distraction). Any posted chart not in line with the POI (e.g., "The Eight Steady Hold Factors") should be removed. One chart - The Four Fundamentals - should be posted on every range.

Sound system requirements: On some ranges the concurrent training area may be located much too close to the firing line. At such sites, some type of hand held speaker is necessary. During any concurrent training station, where the trainees are spread out (e.g., Period 2, Foxhole Supported Position), a proper sound system is also needed. It should be stressed, however, that every range should have some type of portable system in case (1) the tower's system fails, and (2) the level of noise from the firing line is such that instruction on other portions of the range cannot be heard.

Remedial Training

How to detect persons needing help: During Period 4 (zero) trainees are not sent to remedial training until his 18 allotted rounds have been fired and he is classified as a non-zeroer. A better system may be to pull these individuals from the range as soon as they have demonstrated the inability to zero their weapons. All these individuals should be identified as potential non-zeroers and immediately given remedial training. The Weaponeer is ideal for this. Individuals with tight shot groups anywhere on the target should not be included. Only individuals who have scattered shot groups should be pulled. The earlier these individuals are identified and given remedial training, the greater the chance of not having future problems. Many of the non-zeroers are simply violating one or more of the four fundamentals. All AI's should be on the lookout for shot groups that typify these violations and corrective measures taken immediately. Use of the "cheater" device (device placed behind rear sights so that AI can see same sight picture firer sees) is strongly recommended. All periods following number 4 work on the "go/no-go" system. Currently, if a trainee receives a "no-go" during Periods 5-10, he normally gets no remedial training prior to the next period. It should be mandatory that any individual that receives a "no-go" in any period be given some type of remedial training before he is allowed to fire again, and he should return to refire the "no-go" period if at all possible.

How to provide the help: The Weaponeer is an excellent training device. Ideally, this device should be available in every period of marksmanship training. And, most importantly, it must be used. One-on-one instruction should not be ruled out as a source of additional remedial training. Solving problems in this type of situation has a greater chance of succeeding than remedial training in a larger group. Other good sources of remedial training are devices such as the Dime/Washer exercise, the Riddle Sighting Device and the Target Box exercise. These items should be available at every range.

How to help persons who have missed training: ARI research data show that men missing some BRM training hit an average of 3.23 fewer targets on record fire than those attending all training. Individuals who missed the first portion of a period should not be immediately put on the firing line or in concurrent training. If an individual arrives late he has, more often than not, missed the introductory lecture and in doing so missed some very valuable information. Therefore, all individuals arriving late should have the opportunity to receive the same type of training the rest of the company had earlier. Some introductions being longer than others, a short but concise and specific lecture is suggested. Some individuals miss training because of being on KP. If an individual misses an entire day, he should receive makeup instruction from his Drill Sergeant on nontraining time. Since each period of BRM relates to the next, it is important to let trainees make up what they missed.

Resource Questions

Instructors needed: Many more instructors/AI's are needed, both in concurrent training and on the firing line. Ideally, a ratio of one AI to every three firing points is needed. The greater the number of AI's the greater the amount of individual attention; and, the greater the individual attention, the greater the learning will be.

Instructor qualification required: Competent and knowledgeable instructors are of paramount importance. Of particular importance is the qualification of the AI's. A percentage of these individuals come from other companies and vary in rank from E-1 to E-5. Many are given concurrent training assignments without being knowledgeable of the material to be taught. (Most of the E-1's and E-2's have themselves just graduated from Infantry training.) AI's should be restricted to the rank of E-4 and above and have a knowledge of BRM as it is related to the particular period in which they will participate. At a minimum, a review of the Basic Rifle Marksmanship Instructor's Guide should be required of all AI's prior to being assigned to a range. All of the instructors from Committee Group are fairly well trained for their assignments. It has been noted, however, that some have little knowledge in the areas of wind and gravity and how they effect bullet strike. Most of the new Committee Group individuals are trained primarily by on-the-job training (OJT). OJT works well; however, it does take time for an individual to become proficient. Upon signing in at his unit, the new individual should be given a copy of the Marksmanship Guide and told to study it. A periodic competency examination on its contents should not be ruled out. "Train the trainer" classes probably are also needed on a regular basis to help new personnel become proficient.

Instructor/Drill Sergeant turnover: As mentioned above, all newly arriving personnel should be given a copy of the Marksmanship Guide and required to study its contents. This not only refers to Committee Group personnel but Drill Sergeants as well. Ideally, the individual departing should brief the newly assigned on what his duties, relating to BRM, are supposed to be. If, for instance, an individual from Committee Group briefs his replacement and the replacement reviewed all the necessary material concerning BRM, his knowledge of the new BRM program and his

duties would be greatly enhanced. Before any new individual is allowed to instruct, he should spend at least one week as an observer.

How to score record fire (automatic or hand): Ideally, automatic scoring is the best system. There is a fairly easy way record fire ranges could be automatically scored. Since this may be currently impractical, hand scoring must be looked at in more depth. In the past, all record fire scorers were cadre personnel from various companies and/or Committee Group. Because of the drop in personnel this was no longer feasible. Presently, scorers are detailed from either other training companies finished with BRM, or other units on post. This system has one big flaw. Since these individuals are detailed for only one day and some being trainees themselves, scores higher than deserved may result.

Conduct of Record Fire

How to deal with alibis: An alibi is defined as a legitimate reason that allows the trainee to refire at targets due to a malfunction. Malfunctions occur from defective targets (fails to operate properly), defective ammunition (e.g., "pop and no kick"), and a defective weapon. It is in this third area where most of the alibis are presently allowed. The strict definition of defective weapon is not stressed; therefore, many trainees are allowed alibis for items such as failing to see the target and not firing in time. Very few weapon malfunctions occur because of legitimate reasons (e.g., broken firing pin or hammer spring). The method of determining alibis should be as follows. If immediate action has failed to solve the problem the trainee will signal the Safety NCO. If the Safety NCO cannot get the weapon working, it will be taken to the maintenance vehicle where it will be inspected by a technician. If the weapon is determined to be defective, the trainee should have the opportunity to refire his entire program. If, however, the weapon is determined to be good, the trainee should be considered as being a "no-go" on his first attempt and allowed to refire (marksman is the best he can do on the second attempt). The following condition should not qualify for alibis: (1) improperly assembled or dirty weapons, (2) missing parts in weapons, (3) failure to see target(s), (4) failing to fire in time, (5) failure to close bolt, (6) failure to take weapon off "safe", (7) improperly loaded magazines, etc.

EQUIPMENT AND TRAINING AIDS*

Period 1, Introduction of Rifle Marksmanship and Mechanical Training

Charts required by the POI:

- o M16 Rifle Parts
- o Four types of 5.56 Ammunition
- o Eight Basic Firing Functions

* Contact the authors for information on obtaining training aids: PO Box 2086, Fort Benning, Georgia 31905. AV 835-3617.

Training Aids required by the POI:

o Cleaning Material (1 per soldier)

o M16A1 Nomenclature Mat (1 per soldier)

o M16 Magazine (1 per soldier)

o 5.56mm Dummy Ammunition (50 plus 5 per soldier)

o Magazine Charger and Charger Strip (5 each)

o Blank Adapters

Charts recommended:

o Purpose of Period 1

o Four Fundamentals

o Qualification Badges

Period 2: Dry Fire

Charts required by the POI:

o Four Fundamentals

o Correct Sight Picture

o Proper Foxhole Position

o Proper Prone Unsupported Position

Training Aids required by the POI:

o Dime/Washer

o M15A1 Aiming Card

o Riddle Sighting Device

o Target Box Exercise

Charts recommended:

o Purpose of Period 2

o Point of Aim

Training Aids recommended:

o Blanks

o Blank Adapters

Blank and blank adapters could be useful in Period 2. First, the trainee would be able to practice such things as loading and unloading, clearing, and immediate action on the M16A1 rifle. He is not given a real opportunity to do so before going on to Period 3 (Live Fire) where he is expected to know how to perform these tasks. Secondly, the use of blanks could serve to maintain interest in the period. However, the primary purpose of this period is accomplished by dry fire practice of shooting fundamentals.

Period 3, Live Fire

Charts required by the POI:

o Four Fundamentals

o Zero Target

o Bullet Trajectory Showing 25 Meter and 250 Meter

Training Aids required by the POI:

o Dummy Rounds

Training Aids recommended:

o Magnetic Spotters

o Rear Sight Simulator

o Front Sight Simulator

Charts recommended:

o Purpose of Period 3

o Point of Aim

Period 4, Zero

Charts required by the POI:

o Zero Target

o Wind Effects on Bullets

o Effects of Gravity on Bullets

Training Aids recommended by the POI:

o Weaponeer

Training Aids recommended:

o Front Sight Simulator

o Rear Sight Simulator

o Magnetic Spotters

Charts recommended:

o Purpose of Period 4

o Four Fundamentals

o Point of Aim

Period 5, Practice Firing - 25 Meter Silhouette

Charts required by the POI:

o Silhouette Target

Charts recommended:

o Purpose of Period 5

o Four Fundamentals

o Point of Aim

Period 6, Downrange Feedback - 75 Meters and 175 Meters

Charts required by the POI:

o 75 Meter Target

o 175 Meter Target

Training Aids required by the POI:

o Spotters

o Blank Adapters

o Pasters

Charts recommended:

o Purpose of Period 6

o Wind Effects on Bullets

o Effects of Gravity on Bullets

o Holdoff Techniques

o Adjusted Point of Aim

o Scorecard

o Four Fundamentals

Period 7, Single Targets and Target Detection

Charts required by the POI:

o Scorecard

Charts recommended:

o Purpose of Period 7

o Adjusted Point of Aim

o Four Fundamentals

Period 8, Single and Multiple Targets

Charts required by the POI

o Scorecard

Training Aids required by the POI:

o Blank Adapters

o Blanks

Charts recommended:

o Purpose of Period 8

o Adjusted Point of Aim

o Four Fundamentals

Period 9, Zero and Timed Fire (25 Meter Silhouette)

Charts required by the POI:

o Zero Target

o Timed Fire Silhouette Target

Training Aids recommended by the POI:

o Weaponeer

Charts recommended:

o Purpose of Period 10

o Point of Aim

o Four Fundamentals

Period 10, Combat Firing (Record Range)

Charts required by the POI:

o Range Layout

o Scorecard

Training Aids recommended by the POI:

o Weaponeer

Training Aids required by the POI:

o Blank Adapters

o Blanks

Charts recommended:

o Purpose of Period 10

o Four Fundamentals

o Adjusted Point of Aim

Period 11, Record Fire

Charts required by the POI:

o Hit Required for Qualification Badges

Charts-scorecards recommended:

o Four Fundamentals

o Adjusted Point of Aim

o Range Layout

Period 12, Automatic Firing

Training Aids required by the POI:

o Bipod

Charts recommended:

o 25 meter Scaled Silhouette Target

o M60 Modified Prone Position

o M60 Modifie[illegible] Foxhole Position

Period 13, Protective Mask Firing

Charts required by the POI:

o Proper Firing Position with Protective Mask

o Correct Sight Picture for Weapon Cant

Charts recommended:

o 25 meter Scaled Silhouette Target

Period 14, Night Firing

Charts required by the PCI

o Night Aiming Procedures

Charts recommended:

o 25 meter Scaled Silhouette Target

"PURPOSE OF PERIOD" CHARTS

Period 1, Introduction to Marksmanship (operation, care and cleaning of rifle)

Name Rifle Parts

Disassemble and Assemble Rifle

Conduct Function Check

Load and Unload Rifle

Clean and Maintain Rifle

Apply Immediate Action

Period 2, Fundamentals of Shooting (basic riflery skills)

Learn foxhole supported position

Learn prone unsupported position

Practice 4 funamentals of marksmanship

o steady position

o aiming

o breath control

o trigger squeeze

Learn value of dry firing

Period 3, Fundamentals of Shooting

Practice 4 fundamentals of marksmanship

o steady position

o aiming

o breath control

o trigger squeeze

Practice shooting tight shot groups

Learn how to zero the rifle

Period 4, Practice Firing

Apply 4 fundamentals of marksmanship

o steady position

o aiming

o breath control

o trigger squeeze

Shoot tight shot groups

Adjust sights to hit target center (zeroing)

Understand the effects of wind and gravity on the bullet

Period 5, Scaled Silhouette Firing (at 25 meters)

Use center of mass aiming to hit silhouette targets - reduced in size to look like actual targets at ranges of 75, 175, and 300 meters

Learn how to shoot at targets at different ranges

Confirm rifle zero

Period 6, Downrange Feedback (at actual range)

Use adjusted point-of-aim to engage targets at 75 and 175 meters

Observe the effects of wind and gravity

Practice shooting at targets at different ranges

Confirm rifle zero

Period 7, Field Fire (single targets)

Detect targets

Engage single targets at ranges of 75, 175, and 300 meters

Apply 4 fundamentals of marksmanship

o steady position

o aiming

o breath control

o trigger squeeze

Period 8, Field Fire (multiple targets)

Engage single and multiple targets at ranges of 75, 175, and 300 meters

Apply fundamentals while quickly shifting targets

o steady position

o aiming

o breath control

o trigger squeeze

Change magazines rapidly

Period 9, Zero and Timed Fire

Confirm battle sight zero

Practice hitting targets under time pressure

Employ rapid semiautomatic fire, using an adjusted aiming point, to engage targets reduced in size to look like actual targets at ranges of 50, 100, 150, 200, 250, and 300 meters

Practice engagement techniques for close and distant targets

Change magazines rapidly

Period 10, Combat Firing (practice record fire)

Detect targets

Engage single and multiple targets at ranges of 50 to 300 meters

Apply immediate action (if necessary)

Execute rapid magazine change

Apply holdoff (as required)

Period 11, Record Fire

Hit at least 23 targets to qualify as marksman

Hit at least 30 targets to qualify as sharpshooter

Hit at least 36 targets to qualify as expert

Period 12, Automatic Firing

Learn when to use and when not to use automatic fire

Engage targets with automatic fire

Use alternate firing positions

o prone supported

o kneeling supported

o kneeling unsupported

Period 13, Protective Mask Firing

Learn how to fire wearing protective mask

Hit targets while wearing protective mask

Engage targets from the opposite shoulder

Period 14, Night Firing

Learn how to sight and fire rifle at night

Engage targets at night

Employ zero procedures for LLLSS

Appendix C

Record Fire Scores

DATE	EXPERT (28-40)	SHARP-SHOOTER (24-27)	MARKS-MAN (17-23)	UNQUALI-FIED (0-16)	COMPANY AVERAGE	10 COMPANY MOVING AVERAGE
18 Jan 79	17	36	106	5	21.25	21.25
25 Jan 79	43	32	73	3	23.07	22.16
2 Feb 79	28	28	79	5	22.50	22.27
3 Feb 79	23	25	82	18	19.60	21.61
8 Feb 79	29	31	78	9	21.70	21.62
15 Feb 79	18	22	99	11	20.50	21.44
16 Feb 79	32	34	82	3	22.67	21.61
23 Feb 79	33	83	33	5	23.00	21.79
2 Mar 79	23	35	95	5	21.00	21.70
3 Mar 79	26	26	93	3	20.60	21.59
29 Mar 79	52	32	78	7	23.20	21.78
12 Apr 79	63	39	74	3	23.89	21.87
19 Apr 79	42	37	99	3	22.73	21.89
20 Apr 79	73	43	57	0	25.16	22.45
26 Apr 79	52	33	96	1	23.25	22.60
4 May 79	44	41	60	2	24.11	22.96
10 May 79	26	27	104	18	20.38	22.73
17 May 79	28	25	95	15	20.07	22.44
24 May 79	20	27	82	13	21.01	22.44
7 Jun 79	56	47	98	7	23.29	22.71
8 Jun 79	47	56	105	2	22.65	22.65

DATE	EXPERT (28-40)	SHARP-SHOOTER (24-27)	MARKS-MAN (17-23)	UNQUALI-FIED (0-16)	COMPANY AVERAGE	10 COMPANY MOVING AVERAGE
14 Jun 79	43	57	103	6	22.96	22.56
21 Jun 79	43	50	94	11	22.35	22.52
22 Jun 79	54	56	82	2	24.09	22.42
27 Jun 79	65	30	107	0	22.75	22.37
28 Jun 79	25	47	114	5	20.68	22.02
30 Jun 79	71	54	72	3	24.37	22.42
6 Jul 79	33	27	119	6	20.99	22.52
7 Jul 79	62	46	92	3	23.82	22.80
12 Jul 79	32	32	90	6	22.31	22.70
13 Jul 79	44	52	91	2	21.57	22.59
14 Jul 79	36	37	90	2	22.80	22.59
19 Jul 79	68	40	54	0	25.06	22.84
20 Jul 79	26	39	109	3	21.36	22.57
25 Jul 79	73	35	60	2	25.10	22.81
26 Jul 79	35	31	102	3	21.93	22.93
27 Jul 79	22	29	124	0	20.14	22.51
3 Aug 79	27	22	128	4	21.09	22.52
9 Aug 79	46	42	101	11	21.93	22.33
16 Aug 79	54	41	106	7	22.40	22.34
17 Aug 79	51	55	86	3	23.75	22.56
23 Aug 79	49	49	105	2	22.16	22.49
30 Aug 79	56	31	102	2	23.25	22.31

DATE	EXPERT (28-40)	SHARP-SHOOTER (24-27)	MARKS-MAN (17-23)	UNQUALI-FIED (0-16)	COMPANY AVERAGE	10 COMPANY MOVING AVERAGE
7 Sep 79	66	52	78	1	24.20	22.60
8 Sep 79	62	42	94	2	23.89	22.47
13 Sep 79	93	43	67	0	26.20	22.90
20 Sep 79	60	39	104	2	24.02	23.29
21 Sep 79	55	49	94	0	24.20	23.60
27 Sep 79	34	51	46	4	24.20	23.83
29 Sep 79	40	27	61	4	23.10	23.90
4 Oct 79	27	32	103	3	21.50	23.67
5 Oct 79	31	29	90	7	22.00	23.66
12 Oct 79	70	55	80	2	24.71	23.80
18 Oct 79	58	56	91	2	23.76	23.76
19 Oct 79	78	48	81	2	24.37	23.81
25 Oct 79	56	41	95	5	23.67	23.55
26 Oct 79	46	59	86	0	23.62	23.51
2 Nov 79	24	35	111	10	20.43	23.14
8 Nov 79	43	34	52	0	24.08	23.12
9 Nov 79	52	36	58	2	24.33	23.25
16 Nov 79	41	32	92	6	20.05	23.10
17 Nov 79	62	31	37	0	26.16	23.52
23 Nov 79	57	46	90	1	23.62	23.41
24 Nov 79	33	38	127	4	20.77	23.11
29 Nov 79	59	41	76	3	24.26	23.10
1 Dec 79	49	38	54	0	25.03	23.24
6 Dec 79	56	49	77	0	24.46	23.32

DATE	EXPERT (28-40)	SHARP-SHOOTER (24-27)	MARKS-MAN (17-23)	UNQUALI-FIED (0-16)	COMPANY AVERAGE	10 COMPANY MOVING AVERAGE
14 Dec 79	55	39	58	0	24.97	23.77
START OF NEW PROGRAM						
7 Jan 80	76	39	75	1	25.00	23.87
12 Jan 80	100	45	45	2	26.82	24.11
18 Jan 80	30	35	99	10	21.61	24.27
25 Jan 80	101	44	37	4	27.06	24.36
28 Jan 80	66	36	97	5	23.20	24.32
2 Feb 80	99	37	67	1	25.75	24.82
4 Feb 80	116	46	54	0	27.42	25.13
11 Feb 80	80	55	59	4	25.21	25.15
15 Feb 80	93	35	68	2	26.17	25.32
START OF NEW RECORD FIRE COURSE						
19 Feb 80	25	64	93	9	27.56	25.58
22 Feb 80	29	51	112	5	27.63	25.84
23 Feb 80	20	52	110	6	26.98	25.86
25 Feb 80	27	69	92	9	28.65	26.56
1 Mar 80	37	59	66	2	29.83	26.84
3 Mar 80	18	56	104	9	28.11	27.33
7 Mar 80	41	63	89	5	28.88	27.64
10 Mar 80	34	57	97	0	29.11	27.81

DATE	EXPERT (36-40)	SHARP-SHOOTER (30-35)	MARKS-MAN (23-29)	UNQUALI-FIED (0-22)	COMPANY AVERAGE	10 COMPANY MOVING AVERAGE
14 Mar 80	47	82	64	2	30.63	28.35
17 Mar 80	17	45	113	13	24.97	28.24
21 Mar 80	23	67	103	4	28.14	28.29
24 Mar 80	34	70	81	1	30.05	28.53
27 Mar 80	16	53	89	11	28.81	28.71
28 Mar 80	29	55	104	5	28.51	28.70
1 Apr 80	43	58	88	0	29.93	28.71
5 Apr 80	24	54	104	18	26.94	28.60
7 Apr 80	20	67	97	4	28.16	28.53
10 Apr 80	29	57	89	5	28.22	28.44
11 Apr 80	52	70	86	0	30.75	28.45
14 Apr 80	11	43	116	19	25.31	28.48
17 Apr 80	51	80	93	4	29.58	28.63
18 Apr 80	24	52	136	4	27.70	28.39
21 Apr 80	21	42	148	12	26.11	28.12
24 Apr 80	15	141	52	8	25.87	27.86
25 Apr 80	23	77	116	3	28.12	27.68
28 Apr 80	58	86	77	0	31.08	28.09
2 May 80	21	64	122	14	26.63	27.94
3 May 80	16	57	129	1	28.11	27.93
5 May 80	19	87	100	0	28.95	27.75
9 May 80	59	61	85	0	30.33	28.25
12 May 80	49	65	78	5	29.53	28.24
15 May 80	64	74	62	0	31.75	28.65

DATE	EXPERT (36-40)	SHARP-SHOOTER (30-35)	MARKS-MAN (23-29)	UNQUALI-FIED (0-22)	COMPANY AVERAGE	10 COMPANY MOVING AVERAGE
19 May 80	40	69	83	2	28.92	28.93
22 May 80	24	76	127	3	28.29	29.17
23 May 80	32	63	121	3	28.72	29.23
24 May 80	53	88	73	6	30.50	29.17
29 May 80	35	79	96	3	29.77	29.49
31 May 80	33	76	93	1	29.74	29.65
2 Jun 80	42	72	86	2	30.07	29.76
5 Jun 80	59	65	97	0	30.57	29.79
6 Jun 80	47	63	85	0	30.54	29.89
9 Jun 80	48	93	83	0	30.60	29.77
12 Jun 80	25	47	141	1	28.14	29.69
13 Jun 80	23	63	129	0	28.24	29.69
15 Jun 80	27	80	100	2	29.33	29.75
17 Jun 80	21	88	104	0	29.22	29.62
20 Jun 80	37	70	99	0	29.30	29.58
23 Jun 80	33	61	104	4	28.36	29.44
26 Jun 80	41	95	85	2	30.30	29.46
27 Jun 80	60	87	61	0	31.97	29.60
28 Jun 80	63	88	74	0	30.46	29.69
3 Jul 80	52	88	72	1	30.43	29.92
5 Jul 80	46	87	76	2	30.43	29.92
10 Jul 80	61	97	74	0	31.49	30.24
11 Jul 80	28	68	121	1	28.20	30.13

DATE	EXPERT (36-40)	SHARP-SHOOTER (30-35)	MARKS-MAN (23-29)	UNQUALI-FIED (0-22)	COMPANY AVERAGE	10 COMPANY MOVING AVERAGE
16 Jul 80	34	75	100	1	29.92	30.19
18 Jul 80	44	72	99	3	29.13	30.18
24 Jul 80	51	68	108	0	30.94	30.44
25 Jul 80	53	83	74	0	31.17	30.53