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Technical Report 17

May 1953

MOONLIGHT IV: *Training the Rifle Squad In Night Technique of Fire*

by

Edgar L. Shriver, John Sivy, and Henry S. Rosenquist

**Human Research Unit Nr 3, CONARC
Fort Benning, Georgia**

Under the Technical Supervision of

**The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
operating under contract with
THE DEPARTMENT OF THE ARMY**

MOONLIGHT IV:
TRAINING THE RIFLE SQUAD
IN NIGHT TECHNIQUE OF FIRE

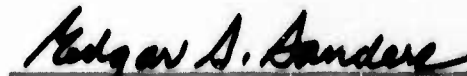
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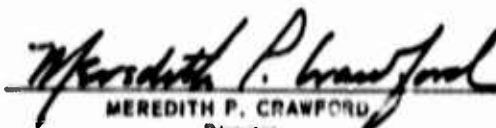
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Task MOONLIGHT

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BRIEF

Problem: Under conditions of low illumination, no single person (including the squad leader) can see enough of either the friendly or the enemy situation to adequately control the fire of a normally deployed squad.

Purpose: To develop methods and techniques for training squads to achieve adequately controlled fire (from normal TO&E¹ flat-trajectory shoulder weapons) under low illumination conditions. This was the objective for both defensive and offensive action.

A secondary purpose was to determine the effect of different types of rapid-fire weapons when used by the squad at night. Several experimental combinations were tested and the results compared with those obtained from firing with normal TO&E weapons.

Results: Squads were trained in the use of techniques developed during the study. These squads, together with an equal number of squads equivalent except for training in the experimental techniques, were all tested in the same simulated battle situations (defense and assault). The squads that had received training in the experimental techniques were two to three times as effective as those which had not been so trained.

The results of testing different numbers and kinds of rapid-fire weapons within the squad indicated that, when normal TO&E was followed, squads performed as well as or slightly better than squads otherwise armed.

Conclusion: Squads instructed by the methods and in the techniques set forth in this study apply such training to achieve significantly better scores in realistically simulated battle tests than do squads not so trained; the natural deduction is that they would be more effective night-fighting units in the actual situations of combat.

¹For purposes of this study, normal TO&E is defined in the following manner: 9-man squad, squad leader unarmed, 2 BAR's, 6 M1's.

PREFACE

The study reported here is the fourth phase of Task MOONLIGHT: Experimental Development of Improved Methodology for Training the Infantry Soldier in Night Fighting. Previously completed work on the other phases was concerned with investigating ranges at which men could detect targets and developing improved methods of training the individual infantryman to fire the M1 rifle at night.

Results of the first phase were reported at the OCAFF Conference on Rifle Marksmanship, held at Fort Monroe, Va., on 24-25 June 1953. The phases pertaining to individual marksmanship were reported in conference with the Chief of Army Field Forces and selected staff members at Fort Monroe on 21 October 1953. A Department of the Army Training Circular (27) incorporating the techniques developed in this research was published on 22 December 1953. HUMPRO Technical Report 15, *MOONLIGHT II: Training the Infantry Soldier to Fire the M1 Rifle at Night*, was published in December 1954.

Revised research plans for the fourth phase, concerning technique of fire in integral squad-sized units, were defined in December 1953. This report describes the research accomplished in that phase, MOONLIGHT IV: The Experimental Development of Improved Methods for Training Squad-Sized Units in the Technique of Night Fire Control. Results of research on this phase were reported to Army Field Forces at Fort Monroe on 6 December 1954. A Department of the Army Training Circular (23-1) incorporating the techniques developed both in this phase and the earlier research was published on 24 February 1955.

**MOONLIGHT IV:
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**MOONLIGHT IV:
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Chapter 1

ORIGIN OF THE PROBLEM

HISTORICAL BACKGROUND

The history of warfare includes many instances where darkness was used to conceal special operations, but until World War II these instances remained isolated examples. The inherent difficulties of control of all types had not been overcome. As long as no army developed nighttime techniques of control, all armies were safe in suspending operations during darkness. Once our enemies initiated operations in darkness, however, we could not ignore the necessity of defending under any conditions they chose for the attack. Nor can an army that intends to win afford to stop at defense; it must go further and develop the more difficult techniques of offensive nighttime control.

It is quite conceivable that the techniques which would be best for darkness differ from those that are currently approved for daytime operations. Darkness is but one of the factors which have determined what techniques of control would be most successful in any given period of history. A brief review of the role of some of these other factors provides a frame of reference in considering the types of changes that might be dictated by darkness.

The concept of small arms fire control has been modified greatly since its rigid beginnings in the Prussian armies of Frederick the Great. The modifications came about as a result of changes in weapons and conditions which, though varied, constantly led in the direction of decentralizing control. A glance at the changing weapons and conditions shows why decentralization has been imperative.

During the latter part of the 18th century, rifles lacked the dependability produced by later developments. At that time the rifle had a maximum range of 150 yards, misfired almost half the time, and could be aimed effectively only at very close distances. It was relatively safe, then, for an attacking army to keep close together and to shield its advance with a wall of fire. Compactness made maneuvering simple and control easy. The entire army behaved as a unit, with every action under the control of the commander.

In the Napoleonic armies of a few years later, two minor changes away from such rigid control took place. Instead of fire in volleys upon individual commands, the principle of "fire at will" was substituted.¹ Also, skirmish troops were instituted.² These troops advanced before the main army and fired from cover or from the prone position, according to the dictates of the terrain.

¹See Bibliography reference 2.

²See reference 10.

Subsequent 19th century developments which were to influence the control over troops were in the realm of weapons. By the time of the American Civil War great improvements had been made in the range, accuracy, and dependability of rifle fire. As a result, "Tactics lagged behind technical improvement in armament Much was written concerning the 'new tactics' but little was actually put into practice."¹ The main effect of these new developments was to turn warfare into a waiting, defensive activity.

For the most part, World War I, in which the machine gun was added to the defense, was a war of trenches, defenses, and attrition. "The machine gun heavily favored the defense, and, used in conjunction with barbed wire, it ruled the battlefield leading to a state of siege warfare."² Attacking in daylight in some arrangement of lines and columns was still the standard technique. As a result, attacks were extremely costly and were seldom made. Both sides sought some new tactics or weapons to counteract the effective defense. The answer came in the form of a new weapon, the tank, rather than a new tactic.

The advent of the tank helped make warfare more mobile. Increased mobility eliminated the reliance upon trenches and substituted the foxhole in World War II. Control at the squad level became more difficult because squads now were frequently isolated from each other and the unit leader. Increased mobility, however, was only one factor which produced the major tactical changes. Equally important was the fact that fighting occurred in such locations as jungles, mountains, and cities—that is, in terrain where it was difficult for large units to coordinate, with consequent reliance upon smaller units of men acting with relative independence.

During World War II a highly significant change occurred in that certain armies began to operate effectively during the hours of darkness. The German armies began to master the techniques of nighttime control³ and the Japanese exploited a certain mastery of darkness in many quarters, among them Malaya, Hong Kong, Singapore, Corregidor, Burma, and the Philippines.⁴

The advent of night fighting made communication more difficult and created the need for readjustment even within the squad. The weakened position of the squad leader with respect to seeing the development of the enemy situation within his own sector, along with the virtual elimination of visual communication, made it difficult to maintain the same degree of control possible during daylight hours.

The armies of the United States answered this challenge by improvising nighttime techniques as the situation demanded. Many of these improvised techniques were undoubtedly effective; others at least served the purpose of giving the unit confidence that it was doing something. The fate of the techniques, good and indifferent, has been generally the same. The units which used them were disbanded; no organized attempt was made to incorporate the techniques into official texts or standard procedure.

No systematic solution to the nighttime problem was reached during the Korean action. Experience in that conflict did emphasize the fact that any future enemy we face will use darkness to the fullest extent.

¹See reference 4, p. 18.

²See reference 13, p. 2.

³See reference 3.

⁴See reference 8.

One answer to darkness which was used in Korea is to "turn night into day" by searchlights, pyrotechnics, or infrared equipment and then apply daytime techniques. A second possible approach is to develop and train men in the use of techniques which utilize darkness for their effectiveness. Either approach is well adapted for use by U.S. military forces. Our production facilities for artificial illumination devices would match those of any other country. Also, our superior training facilities¹ could produce more troops trained to use darkness to their own advantage.

The commander who, in striking the enemy, can choose between using artificial illumination and using skilled night fighters is in a superior position. He can use either or, if necessary, both approaches to the problem of night-time offensive operations.

Interest in the implementation of the second approach (training) was of grave concern to the Chief of Army Field Forces early in 1952.

MORE RECENT DEVELOPMENTS

The initial problem of developing a means to improve the night firing capabilities of the individual infantry soldier was presented to The Infantry School, Fort Benning, Ga., on a staff visit by Army Field Forces on 12-13 August 1952. On 16 January 1953, the Assistant Chief of Staff, G-3, Office, Chief of Army Field Forces, recommended that a formal project be initiated with the Human Resources Research Office to develop means of improving the ability of the individual soldier to fire his rifle at night.² This project was amplified in 1954 to include the development of means for improving the night fighting ability of the rifle squad.

RELATED LITERATURE

The firing effectiveness of a squad depends upon two factors: (1) the individual proficiency of each man in the squad and (2) the additional effect that comes through the squad action of concentrating and distributing fire. The proficiency of individuals firing the rifle at night was the concern of MOONLIGHT II.³ A discussion of literature relevant to the individual aspects of training may be found in that report.

The concern of the present study was with those effects that can be achieved only by group action. The term used to describe the technique by which fire is concentrated and distributed is "technique of fire." Field Manual 23-5, U.S. Rifle Caliber .30, M1,⁴ describes the basic techniques of achieving these effects in the daytime but gives no indication of what techniques can be used to achieve the same effects at night. Many articles have been written regarding the importance of nighttime activities but the present writer has

¹See reference 6.

²DF CN57394, from ACofS, G-3, OCAFF, to RD-8, OCAFF, dated 16 January 1953. The Office, Chief of Army Field Forces, is now Headquarters, Continental Army Command.

³See reference 11.

⁴See reference 7.

found none that describe how control is to be effected under nighttime conditions. Two references only are reported here as pertinent to the present problem. They are the technique of fire section of Field Manual 23-5 and the MOONLIGHT II Report.

The Department of the Army has issued two training circulars incorporating the results of the MOONLIGHT research. Training Circular 27, Night Firing of M1 Rifle Without Artificial Illumination, based on the MOONLIGHT II results, was issued 22 December 1953. It was rescinded and its contents incorporated in a new circular also covering MOONLIGHT IV findings, Training Circular 23-1, Technique of Rifle Fire at Night Without Artificial Illumination, published 24 February 1955.

Chapter 2

THE PROBLEM AND GENERAL APPROACH TO ITS SOLUTION

RESEARCH REQUIREMENT

The military requirement for MOONLIGHT was for training research directed toward "training of individuals to fire effectively at night, particularly with the M1 rifle."¹ This was later rephrased in the research plan submitted by the Director, Human Resources Research Office,² to the Chief, Army Field Forces, and subsequently approved by the latter³ to include four phases: (1) to develop improved methods of training the individual infantry soldier in night detection; (2) to develop improved methods of training him in night firing of the M1 rifle; (3) to standardize a transition course for simultaneous training of a number of individuals in night firing; and (4) to develop and standardize a course for training integral squad-sized units in the technique of fire at night.

This approval also included the specific understanding that the project was somewhat exploratory and that various changes in direction and emphasis might be required as the work proceeded.

The first three phases were completed in 1953. At the end of that time it was recognized, as anticipated, that the fourth phase involving the squad technique of fire required change in emphasis. Research plans for MOONLIGHT IV were prepared with the following objectives: (1) to investigate night fighting technique problems of fire control; (2) to develop methods for training squads in coordinating various types of fire power during night engagements; (3) to develop a night firing proficiency course for training integral squad-sized units; (4) to determine the most effective of these training methods by testing them on the proficiency course; (5) to determine the relative night effectiveness of squads equipped with various proportions of automatic weapons.

¹Basic Letter ATDEV-8 353.1, from OCAFF to ACofS, G-3, D/A, dated 2 February 1953, Subject: Requirement for Training Research in Night Vision and Night Firing; (2) DF G-3 353 (2 Feb 53), from ACofS G-3, D/A to ACofS, G-1, D/A, dated 11 February 1953, Comment No. 1 on Basic Letter, Subject: Requirement for Training Research in Night Vision and Night Firing; (3) Letter G-1 353 (11 Feb 53), from ACofS, G-1, D/A to Director, HumRRO, dated 17 February 1953, Subject: Training Research in Night Vision and Night Firing.

²Letter Director, HumRRO to Chief, AFF, Attn: RD-8, dated 19 February 1953, Subject: Training Research in Night Vision and Night Firing; without inclosure.

³Letter ATDEV-8 470 (19 Feb 53), from OCAFF to Director, HumRRO, dated 25 March 1953, 1st Indorsement to Letter, HumRRO to OCAFF, 19 February 1953, Subject: Training Research in Night Vision and Night Firing.

The first four objectives were followed in the study of squads in defense and assault situations. The detailed experimental treatments of these two situations were, of necessity, different and are described separately in Chapters 3 and 4. The general scientific approach to their solution was the same, however, and is described in this chapter. The fifth objective, concerning automatic weapons, was met by conducting a test of their effectiveness when used by squads in a defensive situation. This test and its results are described in Chapter 5.

METHODOLOGICAL APPROACH

The general approach to the solution of the research requirement for MOONLIGHT IV consisted of three steps:

- (1) Building the criterion situations as realistic, valid representations of the nighttime battle situations and building them so that they could be scored in such a way as to differentiate reliably between all degrees of good and poor squads performing on them.

- (2) Developing methods and techniques for training squads to be smooth-working night fighting units in the final phases of attack and defense.

- (3) Testing, on the criterion courses, squads that received no special nighttime squad training and squads that received the experimentally developed nighttime training, in order to determine how much improvement could be expected from the special squad training.

RESEARCH DESIGN

Subjects

The troops who composed the 30 squads used in this study were supplied by the 1st and 2nd Battalions, Combat Training Command, Fort Benning, Ga. They reported as 'TO&E rifle squads.' With respect to military experience these troops ranged from men who had just finished basic training to those who had had combat experience in two conflicts. There was some variation in the amount of time the various members had been assigned to the squads. All troops had received individual night firing instruction with the M1 rifle.¹ Their scores were kept for purposes of a later comparison.

Standard and Experimental Squads

Squads were designated as either standard or experimental. The standard squads were not given the experimental squad training developed in this research. They were tested on the Criterion Ranges and their scores were used as a baseline of performance.

¹For purposes of this study the composition of the TO&E rifle squad was six riflemen, two A11 men, and an unarmed squad leader.

²This training was conducted as Problems 1171, 1172, and 1173, by the Small Arms Committee, Weapons Department, The Infantry School, Fort Benning. The training is based on the MOONLIGHT II research.

The experimental squads were first given the experimental squad training developed for this phase.¹ They were then tested on the Criterion Ranges, and their performance was compared to the baseline performance of the standard squads. The differences in performance provide an estimate of the increase in performance that can be expected from the experimental training.

Composition of a Group

As all 30 squads could not be studied at the same time, they were divided into five groups of six squads each. Each group (I, II, III, IV, V) consisted of three experimental squads and three standard squads. Thus each group could be considered as a balanced study in itself. This grouping controlled for any chance factors which might be operating on a given test night; whatever the factors were, there would be an equal chance for exposure of the experimental and standard squads. As a further precaution against any factors which might be operating in a systematic manner during any given testing night, the order of testing in each group was alternated. This was counterbalanced with successive groups.

For administrative reasons Groups I, II, III, and IV were studied in the defense situation and Groups II, III, IV, and V were studied in the assault situation.

Designation of Squads as Experimental or Standard

In each group squads were assigned as either experimental or standard on the basis of the battalion to which they belonged,² with three squads from each battalion in each group. This meant a minimum of contact between squads from one battalion receiving the experimental training and squads from the other battalion being tested without special training for comparative purposes.

The battalion designated as standard was alternated with successive groups. This counterbalancing procedure made it likely that the experimental and standard squads would be equal in individual night fighting ability. Proof that they actually were matched is found in the fact that on the individual night firing training the men assigned to the experimental squads averaged 38 per cent hits and the men assigned to the standard squads averaged 39 per cent hits.

Assignment of Troops for the Weapons Test

All troops in Groups IV and V were included in the weapons test. This phase of the study was conducted after all other training and testing had been completed and consequently had no effect on any other results reported.

TRAINING METHOD

The training method used in both the defense and assault situations followed the same pattern which was successfully employed in the MOONLIGHT II research. This method involves three stages of training.

¹See Appendix A for explanation which was made to the experimental squads with regard to the research.

²Squads could have been matched according to their individual firing records, and on that basis designated as experimental or standard, but this procedure would have been undesirable administratively. It would have caused a situation where men receiving special squad training would possibly be housed with men who were not receiving the training.

Familiarization

Squads were placed in a simulated combat situation¹ and told to react to the enemy situation that developed, exactly as they would in combat. This familiarized them with the difficulties of the nighttime situation, served to provide them with an idea of how well they could meet such situations, and also demonstrated what they needed to know in order to meet them more successfully.

Correction

Squads were critiqued on their performance during familiarization and then given oral instruction on how they could do a better job in such situations. Immediately after oral instruction they were put into the situation again to practice the new techniques they had just heard. This practice was critiqued constantly and continued until the squads could use the techniques without having to hesitate to think about the instructions; all their actions became cued to this physical practice rather than the oral instructions.

Application

After the squads finished their corrective training they were again placed in the same situation they had been in during familiarization. This time they utilized the techniques learned during corrective training. In this way they were able to see how much better they could do because of their training and thus gained confidence in both themselves and the training.

DESCRIPTIVE LEVEL OF THIS REPORT

Certain minor changes were made in the administration and content of the training for successive groups. Rather than burden the report with these details, the description of the administration and content has been kept on a level which encompasses these variations.

Also, the amount of light under which various groups were trained and tested varied. With one exception the description of this illumination was kept on a level which encompasses them all, namely "moonless."

¹For detailed information on these situations see Chapters 3 and 4 and Appendices D-G. A Staff Memorandum describing the equipment is under preparation by Human Research Unit Nr 3.

Chapter 3

DEFENSE

SCOPE OF THE TECHNIQUES

The techniques described in this chapter were developed for use by the unsupported TO&E rifle squad in close-in defense from position under conditions of low illumination.¹

PROBLEM

Under low illumination conditions neither the squad leader nor any other man in the squad can see enough of the enemy situation to the squad front to control the squad. The problem in the present study was to develop some way of achieving the effects of a squad acting as an integrated unit, but without direct control by the squad leader.

DEFINITION OF SQUAD EFFECTS

The following functions of the squad were considered to be the essential effects that can be achieved in the daytime with control by the squad leader:

- Surveillance of the entire squad sector
- Target allocation
- Fire control
 - Initiation of fire
 - Distribution of fire
 - Concentration of fire
 - Redistribution or shifting of fire
 - Cessation of fire
- Ammunition conservation

These squad functions form the requirements toward which the present research was directed. They will be discussed individually, in the next section, in terms of the techniques that were developed to achieve each effect under low illumination conditions and without control by the squad leader.

¹Low illumination refers to the range of illumination typical of moonless nights when no artificial illumination is present.

EVOLUTION OF TECHNIQUES

Surveillance of Entire Squad Sector

For the purposes of this study the squad sector was considered as the 180 degrees to the squad front. In situations where the possibility of attack from the rear becomes likely, the techniques described here must be modified accordingly. It was felt that 180 degrees was a minimum coverage under low illumination conditions, because (1) the enemy can move into the flank area more easily at night than in the daytime and (2) the distance between squads may easily be twice detection range so that enemy soldiers could move into the gap between the two squads and be near their flanks before being detected.

Under conditions of low illumination the squad front cannot be surveyed in depth as in the daytime. The maximum depth for detecting dark targets against a dark background is about 75 yards. Surveillance or search sectors can therefore be described in terms of angles with the rifleman at the apex.

In the technique for searching the squad front which was developed, each rifleman (excluding the AR men) was assigned an angle-shaped sector of the squad front nearest him as his primary area for search. The size of this sector was 30 degrees, which allowed the 180 degrees of squad front to be covered by the six riflemen (Figure 1). The fact that the hours on a clock form 30-degree sectors provided a convenient teaching device.¹

SURVEILLANCE OF SQUAD SECTOR

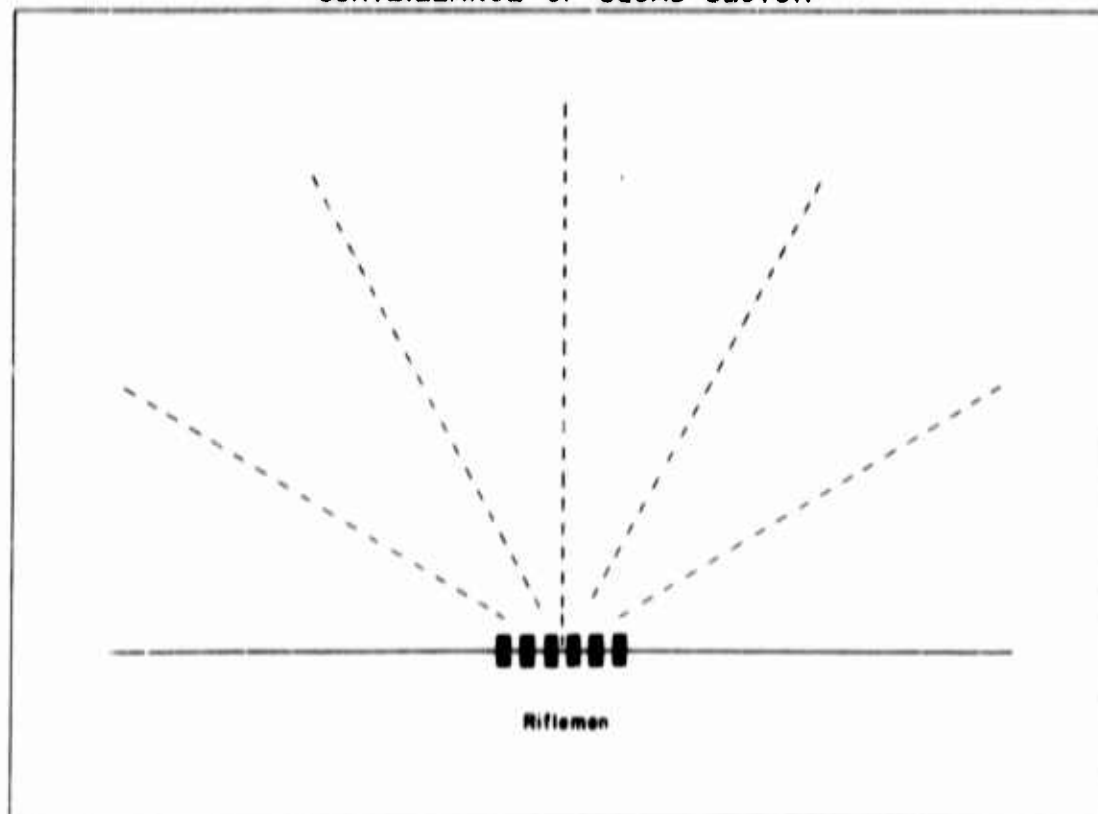


Figure 1

¹See Appendix B.

The primary purpose of assigning a sector to each man is to maximize the probability of target detection over the entire squad front. Under this system a man does not waste time and effort by trying to detect targets that are laterally displaced from him, and in sectors where other men along the line are better able to detect them.

A secondary advantage of this sector assignment is that it gives each man a particular responsibility for protecting his squad. This increases his awareness of his function as a squad member rather than as an isolated individual.

The sector system of search just described is applicable when either double or single foxholes are used. If for some reason (terrain, friendly dispositions, etc.) it is not necessary or desirable to search each 30-degree sector, men can be assigned to sectors "in between" other sectors, such as between 1:30 and 2:30 o'clock or around 10 o'clock. The rifleman should be cautioned to err on the side of overestimation rather than underestimation in determining his sector. As men become casualties other men must increase the size of their sectors of search.

Target Allocation

Two types of enemy targets were selected for consideration in the study: automatic weapons forming a base of fire, and dark infiltrators maneuvering toward the friendly squad. The enemy automatic weapons were simulated by a small flashing red light inserted in a dark E-type silhouette target. The infiltrators were common pop-up or moving E-type silhouettes painted black.

On the basis of information obtained from pilot studies, AR men only were instructed to fire at the automatic weapons targets. The riflemen were instructed to save their fire and attention for close-in infiltrators.

Fire Delivery With Luminous BAR Sight

The allocation of targets just cited was made because, in preliminary research, AR men were found to be far more effective in hitting the automatic weapons targets than were riflemen. A technique was developed which utilized the characteristic of steadiness given the BAR by the bipod mount. It was found that the sight of the BAR could be utilized in aiming at automatic weapons targets even under low illumination conditions. The flash of the enemy targets could be seen through the rear sight; when a piece of luminous tape (or adhesive tape) was placed over the front hood, with the top edge even with the top of the front sight, the two sights could be brought into alignment with the flash of the enemy weapon (Figure 2). The steadiness of the BAR allowed this alignment to be accomplished quickly and retained while the BAR was being fired. The number of hits obtained by AR men using this technique was so much greater than the number of hits obtained by riflemen that the increment in hits which would have resulted from adding the fire of the riflemen was too small to warrant use of rifle fire on these targets. Consequently, riflemen were instructed to allow the AR men to "take care" of the automatic weapons fire and save their own ammunition and attention for the dangerous infiltrators.

BAR LUMINOUS SIGHT

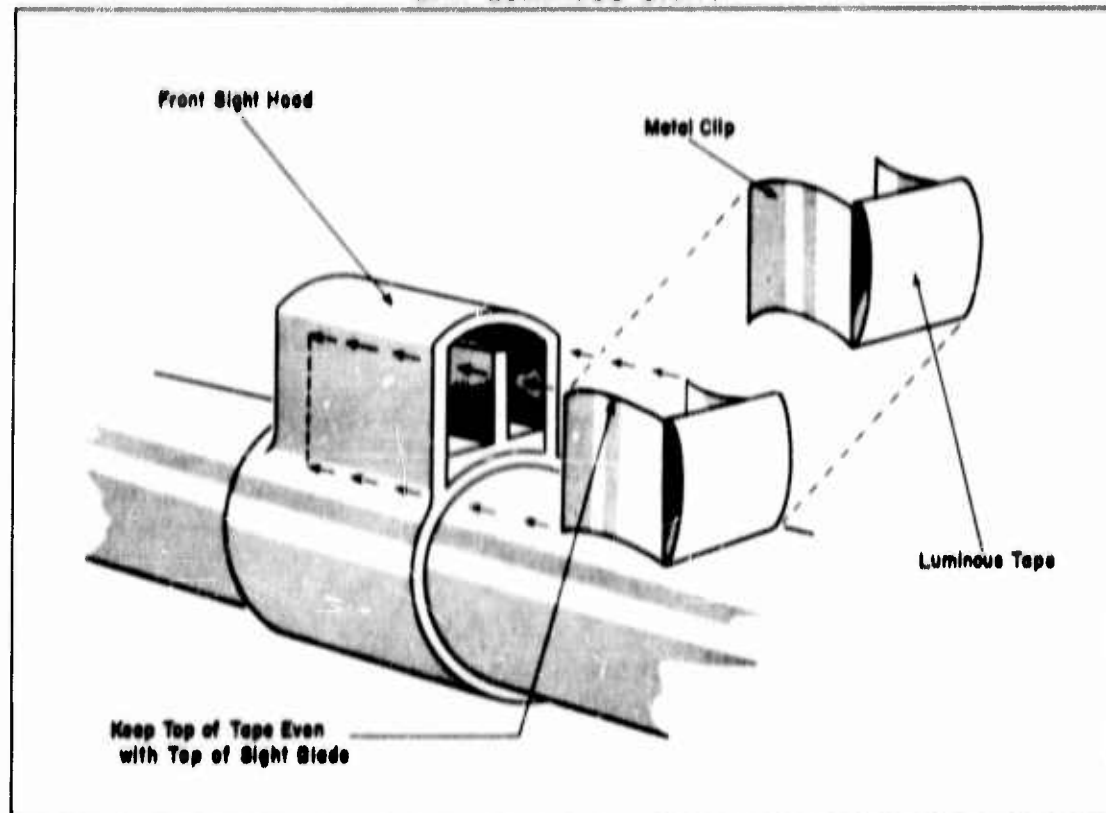


Figure 2

Fire Delivery on Infiltrator Non-Flashing Targets

The BAR technique just described could not be utilized on the maneuvering infiltrator element of the enemy attack; a visible enemy flash which remains relatively stationary is the only target on which the technique can be used. In firing the BAR against the other types of targets, the same technique employed by the riflemen was utilized. This technique is the one developed in MOONLIGHT II research, in which the man is trained to "hold off" low and to the right to compensate for the normal nighttime error of shooting high and to the left.

Control of Fire

Relevant Differences Between Day and Night Conditions

Under daytime conditions the squad leader can survey the situation to his front and make his analysis. He can then communicate his decisions to the squad by means of fire commands and visual signals. The following facts militate against such a technique of control for low illumination conditions:

- (1) The squad leader cannot see the entire enemy situation from which to select opportune targets.
- (2) Some men in the squad may have better night vision than the squad leader.

(3) The enemy in any particular sector will probably be detected by the man responsible for that sector sooner than by the squad leader. Valuable time would be lost in communicating this information to the squad leader formally.

(4) No single man can see the entire situation to the squad front, but at any given time there is one man who knows more about the situation than any other. He is the one in whose search sector the enemy has appeared. As the enemy situation shifts, different men become aware of the presence of targets.

(5) The enemy is close in; there is not time for a fire command after the enemy has been detected.

(6) The range need not be given in a fire command since the range of a detectable target at night is always less than 75 yards.

(7) Visual signals, at best, are difficult to see at night.

Initiation of Fire

The facts just mentioned show that at night the squad leader is not in possession of the best information on which to initiate the fire. Furthermore, the time required for the squad members to inform him of targets and for him to make the formal command would be prohibitive.

The conditions under which fire should be initiated were therefore defined, and a standard operating procedure set up. AR men were instructed to fire on enemy automatic weapons when they detected them. Riflemen were instructed to initiate fire when they saw enemy targets in their own sector, but not to fire at random noises or the flash of automatic weapons. In this way the capabilities of each man were utilized to the fullest extent—the man with good night vision could utilize that quality and the man closest to the enemy situation could use his information to best advantage.

Distribution of Fire

The disposition of the enemy at any particular moment will determine whether fire should be distributed or concentrated. If the enemy is distributed evenly throughout the entire squad sector, the fire of the squad should also be distributed over the entire sector. This will happen without command by the squad leader when the rules or SOP's already stated are followed. If enemy soldiers are distributed evenly, some of them will appear in each man's sector of search. When the man responsible for a sector sees the enemy he will open fire without command. In this way fire will be distributed over the entire squad front, each man firing in his own sector.

Concentration of Fire

In the event that the enemy is not evenly distributed across the squad front but is concentrated in one or two sectors, concentrated fire is required. The squad leader cannot call for this concentrated fire because he is not in a position to know where the enemy is located. The man with the most information regarding the problem is the man in whose sector the enemy concentration is located. A signal is needed for this man to tell other squad

members of the concentration. It was found that the fire of the rifle itself is enough of a signal for the other men to identify.

If the squad is instructed in the use of an additional SOP, fire can be concentrated in danger areas. The SOP used in the experiment was that any man not having a target in his own sector should turn his attention to sectors where he did hear fire. If he could detect a target in this other sector he should fire at it. This signal involved no time delay, and no man had to be distracted from his task to either send or receive it. The dependency of each man on every other is, again, a way to bring men to feel they are working as a team at night and thus allay their fear of darkness.

Redistribution of Fire

The enemy situation may change at any time; what was once a concentration in one area may turn into an even distribution or a concentration in another area. Again, no single person can assess the change in the situation. This contingency must also be controlled by SOP. The addition of another SOP provides a method for releasing the concentration developed by the previous SOP. The rifleman was instructed to fire no more than three rounds into another sector before returning his attention to a search of his own sector. If he then saw enemy in his own sector he would fire at them (by the previous SOP regarding primary responsibility). Fire would thus be redistributed but the concentration previously built up would not disintegrate suddenly; it is not likely that each man would have fired his third round at the same instant. Once the man returns to search his own sector, his fire becomes available for reconcentration at any available target. This cycle continues to repeat until the enemy attack is broken or the position overwhelmed.

Cessation of Fire

An SOP previously stated indicated that men were to fire when they saw enemy targets. By implication this means they were not to fire when there were no detectable targets. Rather than trust to implication, another SOP was instituted which specifically directed that when a man could not detect a target he should not fire. When the enemy is no longer in the squad sector, fire should therefore cease.

As an emergency control of this squad action, the squad leader was supplied with a shrill whistle with which to signal "Cease fire." He was instructed to use this only when he was sure that no enemy were in the area.

The squad leader of course need not be idle until the time for signalling "Cease fire." The SOP's are directed at him also; he can help anywhere he is needed and should monitor the system of SOP's at all times.

Ammunition Conservation

The SOP's already described give no direct instructions regarding ammunition conservation. However, under these SOP's ammunition is fired only when a target is present and then the shot is pointed as accurately as is possible under dark conditions. The result is that only the amount of ammunition needed to do the job is expended.

TRAINING SQUADS TO USE THE EXPERIMENTAL TECHNIQUES

The Familiarization, Correction, and Application pattern of training was used in training the experimental squads.¹ The Correction stage of training involved the oral presentation of the experimental techniques and their physical practice. This practice, along with the Familiarization and Application stages of training, was accomplished on the Defense Training Range.

Defense Training Range

This training range presented the same general problems to the squad as the Criterion Defense Range used in the final evaluation of the troop performance, but differed from it in physical characteristics so that experimental squads would not be learning specific habits regarding target location during their training. The complexity of the range was bounded by two considerations: first, that it be simple enough for any unit in the field to build, and second, that it be elaborate enough for squads to receive realistic practice on the experimental nighttime SOP's.

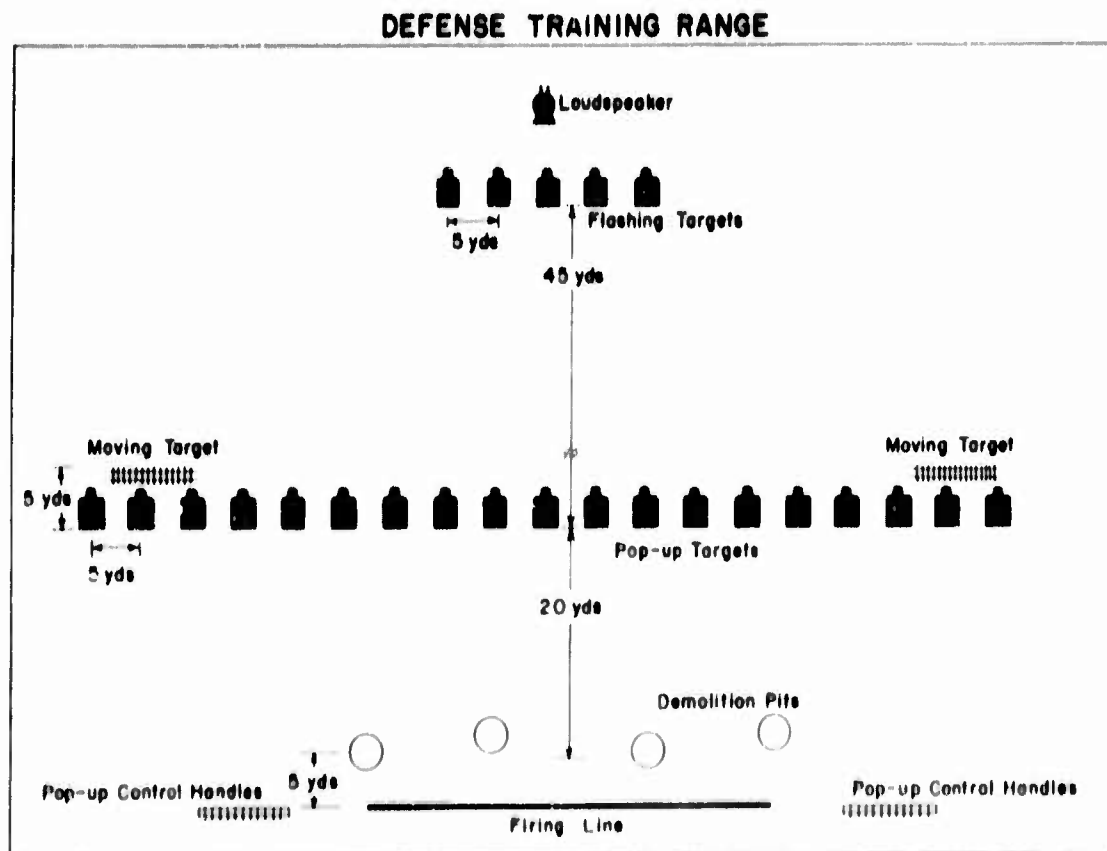


Figure 3

¹See Appendices B and C.

The range was flexible in that Familiarization, Correction, and Application firing could all be accomplished on it without direct repetition of the pattern of enemy activity (see Figure 3). There were demolitions followed by simulated enemy automatic weapons fire at a 70-yard range. After this, a pattern of dark-backgrounded targets came up somewhere in the squad's sector. The exact targets which came up were varied. A line of 19 targets was located parallel to, and 20 yards distant from, the squad front. Four different combinations of these targets were used to avoid direct repetition, except that the Familiarization and Application combinations were identical for purposes of comparison. This line of targets extended for 95 yards while the squad front was only 40 yards. The targets, therefore, often appeared toward the squad flanks. Behind the flanking pop-up targets two moving targets were located. These targets entered into the combinations just as did the other dark targets.

Integration of Oral Instruction and Physical Practice

On the day following Familiarization training on the range, the SOP's and the reasons for them were presented to the squads orally. Squad leaders were briefed on the SOP's before presentation to the squads. The squads then practiced the SOP's in dry runs on the training course. The squad leaders were kept one step ahead of their squads in the use of the SOP's so that they could be used as assistant instructors. The squad leader watched his squad closely and gave personal direction to any men who were not performing correctly with respect to the SOP's. The squads were critiqued continually during all runs by the instructor and squad leader. When the instructor and squad leader were satisfied that the squad was reacting properly to the enemy situations appearing before it, the dry runs were discontinued and ammunition was used in subsequent runs to further practice and ingrain the SOP control system.

After dark the BAR men were instructed in the use of the luminous BAR sight. They were shown how to get the sight picture and were allowed to fire one magazine, while the rest of the squad watched and heard the results announced.

The squads were then given Application training so that they could see their own improvement as compared with their first effort at the course. This improvement averaged 1406 per cent when scored in terms of per cent hits, against number of rounds fired. The squads averaged 2 per cent hits in Familiarization and 32 per cent during Application firing.*

TESTING SQUADS ON THE CRITERION DEFENSE RANGE

Both experimental squads and standard squads were tested on the Criterion Defense Range (Figure 4) in order to assess the increments in proficiency that could be expected with the experimental training program. Neither the experimental nor the standard squads had seen this range prior to testing.

The squad members were placed on line in foxholes five yards apart with the squad leader free to move around behind the line. Shortly after they got in position an enemy "attack" developed to the front. The troops being tested had been instructed to meet it exactly as they would an attack in combat.

*The percentage of hits score was obtained by dividing the number of hits by the number of rounds fired. The percentage of advantage was calculated by subtracting the standard score from the experimental score, then dividing by the standard score. See Appendix II for data.

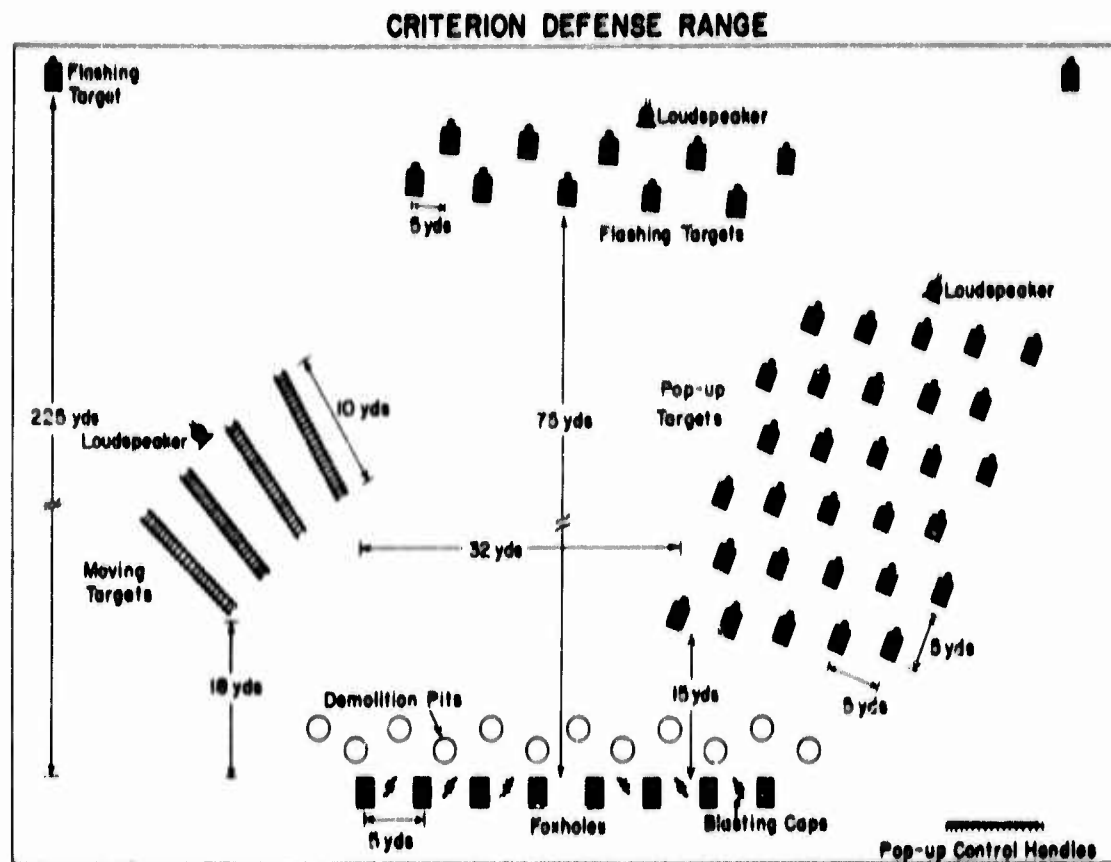


Figure 4

A description of the elements in this Criterion Range, along with an explanation of the reasons for incorporating each element of the attack, follows.

Silence, then flute and drum music. Members of the Platoon Committee, Tactics Department, The Infantry School, suggested that such an element be included in the test because of the success of similar actions by Chinese Communist forces in Korea in drawing our fire prematurely.

Twelve simulated artillery bursts. Attacks frequently are preceded by artillery and mortar fire. During the latter stages of World War II, the Russians employed as many as 250 to 300 tubes (including mortars) for each 1,000 yards of front in the sector of main effort.¹ These bursts on the Criterion Range also made the situation more realistic in that dust was thrown up which made it more difficult to detect the targets.

Light machine guns (flashing targets) at a range of 225 yards with synchronized machine gun sounds from loudspeaker. During the attack, Chinese Communist forces usually demonstrated more expertness and persistence in their employment of the machine gun than in that of any other weapon.² Ranges as short as 200 yards are advocated for this weapon by the Chinese Communists.

Automatic weapons (flashing targets) at a range of 75 yards with synchronized automatic weapons fire from hidden loudspeakers. The Chinese Communists frequently moved a wave of rapid fire weapons up close to our positions before their main troops advanced.

¹See reference 6.

²See reference 5.

Dark-backgrounded targets (the targets were dark, not skylined, and could be described as infiltrators). These targets moved and approached the squad position from both the left and the right flank (double envelopment). Such a tactic appears to be the keynote of Chinese Communist offensive tactics. All CCF field manuals emphasized it, and field observations in Korea indicated that all echelons from Army down to platoon attempted to employ it whenever possible.¹

The dark targets were placed from 15 to 60 yards away from the squad front. It had been found previously that these ranges were practicable nighttime ranges for dark-backgrounded targets.² The targets were placed in the left and right front and left and right flank areas, because enemy forces can infiltrate to the flanks much more easily at night than in the daytime. On the right, rows of pop-up targets appeared to advance in waves, while on the left the targets moved forward on tracks.

These targets were not "massed." The word "mass" has been used quite loosely in descriptions of enemy operations circulated in this country; press accounts have given the impression that the Chinese attacked in great numbers closely concentrated. However, intense concentrations were the exception.³ Targets were therefore placed at five-yard intervals rather than tightly massed.

RESULTS OF THE CRITERION DEFENSE TEST

Hits on Flashing Targets (Simulating Enemy Automatic Weapons Fire)

In the experimental squads, only the AR men fired at the flashing targets; they obtained an average of 17 hits per squad.⁴ In the standard squads, both AR men and riflemen fired at the flashing targets; their combined fire obtained an average of 11 hits per squad. The experimental squads thus had a 57 per cent advantage but this was not statistically significant;⁵ that is, it might have been due to chance factors. In firing at these targets the standard squads expended many more rounds than the experimental squads. The subsequent section on percentage of hits should be examined for a more meaningful assessment of these results.

The distribution of hits on these targets differed for the standard and experimental squads but one could not be described as superior to the other.

Hits on Dark-Backgrounded Pop-Up Targets (Simulating Enemy Infiltrators)

The experimental squads obtained an average of 11 hits per squad on the targets which composed the envelopment on the right flank. The standard

¹See reference 5.

²Unpublished results of MOONLIGHT I.

³See reference 12.

⁴In the text, figures are rounded to whole numbers; for more exact figures the tables in Appendix II may be consulted.

⁵The $p < .05$ level of significance (that is, the difference reported could not have happened by chance alone more than five times in a hundred) was adopted as the minimum acceptable for all differences given in this report.

squads obtained only one hit per squad on the same targets. This was an advantage of more than 1,000 per cent for the experimental squads and is statistically significant.

Because of unfavorable conditions, the targets composing the envelopment of the left flank were impossible to detect during the greater part of the criterion testing. Consequently they were not fired on and no detailed results were obtained for them. One indication regarding these targets is, however, available. For administrative reasons one group of squads fired under moonlight conditions, and the left flank targets were detectable under this illumination. Of the squads tested on this night, the experimental squads obtained an average of three hits per squad and the standard squads obtained one hit per squad on these targets. No statistical test of this difference is reported because of the small number of cases.

Over-All Performance of Squads (M1's and BAR's) on Both Types of Targets

Total Number of Hits

The experimental squads averaged 29 hits per squad while the standard squads averaged 12 hits. This is an advantage of 144 per cent for the experimental squads and the difference is statistically significant.

Ammunition Expended

When adjusted for ammunition expended, the scores of the squads disclose even greater differences in favor of the experimental squads. The experimental squads used less ammunition than the standard squads—224 rounds to 306 rounds per squad. The standard squads had an average of 25 per cent of their ammunition left after the enemy "attack." Therefore, they could have applied fire to the enemy at any time had their surveillance and control been adequate.

Percentage of Hits

The over-all average of percentage of hits on all types of targets was 13 per cent for the experimental squads and 4 per cent for the standard squads. This is an over-all advantage of 233 per cent in favor of the experimental squads and is statistically significant.

Chapter 4

ASSAULT

SCOPE OF THE TECHNIQUES

The techniques described in this chapter were developed for use by the unsupported TO&E rifle squad in the assault under conditions of low illumination.

PROBLEM

Two independent problems were considered in the assault situation.

Movement to the Objective

When men cannot easily see other men in the assault line they become disorganized, dangerous to each other, and much more likely to "break" than when they can see each other. The first problem was to develop techniques that would enable squads to assault at night without these deleterious effects.

Delivery of Fire While Moving

Since sights cannot be used under low illumination conditions, accuracy in firing from the shoulder is lessened or lost at night, especially when the rifleman is walking while firing. The second problem, therefore, was to find out whether a small amount of practice in a hip firing position would make squads as effective as or more effective than squads using shoulder fire.¹

DEVELOPMENT AND TEACHING OF TECHNIQUES¹

Movement to the Objective

The dressed skirmish line for the nighttime assault was selected as an experimental technique which would enable men to know where other men in the squad were located. Experience showed that merely telling men to retain

¹In a later study, the hip technique was compared with a "butt-under-the-arm" procedure developed by the Technique of Rifle Fire Committee, Weapons Department, The Infantry School. Results were as good or better with the underarm technique and the men found it easier to use, so it was recommended for inclusion in the new Training Circular.

²See Appendices E-G.

their alignment at night was not enough. When a man moves forward with other men for the first time at night, he has little idea of how fast he should go, what other men will do, how he can see the other men, or how to reload in the dark on the move.

In the assault training, men were to move in a line, under low illumination conditions, for a distance of 60 yards. Their first attempt (Familiarization) at this task usually ended in disorder. For Correction training the same procedure was continued while the instructor critiqued them on each trial. After the men could maintain their alignment under these conditions, blank rounds were issued. The blanks provided a flash which is an important clue for maintaining alignment at night.

The blanks also introduced the men to the problem of reloading in the dark. This difficulty was overcome through reloading practice under dark conditions. After several "runs" with blank ammunition the squad could maintain alignment while firing and reloading and still watching their objective. A certain degree of skill as well as confidence was developed during this training. The last run in this series was considered as the Application run. The improvement of this run over the first (Familiarization) was always considerable; the men in the squad were seen to function as members of a team rather than as disorganized individuals moving haltingly.

Delivery of Firing While Moving

Gross Error in Learning to Fire From the Hip

It became apparent in pilot studies that when a man first fires from the hip, he makes a gross error in the high direction. This error is as much as 15 to 20 feet at a range of 60 yards. The error does not occur when firing from the shoulder.

A simple training method was used to correct this error. The men were equipped with tracer ammunition and allowed to fire, while advancing, at flashing lights which simulated enemy rifle fire. They could then see every round they fired, thus acquiring immediate knowledge of the results and finding it easier to correct each round on the basis of the observed error. This practice, along with oral admonitions from the instructor to "bring down the fire," soon corrected the initial tendency to fire high from the hip.

Error Caused by the "Bounce" of Walking

After the gross error of elevation is corrected, a smaller variable error, attributable to the bounce of walking, remains. A technique of thrusting the weapon forward to give it a momentum of its own was developed to counteract this error. The men were trained to thrust the weapon forward as the left foot went forward and to fire while the weapon was moving. The recoil of the weapon sent it back into position for another thrust. The thrust then became a rhythm as the weapon was thrust forward and pushed back. Most men succeeded in learning to use the technique. A relevant factor in learning it appears to be that American men have a long history of this type of coordination; it is required in almost all sports where throwing something is part of the game.

Maintenance of Fire

Men generally finished firing their clips at the same time, causing a lull in the fire. The instructor pointed out this condition and told the All men to increase their fire during this period. The squads also learned for themselves how to reduce the length of this period.¹

Learning Under Stress

The nighttime assault with ball ammunition is a stressful situation. Men are serious when working in this situation; they learn quickly because they know that if they do not learn they will be in much more danger. Techniques learned in such a situation appear less likely to be disrupted under the greater stress of battle than if stress had not been present in the training.

TRAINING THE SQUADS TO USE THE EXPERIMENTAL TECHNIQUES

The physical practice of the assault techniques has already been discussed in connection with the development of the techniques. All practice was accomplished on a level field covered with "knobs" of grass. The objective consisted of eight flashing red lights at an initial range of 60 yards.

Before their physical practice, the squads were given the following conceptual framework for the techniques they were to employ:

Mass. The idea of mass was used to stress the number of weapons firing in squad assault—six rifles and two AR's. If, due to the difficulties of maintaining a line at night, men fall behind or get ahead, someone may be shot by his own squad. By maintaining a proper formation, mass will not be reduced by our own fire.

Rate. Generally, the higher the rate of fire the greater are the chances of hitting the enemy. However, there is a point at which rate begins to affect accuracy.

Accuracy. Generally, the greater the accuracy of fire the greater are the chances of hitting the enemy. But again, there is a point at which accuracy begins to affect rate. The two concepts are definitely complementary and the correct balance between them must be reached.

Shock Action (Time). By obtaining the optimal balance of the other principles acting in the shortest amount of time, the maximum shock action is achieved. The squad must move at a speed which does not upset the balance of the other factors but which is the most rapid that is consistent with that balance.

TESTING SQUADS ON THE ASSAULT CRITERION RANGE

Both experimental and standard squads were tested on the Assault Criterion Range (Figure 5) in order to assess the increments in proficiency which could be expected with the experimental training program. Neither the experimental nor the standard squads had seen this range prior to testing.

¹A "buddy" system was tested, with the men being paired and then trained so that one man would fire his clip while the other reloaded. This proved to be unsatisfactory and generally reduced the fire power of the squad.

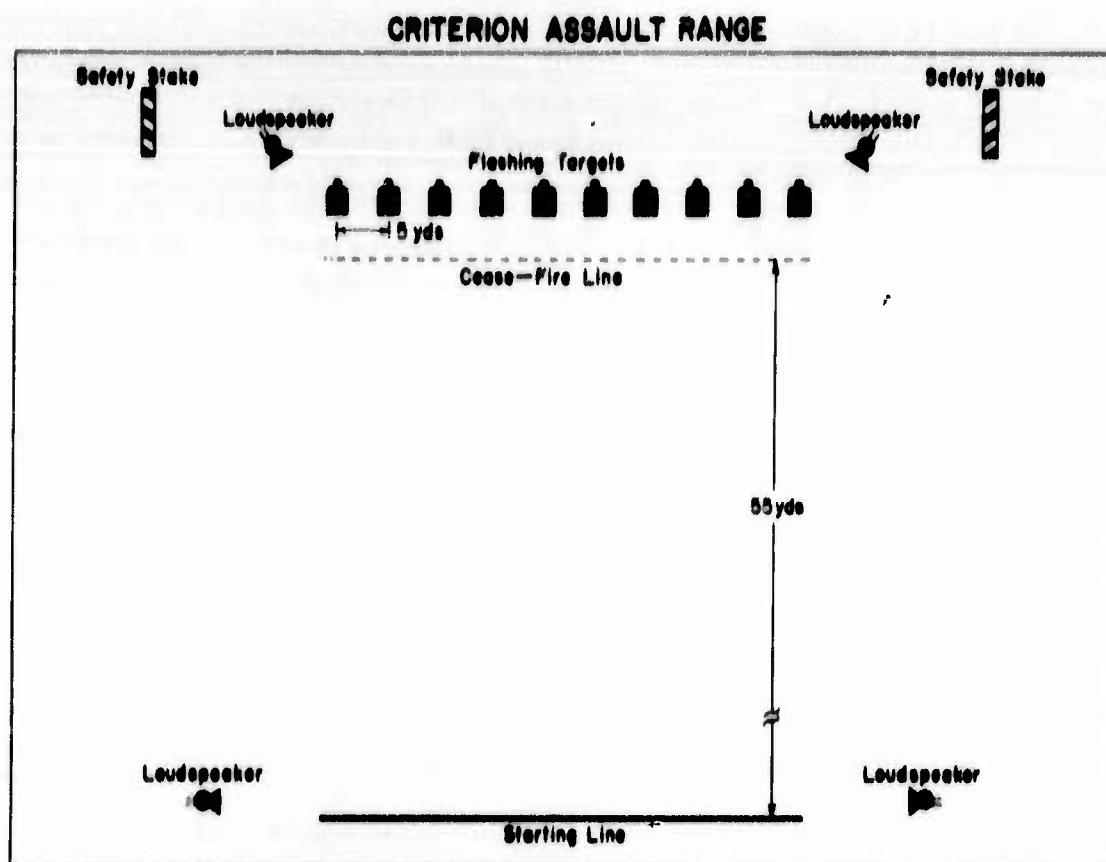


Figure 5

The eight squad members were started from a dressed (five-yard interval) line, the squad leader just behind them. An umpire was assigned to each man on the line.

The umpire removed from the line any man who deviated from a dressed line by more than 1 1/2 yards in any direction. The smallness of this deviation was in the interest of safety since the line could not be allowed to become broken and disorganized when live ammunition was being fired. The fire power of any man removed from the line was lost to his squad, as would have been the situation had he shot some other man or been shot in the darkness.

Description of Criterion Assault Range

The Criterion Assault Range was generally flat, covered with "knobs" of grass, exposed roots, and some small shrubs. Ten lights flashed from the objective at the rate of rifle fire. The lights were centered on E-type dark silhouettes placed in a trench at a range of 60 yards. Behind the targets were continuous dark panels four feet in height. The panels extended one foot into the trench and three feet above ground level.

Types of Scores Obtained

Four types of scores were recorded on each squad when tested on this range.

Number of Hits on Target. Rounds which went through the target were totaled for the squad score.

Number of Hits on Panel. Rounds which went through the panel, excluding the area covered by the targets, were totaled for the squad score.

Number of Men Finishing the Assault. The number of men removed by their umpires for deviating from a dressed line was subtracted from eight to provide this squad score.

Distance Traveled. A time limit was set for the assault. If a squad moved at the proper speed there was adequate time to reach the "Cease fire" line five yards in front of the targets. If the squad moved very slowly it could not go the entire distance within the time limit. The distance that each man had traveled when "Cease fire" was called was recorded and these scores were averaged for the squad score.

RESULTS OF THE CRITERION ASSAULT TEST

The results are presented in two ways.¹ First, experimental and standard squads are compared, with hip and shoulder fire scores for each squad averaged. Second, hip and shoulder performances are compared. The scores from the experimental and control squads are not combined in this last analysis; instead two comparisons of hip and shoulder fire are presented, one based on the hip and shoulder scores obtained from the standard squads, and the other on scores from the experimental squads.

Comparison of Performances of Experimental and Standard Squads

Hits on Target

The average number of hits on targets obtained by the experimental squads was 18 per squad, while the average number obtained by the standard squads was 8. This is an advantage of 142 per cent for the experimental squads and is statistically significant.

Hits on Panel

The average number of hits on panel obtained by the experimental squads was 88 as compared to 52 by the standard squads. This is a 70 per cent advantage for the experimental squads and is significant.

Number of Men Finishing

The average number of men still in the skirmish line when the time limit elapsed was seven in the experimental squads, while the average for the standard squads was six. This was a 15 per cent advantage for the experimental squads but is not significant.

Average Distance Traveled

The average distance traveled by the experimental squads was 42 yards while the average for the standard squads was 31 yards. This was a 34 per cent advantage for the experimental squads and is significant.

¹For more detailed results see tables in Appendix II.

Number of Rounds Fired

The experimental squads were able to fire an average of 232 rounds per squad while the standard squads fired an average of 171 rounds per squad. This difference is significant.

Comparison of Hip and Shoulder Fire of Standard Squads

Hits on Target

The average number of hits on target was nine for shoulder fire and six for hip fire. The difference was not statistically significant but was an advantage of 69 per cent for shoulder fire.

Hits on Panel

The average number of panel hits was about 60 for shoulder fire and about 44 for hip fire. This advantage for the shoulder fire was 39 per cent and is not statistically significant.

Number of Men Finishing

The number of men per squad who finished the assault was six, whether they fired from the shoulder or from the hip.

Average Distance Traveled

Squads firing from the shoulder traveled an average distance of 30 yards while the average distance traveled by squads firing from the hip was 32 yards. This was a 6 per cent advantage in favor of the hip fire and is not statistically significant.

Comparison of Hip and Shoulder Fire of Experimental Squads

Hits on Target

The average number of target hits for hip and shoulder firing was the same, 18 for each.

Hits on Panel

The average number of panel hits was 93 for shoulder fire and 83 for hip fire. This was an advantage of 12 per cent for shoulder fire and is not statistically significant.

Number of Men Finishing

The same number, seven men, finished when firing from the two positions.

Average Distance Traveled

The average distance traveled when firing from the two positions was the same, 42 yards.

Chapter 5

WEAPONS TEST

PURPOSE

The weapons test was concerned with the relative effectiveness of the M1, BAR, light machine gun - A6 (LMG), submachine gun (SMG), and carbine when fired by squads in nighttime defensive positions. The test of the various types of weapons was designed to determine any major advantages which one type of automatic weapon might have for night defense. It was not designed to make an exhaustive analysis which would give a definite answer regarding their exact relative capabilities. Had any weapon possessed outstanding capabilities, more exact tests would have been initiated.

PROCEDURE

Each man who fired in the test was given practice on every weapon. While this did not make the men experts with the automatic weapons, every man did know how to operate the weapon and knew what it would do when fired. Twelve squads (Groups IV and V) were tested on the Defense Training Range. When being tested, the eight men in the squad (excluding the squad leader) were equipped entirely with one type of weapon. In the case of the LMG, only four weapons were issued to the squad and two men were assigned to each weapon. On each test, 80 rounds of ammunition were issued to each squad for firing at the flashing targets, and then another 80 rounds were issued for firing at the dark targets.

RESULTS

The results summarized in Table 1¹ show that no automatic weapon was strikingly superior to the M1 and BAR on both types of targets. The SMG was quite effective on the dark targets but very ineffective on the flashing targets (which were at a greater range).

¹See Appendix II also.

Table 1

HIT SCORES IN WEAPONS TEST

Weapon	Hits per Squad	
	Number	Per Cent
Flashing targets		
BAR	7	9
M1	5	7
LMG (A6)	5	6
SMG	3	3
Carbine	2	3
Dark targets		
SMG	9	12
M1	7	9
BAR	6	8
Carbine	4	5
LMG (A6)	2	2

Chapter 6

COMPARISON OF THE MOONLIGHT IV AND EARLIER MOONLIGHT RESEARCH

METHOD

The method of instruction in this study was the same as that used in MOONLIGHT II. It was built on the assumption that men learn best by doing. Only enough oral material was presented to the trainees to enable them to make the correct responses for themselves in the action situation.

The Familiarization phase was designed (a) to show the trainees exactly what the problems of the situation were, (b) to demonstrate to them that they did not have the necessary skills to master the situation, (c) to provide them with experiential referents for the verbal ideas that would be presented during Corrective training, and (d) to give them a baseline performance which they could compare to their performance after training.

The Correction phase was designed first for oral presentation of the ideas that formed the solution to the problems the trainees had encountered in Familiarization. These ideas were expressed in terms of the action the men would have to take to perform correctly in the problem situation. The second step in Correction was to have the trainees physically enact, in the problem situation, the responses which had previously been described to them verbally. This action period was continued until all trainees could perform correctly without hesitation and without stopping to think of the instructions.

The Application phase served the purpose of allowing the trainees to perform in the same situation they had encountered during Familiarization. True confidence was instilled when the trainees could see how much they had improved. After repeating the original problem situation the trainees know, by their own performance, that they are now better able to meet the problem.

This general method has been successfully employed in three situations in the MOONLIGHT research—individual nighttime firing, squad defensive firing, and squad assault firing. It is applicable to a wide variety of other situations.

RESULTS

In the MOONLIGHT I investigation into the nature and extent of the night fire problem, measurements were made of the ability of soldiers to see targets under varying degrees of low-level illumination and at varying distances.

The extremely short ranges at which the men were able to detect targets with any degree of consistency were a determining factor in planning later research phases on individual and squad training in night firing.

Ways of improving the night firing accuracy of the individual rifleman, within the limitations imposed by the difficulty of detecting dark targets, were sought in MOONLIGHT II. Experimentation showed that the soldier firing at night, unable to use the sights on his rifle, tended to fire high and to the left. This information provided the basis for development of a special firing technique for night use. Practice in this and other aids to night marksmanship demonstrated that accuracy of night fire on both dark and flashing targets can be sharply improved by training.

For squad training, the primary implication of the target detection data was this: No single person can see enough of the enemy situation to fully direct the fire of others. This was the most important condition of darkness which had to be considered in MOONLIGHT IV. Either directly or by implication, it revealed the points at which the daytime technique of fire was not applicable at night.

MOONLIGHT IV results again showed that distance from a dark-type target is an important factor in likelihood of detection, but there was a notable exception. Even when the dark targets on the left of the Criterion Defense Range were at the same range as certain ones on the right, they were much more difficult to detect, even by the instructors who knew exactly where they were located. cursory examination of the general background revealed no difference. Further investigation of this phenomenon might well uncover some important principles or concepts regarding detection at night.

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AND
APPENDICES**

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Appendix A

GENERAL EXPLANATION OF PURPOSE OF THE
RESEARCH TO EXPERIMENTAL TROOPS

"As you know, all the armies in the world train their men in night fighting. In many other countries people are natural night fighters because they have had to work at night without electric lights. In order to overcome any natural advantages they might have, our training must be better than theirs. Our job is to find out what training methods are best and how much better they are. We have already worked out individual nighttime training methods for the Army. You have had that training already.

"What we are doing here is working out the best ways for squads to be trained as smooth working, night fighting teams. We must now depend largely on what we find here with you. Exactly what we are doing is selecting the absolute best of these methods so that one method can be taught to everybody in the Army.

"At times we may ask you to do things without giving you a reason. In experiments like this that is often necessary, but when we finish we will answer any questions you have on what has been done.

"Other people from your outfit will be trained and tested. Some of them will get different types of training than you do. If you tell them anything about the test, we will not know if they are better because of this other training or better because of what you told them. So, please don't talk about the things you do here, even with people in your own outfit. This is very important to the whole experiment."

Appendix B

INSTRUCTOR'S MANUAL FOR THE DEFENSE TRAINING

A. FAMILIARIZATION

1. General Administrative Arrangements

Have squad formed in semicircle just behind firing line. Weapons are in place on the line.

Give squad the tactical briefing. After they are placed on the firing line, give a safety briefing.

2. Tactical Briefing

"Consider me as an officer of your company who preceded your squad to this position.

"You are relieving a squad which has been occupying this position (point) on our defensive line. Other friendly squads are on your left and right. To your front is an open field which slopes gently toward a wooded draw. Our forward observers have just reported an enemy advance toward our position and an attack is expected shortly."

To the squad leader: "Take five minutes now to figure out how you will meet this attack. When you have finished, go to your firing points and safety procedures will be explained."

3. Repeat safety procedures on loudspeaker, issue ammunition, and return control of squad to squad leader. The men then go through the exercise.

B. CORRECTION

1. Verbal Instruction

Place all squads in bleachers and give verbal material on techniques to be learned.

"Let me start the afternoon off by telling you of a tactic developed by Communist troops for use against our forces. After the human wave tactic was abandoned they developed the idea of sending small probing attacks against our position throughout the night. They had found that Americans react with a prolonged volley of fire to the slightest provocation. They also knew that, when this was repeated several times during the night, the Americans would run out of ammunition. I don't know how many of you experienced this, but I do know that most of the time it worked. After the ammunition was gone, they would come in, in force, with hardly a casualty.

"You saw on a small scale, last night, how this could happen. Of course, you had only a clip, but the same thing happens when you have a bandoleer or a box of ammunition. It just takes a little longer before they send in the main force.

"All this leads up to the first question I want to ask: Why do we have to have a system of fire control set up for night fighting? Why can't we just give 'em hell and pour the lead out? Of course the answer is simple. It doesn't work. Against an enemy with the tactics I have just described, this kind of firing is 'near suicide.'

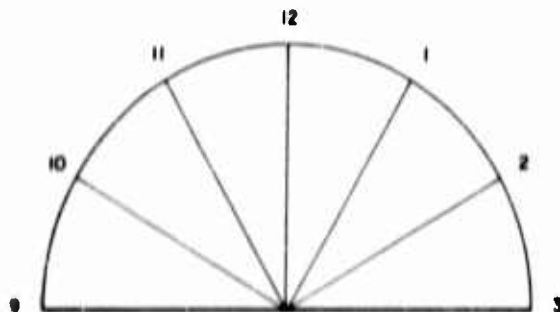
"You can see from your own experience and what I have just said, that a system of fire control is absolutely necessary. The next question is: What should it be? Should it be the same as daytime fire control with formal fire commands and signals? There are four facts that we should keep in mind before answering that question:

- a. Squad leaders do not necessarily have the best night vision in the squad.
- b. The enemy is already close in; there is no 'time cushion' in which to give a formal fire command.
- c. The information in a formal fire command is not needed because the enemy is always close in, within 100 yards.
- d. The position of all the men in the squad is better than the position of the squad leader for first spotting the enemy.

"Pvt. _____, in view of these facts, do you think a daytime fire control system can be used for night fighting? Right. The system must make use of the eyes and night vision of every man for detection of the enemy, and every man must know what he is to do in starting the fire fight.

"This brings us to the next question: Who should open fire? The flash of automatic weapons is easy to see, but you all saw how hard they were to hit last night. Should riflemen fire at them even if they can't hit them? Luckily, there is an easy answer. We have a luminous sight for the AR men. With that sight on an AR and the training they will get out here, they can knock out enemy automatic weapons as if it were daylight. Therefore, riflemen should not fire when the only target that they see is the flash of automatic weapons. They should fire only when they have seen the outlines of enemy riflemen or have seen enemy riflemen firing on their position.

"Now that we have answered the question of who is to fire on the enemy, we are left with the question of where. You saw last night how hard it was to scan the entire area in front of you. You would do a much better job with a smaller sector. We know that the size sector you can cover best is about an angle of 30 degrees. That is the angle between one o'clock and two o'clock on your watch. We also know that the enemy can get in toward our flanks more easily at night. He doesn't always appear way out to our direct front. What kind of system does this suggest?" (Listen to ideas and mention the difficulty of seeing landmarks at night.) "What you have said is basically the sector system that you will use." (Show sector system training aid. Discussion.)



Sector System Training Aid

"There are just two more things to learn about the sector system."

a. Discuss the SOP's regarding fire from another part of line and how this builds up fire rapidly.

b. Discuss the SOP regarding two or three rounds into another sector and returning to own sector, and how this effects redistribution and reconcentration of fire.

"What you have in the nighttime fire control plan we have just discussed is the same as a 'play' in football or basketball. The squad leader does not have to draw a diagram for each man each time there is an attack. Every man knows what he is to do in the 'play' and it just reels off. That is what we must have in fighting at night. Communication is too difficult at night to set up 'plays' on the spot.

"There is just one more thing to think about on this, and that is: What if the squad gets trigger-happy in spite of their training? Of course, the squad leader must maintain emergency control of the rate of fire. He is the best qualified for this because:

a. He knows the ammunition supply the best.

b. He was selected for his experience and coolness under pressure.

c. He knows the general situation the best.

"You can see how the knowledge of how nighttime affects battle conditions has been used to get up this nighttime fire control system. In a few minutes we will let you work this system out for yourselves in the daylight. Tonight you will have a chance to apply it to the same situation which you faced last night."

2. Practice on Training Range

Administratively this is the same as on familiarization night.

Allow three (or four) dry runs.

Critique with squad leader after each run. Critique should stress the pertinent SOP's for any mistakes which arise.

Allow three wet runs with critiques after each.

3. Practice for AR Men

After dark show the AR men how to get a sight picture with the luminous sight. First, have them look through the peep sight and see the luminous tape. Next, tell them to get the flashing light in their peep sight. After they can do these two steps readily tell them to bring the luminous tape halfway up in their peep and get the red light to 'sit' on top of it, centered. When they can get their sight picture in three seconds or less they can go on to wet firing.

With the entire squad present give each AR man of the squad one magazine of ammunition and let him fire at a flashing light. Score their targets and tell the squad the scores.

C. APPLICATION

Procedure for application is exactly the same as in the familiarization.

Appendix C

SAFETY INSTRUCTIONS TO DEFENSE RANGE UMPIRES

A. INDIVIDUAL BRIEFING TO BE GIVEN BY UMPIRE TO HIS MEN IN THE FOXHOLE

"Always keep your piece pointed down range between this stake and that stake—even when loading. Never fire outside of those stakes.

"Do not fire until the loudspeaker tells you. You lock and load when I give you the ammunition and you load thereafter without being told.

"If your piece fails to fire, immediately pull the operating rod handle all the way back with the right hand; let it go, aim, and fire. If this does not work, let me take it over." (Umpire will lock, pointing piece down range for ten seconds, then clear the piece.)

"Yell 'Cease fire' if you see anything dangerous. Whenever you hear 'Cease fire' given by anybody, lock your piece and let me take it over."

If your man shifts his piece beyond the safety stakes, seize it, forcing the piece down range at the same time. Warn him, but allow him to continue.

If your man is injured, yell "Cease fire" and "Aid man."

B. GENERAL REMINDERS FOR UMPIRES

When your man first arrives with his piece, see that it is locked and then insert your finger in the chamber and rake your finger back over the follower guide to insure that there is no ammunition.

When your man is ready to fire, you be ready to call "Ready number____." If your number is two, you call first, if your number is three, call second, etc. This counting off must always be in sequence. The loudspeaker will call "Unlock and fire at will" when all umpires have reported. Do not allow your man to unlock before this signal.

When "Cease fire" ends the problem, clear and lock the piece with rifle pointing down range. Pull the operating rod fully to the rear, thus extracting and ejecting the cartridge from the chamber. Eject the clip from the receiver by depressing the clip latch on the left side of the rifle. Again, insert finger in the chamber and rake your fingers back over the follower guide to insure that no ammunition remains.

After you have cleared your man's weapon, you call "Clear number 2, number 3, etc.," then loudspeaker will call "All clear on the line, move out."

Appendix D

INSTRUCTOR'S MANUAL FOR THE CRITERION DEFENSE

1. General Administrative Arrangements

Have squad formed in semicircle just behind firing line. Weapons are in place on the line.

Give the squad a tactical briefing followed by a safety briefing (see Appendix C for safety briefing) when they are placed on the firing line.

2. Tactical Briefing

"You are the Second Squad of the First Platoon of ABLE Company. Your platoon is dug in along a north-south line defending Rowan Hill, right up there (point). Your squad has the center position on the line. You have been in this position for three days. The terrain in front of you is a gentle slope ending in a wooded draw about 300 yards to your front (point).

"The enemy originally attacked your platoon in battalion strength tonight. You have already had three attacks during the night. Enemy losses have been high but they still have enough men for another attack. Their mortar fire has not been particularly effective so far.

"Many of their men are equipped with burp guns and they have some machine gun support. They have tried infiltration on each attack and have succeeded in getting some men through our FPL's.

"In the earlier attacks most of the platoon's ammunition and all of the flares were used. All that is left now is M1-AR ammunition; 48 rounds per rifleman and 60 rounds per AR man. All units in this area have been under heavy attack tonight and the First Platoon cannot count on any other support or relief.

"The platoon's mission is to hold this defensive line.

"The Company Aid Station is back about 300 yards on the reverse slope of Rowan Hill. There is no ammunition at the ammunition supply point. Bayonets will be fixed.

"The password is 'Pine fire'."

Appendix E

INSTRUCTOR'S MANUAL FOR THE ASSAULT TRAINING

A. FAMILIARIZATION

1. General Administrative Arrangements

Squad leaders are instructed to form their squad, on line, in the following order:

9 5 7 3 2 4 6 8

AR men (numbers 5 and 6) are checked to see that their slings are adjusted and their pouches on their belts. The order is given to fix bayonets with scabbards on. Assault Range umpires are formed behind their respective trainees.

2. Briefing

"This will be the starting point of your assault. You will assault from here (point) to that point which is about 60 yards away. You will be issued three clips per rifleman and two magazines per AR man. Now, check that you are in the correct position and sound off when you are ready. Squad leader, you tell me when you are ready. (Safety instructions to Assault Range umpires apply here.)

"Ready, move out."

(After traveling 50 yards halt men.)

"Halt!"

"All right, see how you did; keep that in mind so you can see how much you improve."

B. CORRECTION

(Given during first night)

1. Maintaining Formation

"You all saw some of the difficulties in assaulting at night. Here are some things that are important as we go through our early training. Keep these things in mind all the time you assault."

a. MANN

"What we mean by mann is the number of men firing. In our situation we have six riflemen and two AR men. With this power we can cover the

situation very well but we must have fire superiority. In other words, we don't want to lose anybody in the assault. When you assault it is important that you stay in line. Why? Because at night you don't want to get too far ahead or too far behind because you may shoot one of your own men during the assault, or if you do get out too far or get back, you will be in someone's way and he won't have a full view of the situation. In either case, your mass or fire power is cut down. If you lose a rifleman that is one-eighth of your mass or fire superiority gone. So, it is best to stay in a straight line, to keep your mass at the maximum. Remember, the enemy will be firing at you, so you have to keep them down in that hole. A good way to stay in a straight line is to get dressed up before you assault. So, dress right.

"Another thing that is important is that you don't want to bunch up. In other words, keep your interval. A good way to do this is to get your interval before you start assaulting. On dark nights that interval should be about five yards. Why? Because everybody can see five yards even on the darkest night. Therefore, before you start, get dressed up to the right with the proper interval."

b. Rate

"By rate we mean rate of fire. When you assault you have to lay down a volume of fire. As I said before, the enemy will be firing at you when he has a chance, so you can't be bashful about laying down that blanket of fire. You have eight men in the mass, as we have already said, and every man will be firing. This shows you what happens to the rate if you lose a man. Keep this in mind. Therefore, to keep that rate at its maximum, every man has to finish at the objective."

c. Accuracy

"This is the next step, but since we are not using ammunition on this course tonight, we will stress accuracy of fire tomorrow because we will be firing ball ammunition. Those of you who have already fired from the hip have seen that there are difficulties in accuracy. Accuracy is as important as mass and rate. Tomorrow we will cover this at length."

d. Time

"By time we mean shock action. The speed at which you assault is very important. You know that if you move too slowly you will be exposed to the enemy longer and they will have more chance to hit you; if you move too fast you won't be able to shoot accurately. You must move just right, not too fast or not too slow. It is hard to tell what is the right speed, but if you dress right and keep your interval you will get the right speed.

"This time business is important because when you start assaulting you want to be on the enemy, all of you, not part of you. The correct combination of mass, rate, and accuracy will give you maximum shock action. The enemy doesn't have a chance if you do all this in the proper manner. Is there anyone who doesn't understand?

"All right, squad leader, get your men in proper positions, get dressed up right, and get the proper interval.

"Let's simulate this time what you would do if you had just been handed a clip of ammunition.

"Ready, lock and load and sound off. No. 2 ready, etc."

(If any of the procedures of loading and sounding off, ready on No. 2, etc., and clear on No. 2, etc., are not executed properly, run through the procedure several times until it is adequate and systematically done.)

"Ready on the firing line, unlock, move out.

"Halt! Lock your weapon and keep it pointing down range.

"Now clear your weapons and sound off."

(Instructor now moves the squad back to original starting point to give men practice in finding their positions quickly in the assault formation.)

Discuss with the men what they did wrong.

- a. Did they stay in a straight line?
- b. Did they keep the proper interval?
- c. Was rate good? (Check by sound of bolts.)
- d. Was speed right?
- e. Was guide man stable? If not, have a discussion with the squad leader to have him replaced or changed if inadequate. If necessary, this should be done after several trials.
- f. Did men do too much dressing right? They should do it only every so often.
- g. Was a 30-inch step used?
- h. Did a gallop develop?
- i. Were the men going off at an angle? They should assault straight ahead.
- j. Did guide man dress? He should not do any dressing. He looks straight forward all the time because the men are dressing on him.
- k. Were any other difficulties encountered? If so, they should be discussed before the next dry run is made so as to have them corrected.

2. Reinforcement of Objectives

"Remember, men, that the enemy will be firing at you when you are detected, so if you use mass, rate, accuracy, and time properly you have the problem licked. Keep this in mind all the time."

3. Safety

"We have one other point to raise and that is safety.

"I just told you to simulate what you would do if you had ammunition. Later we will have live ammunition, so let's go through some of the safety aspects. If you dress right, keep your interval, and get the right speed you have the problem beat; but it is also very important that when you start your assault and get ammunition, you do not load until you are told. You will lock and load, keep your weapon pointed down range, and unlock when you are told. When you are called to a halt, lock your weapon and hip it, keeping it pointed down range. Later we will have umpires for each man in the squad. When you are halted, you will let the umpires take over your weapon and clear it. Then sound off that No. 2 is clear, etc."

4. Instructions

"Squad leader, get your men in position to assault. Men, listen to any of the hints your squad leader gives you while you are assaulting. He sees the situation better than you.

"All right, assume that you have been issued ammunition.

"Lock and load.

"No. 2 ready, etc.

"Ready on the firing line.

"Unlock and move out.

"Halt!

"Lock your weapon and clear it.

"No. 2 clear, etc."

After each dry run instructor should go over all the errors made.

A minimum of six dry runs is necessary unless the squad has had unusually good training before.

Summarize all corrective training and stress that the men will fire live ammunition and each man will have an umpire. He is not to resist the umpire under any circumstances. However, if he does everything he is taught, the umpire will not take him out of the situation. It is important that every man start the assault and finish it because it is not an assault if no one finishes.

(Approximate total time for complete course for one squad on the first night is 60 minutes.)

(Given during second day)

5. Accuracy (Verbal Instructions and Blank Fire)

"In addition to maintaining line, you have to be accurate. Here is one thing we have found that will give you accuracy in firing. Thrust your weapon about five inches as you fire (demonstrate). As you are thrusting, squeeze off a round. Don't wait to squeeze as you finish your thrust because you will have the weapon's muzzle pointed too high over the enemy. You know that we all have a tendency to bounce when we walk and this makes the muzzle bounce. If you thrust the weapon it will stabilize it and give you the accuracy you want. Fire on either foot as you move. As you practice this you will get the rhythm of it. Remember all that we discussed about mass, rate, and time, and then this about accuracy.

"Squad leader, prepare your men for the assault.

"Let's have a dry run doing all the things we did last night and things we talked over this afternoon.

"Lock and load.

"No. 2 ready, etc.

"Unlock and move out.

"Halt!"

(Discuss difficulties for those individuals who are slow in catching on. Give individual attention. Use simile of dancing and its difficulty.)

Have individual runs for riflemen using thrust.

"If you remember, I told you we would use ammunition tonight. This afternoon we will use blank ammunition. Everyone here knows that blank ammunition can be dangerous, so let's keep in mind the safety procedures and treat today's situations as if we had live ammunition." (Go through safety procedures again.)

"Don't load until you are told. Be sure your piece is locked before you load. Keep your weapon pointed down range at all times, loaded or unloaded. This is a good habit to get into.

"One more thing. When we run these situations with blank ammunition, if you get out of line one step to the front or to the rear you will be tapped on your helmet. This means you stop immediately. Lock your weapon and don't move until the situation is over or until you are told to.

"Tonight when you run the situation each man will have an umpire. Any time this umpire sees that you are out of line one step either to the front or to the rear, he will take your weapon. You are not to resist him. This is why, when we run the situation with blank ammunition, we tap you on the helmet. This is just the same as having the umpire take your weapon.

"All right, squad leader, prepare your men to assault. Pass out one clip of blank ammunition."

6. Reloading Training

"At any time you receive ammunition be sure that you take each clip and tap it on the butt plate. The reason you do this is to eliminate having a long round. When you are assaulting you do not want to stop and fumble with your ammunition. You must move constantly. If you tap each clip on the butt plate and place it in the cartridge belt, you won't have to stop in your assault. If you are given a bandoleer of ammunition, take out each clip and put it in your cartridge belt after you have tapped it on the butt plate. Tonight you will be firing anywhere from three clips to a bandoleer. An AR man will have from one to three magazines. Each AR man should have a magazine pouch. Check and see that you have one now.

"Lock and load one clip of blank ammunition.

"Sound off when ready, No. 2 ready, etc.

"Ready on the firing line.

"Unlock and move out." (After men have traveled approximately 30 yards, halt them.)

"Halt!

"Lock and clear your weapon.

"Sound off when cleared. Make sure you rake your finger over the follower guide and check for a round in the chamber.

"Move back to your original positions." (Discuss with men errors made, emphasizing that these should be corrected.)

"Last time you saw that it is easy for you to guide on the rifle flash next to you. This is another reason for you to stay in a straight line, especially at night. It is also important that when you are assaulting you do not dress right too often. Look where you are firing; remember all the things you were taught

about mass, rate, accuracy, and time. This time you will be given one clip and one round. We will practice reloading in place.

"Squad leader, prepare your men for assaulting.

"Pass out one clip and one round.

"Lock and load one round of blank ammunition. AR men, you will not have any ammunition to fire but you will practice changing magazines. You should have one magazine in your weapon and one in your pouch.

"Sound off when ready. No. 2 clear, etc.

"Unlock.

"Commence firing.

"Cease firing.

"Lock your weapon and clear it.

"Sound off, No. 2 clear, etc.

"You can see that it is difficult without practice to load quickly. At no time are you to look down at your weapon when you are reloading in the assault. Each man should know exactly where he should put that clip. The clip is easy to get out of the cartridge belt and there is little difficulty if the man has each clip tapped on the butt plate. Remember, you do not hesitate at any time when you are assaulting." (If necessary, remind AR's to fire while the riflemen are reloading.) "Did you notice how quiet it was that time? Well, your shock action goes when it is quiet. The AR's should pick up this lull and keep the rate while the riflemen are reloading. Here is another duty for the AR's. If another target of opportunity shows up, the AR covers it immediately, not the riflemen. For example, a machine gun may open up on the assaulting troops. The AR places fire on it at once. You keep your time constant so you do not lose the shock effect.

"We will now practice reloading on the move. Let's go to our original starting position.

"Ammunition man, pass out one round and one clip of ammunition. This time I want each man to look where he is firing. We will move out and will reload on the move.

"Lock and load one clip of blank ammunition.

"Sound off when ready.

"Ready on the firing line.

"Unlock.

"Move out."

(After men have completed firing clip of blank ammunition, cease fire.)

"That time I timed you and it took you seconds to reload. This is not fast enough. We will do it again." (Three runs of one clip and one round are given.)

"Since we have reviewed all the important parts of assaulting, we will now simulate nighttime conditions. Each man will be given a pair of dark goggles. Put these goggles on and leave them on so that your eyes will get used to them. It is more difficult to see with these goggles on now than it will be at night, but if we make it difficult for you now it will be easier for you tonight when you fire ball ammunition. Remember, when you are tapped on the helmet, lock your weapon and do not move until the situation is over."

(Give one dry run with goggles and discuss errors.)

"Next we will fire blank ammunition with goggles.

"Pass out one clip and one round.

"Lock and load one clip of blank ammunition. Keep in mind your safety instructions. This time you will move out and reload on the move.

"Sound off when ready, No. 2 ready, etc.

"Unlock and move out." (After men have traveled 30 yards or so, halt them.)

"Halt!

"Clear your weapon.

"Sound off.

"Move back to your original starting positions.

"You saw that time that it was easy to guide on the flash from the weapon next to you." (Discuss any errors made by the men in that situation.) (Run the identical situation one more time.)

"During any assault you must keep moving. Even though you have fired all your ammunition you must stay in line. You do not stop at any time. If your weapon should malfunction any time during the assault, do not stop moving, and keep it pointed down range. Is there anyone who does not understand?" (Have men gather at starting point and discuss initial part of the assault.)

(Given during second night)

7. Accuracy (Wet Firing)

"Tonight we will fire live ammunition. Therefore it is important that safety be stressed first. Remember all I told you about safety last night and this afternoon. Tonight we will also have one umpire for each man in the squad. Therefore, be sure the umpire can take your weapon when he wants to. He will take it when you are one pace out of line either to the front or to the rear. When you are issued your ammunition be sure and place it in your cartridge belt after you have tapped it on the butt plate. AR men, make sure you have magazines loaded properly in your pouch. You don't want to have any difficulty loading while you are assaulting. Remember, you want to be firing your weapon, not fumbling with it because your ammunition is fouled up or your magazine is in backwards. Therefore, get set up before you assault. Get dressed right, get your interval, use your thrust technique, and watch your tracer for high rounds and size of shot group. Do not load until you are told to do so. When you do, look before you load. Keep your weapon pointed down range at all times. Do not hesitate when you are reloading during assault. If you fire all your ammunition before cease fire, keep moving. Do not stop if the weapon malfunctions. Do not stop, keep moving. When you hear 'Cease fire', halt immediately, lock your weapon, and let the umpire take over the weapon and clear it. I repeat, if the umpire starts to take your weapon during the assault do not resist him.

"Your firing areas will be these. Each rifleman is to fire directly in front of him. He is responsible for that area, so keep that area out in front of you saturated with fire. AR men can fire the full length of the trench the enemy is in or at any targets of opportunity. Keep accuracy in your mind at all times.

As you look down range right now you will see two luminous patches painted on the posts down range. At no time is anybody supposed to fire outside these patches. If anybody does not see these patches, ask your umpire to point them out right now."

(Give safety instructions.) (Have assistant pass out ammunition.)

"Lock and load.

"Sound off when ready.

"Unlock and move out."

After the cease fire, discuss errors men have made. Have the umpire point out to the men individually what their difficulties were (shot groups, firing high, etc.).

"Each man will have his bayonet fixed any time he is running the assault. I do not have to explain the reason for this." (Have each man place a scabbard on his bayonet for safety purposes.)

(About four runs with tracer ammunition are required for this training.)

C. APPLICATION

A fifth trial of the accuracy training is run and the squad is told to notice how well they did in comparison to their first run the night before.

Appendix F

SAFETY INSTRUCTIONS TO ASSAULT RANGE UMPIRES

"In the night assault, live ammunition will be used and the umpire will be responsible for determining that each safety measure is carried out in compliance with range regulations.

"When the assault line is formed for the first order each man will have an umpire. This umpire will stand to rear, right, or left, depending upon which side the firer holds his rifle. The umpire should be close enough to the man so he will be able to take the firer's weapon when safety is jeopardized. However, the umpire should not be so close as to restrict the firer in any way. The umpire must also observe from which side the firer will fire and take his position accordingly. In each squad eight men will line up dressed to the right with a five-yard interval between them and one umpire behind each man. On the signal to move out the umpires will stay with their man until 'Cease fire' is called.

"Before the signal to move out, the umpire will be issued the ammunition. On command from the instructor he will issue the ammunition to the firer and have him lock (umpire must check that weapon is locked before it is loaded) and load. On the signal to move out the weapons are unlocked and the men move out and begin to fire.

"At this point the umpire is responsible for safety for his man. The umpire should take his man's weapon and stop him if any of the following things occur:

- (1) The man gets in front of the main assault line by one pace
- (2) The man gets behind the main assault line by one pace
- (3) The interval between the man and the man on either side of him becomes less than three and one-half yards
- (4) The man begins to fall or trip
- (5) The man does not control his weapon (becomes erratic in fire)
- (6) The man stops for any reason

"If any firer does any of the above listed things he naturally endangers the situation, and the umpire must be alert to keep the situation safe. It should be noted that the umpires should not judge safety limits for themselves but should remove the man from the situation when he gets closer than three and one-half yards to either of the men beside him.

"Once the firer is taken out, the umpire will hold him in place and hold the weapon.

"When the umpire sees that the firer is doing any one of the above things he will first take his weapon [demonstrate], lock it, and hold him in place.

After the instructor calls 'Cease fire' the umpires will clear the weapons on command. To do this he will place his finger in the chamber and rake it back over the follower guide. At no time are the umpires to clear weapons until told to do so.

"The umpire also can call a 'Cease fire' if he sees a situation that is dangerous. In this case each umpire should take the firer's weapon when 'Cease fire' is heard. The weapons should be locked until the condition is declared safe.

"Now we will have a demonstration on how the weapon should be taken by the umpire.

"Now we will demonstrate conditions when the weapon should be taken from firers." (Use students.)

"Are there any questions?"

Appendix G

INSTRUCTOR'S MANUAL FOR THE CRITERION ASSAULT

"For tonight you are the Second Squad of the First Platoon of Able Company. Your squad will be the center squad of an unsupported platoon assaulting on the enemy lines. The First Squad will be on your left and the Third Squad will be on your right. The Fourth Squad will be in reserve. You will deploy in a skirmish line about 60 yards in front of the enemy position. The enemy has been known to use trench-like fortifications. They haven't shown machine gun support in earlier attacks. Your squad is opposing at least a full-strength enemy squad or possibly more. The terrain is fairly level and has a gentle slope down.

"The assignment of individual duties will be given you by your squad leader.

"Your Company Aid Station is about 150 yards west from where you are now. Your Company CP is about 300 yards west from this point (point).

"When you are told to move out, the assault will begin.

"You will become nontactical until you get your ammunition and final safety instructions. You will become tactical when you are told to move out.

"Ammunition men, pass out the ammunition."

Signal for flashing lights to start.

Call "Move out" as soon as flashing lights begin.

Appendix H

STATISTICAL SUMMARY OF DEFENSE AND ASSAULT RESULTS

This section is intended for the reader with an interest in the statistical background of the results presented in the Defense and Assault sections of this report. It is a summary of all results from Chapters 3, 4, and 5.

A key to the abbreviations in the tables is as follows:

N = Number of cases.

M = Mean or average score.

SD = Standard deviation, a measure of dispersion of scores around the mean.

t = A statistical test of significance where the difference between the means is compared to the variability of the scores comprising those means. From this t a p value is obtained.

p = Probability that the difference reported could have occurred by chance alone. The value .01 indicates only one chance in one hundred; the value .001, only one in a thousand, and so on.

NS = Not significant. The $p < .05$ level was considered as the minimum acceptable value in this study. However, specific values are shown in the tables to the .10 level to provide further information.

CR = Critical ratio, a statistic similar to the t.

< = Less than.

> = Greater than.

Table H-1

COMPARISON OF MARKSMANSHIP SCORES IN
FAMILIARIZATION AND APPLICATION PHASES OF DEFENSE TRAINING
(N = 12)

	Familiarization Phase		Application Phase		Difference Between Means	t	p
	M	SD	M	SD			
Number of hits							
Flashing targets	1.7	1.3	14.8	7.4	13.1	6.57	.001
Dark targets	0.1	0.3	5.6	6.2	5.5	2.92	.02 > p > .01
All targets	1.8	1.2	20.4	9.4	18.6	6.99	.001
Number of rounds fired	79.6	10.1	65.2	17.6	14.4	2.38	.05 > p > .02
Percentage of hits on all targets	2.2		31.3		29.1	16.77*	< .001

*CR

Table H-2
COMPARISON OF SCORES OF EXPERIMENTAL AND STANDARD SQUADS
ON THE VARIOUS TARGETS ON THE CRITERION DEFENSE COURSE
(Experimental N=12; Standard N=12)

	Experimental		Standard		Difference Between Means	t	p
	M	SD	M	SD			
Number of hits per squad							
Flashing targets	17.2	12.8	11.0	11.7	6.2	1.20	NS
Dark targets	11.2	10.6	0.9	2.2	10.3	3.15	.01
Rushing dark targets ^a	0.8	--	0.1	--	0.7	--	--
All targets	29.2	18.6	12.0	11.5	17.2	2.61	.02 > p > .01
Number of rounds fired	223.8	71.8	305.7	117.2	81.9	1.98	.10 > p > .05
Percentage of hits on all targets	13.1		3.9		9.2	13.44 ^b	.001

^aNo statistical tests were computed because only three squads performed under sufficient illumination to detect these targets.

^bCH

Table H-3
COMPARISON OF PERFORMANCE OF EXPERIMENTAL AND STANDARD SQUADS
ON THE CRITERION ASSAULT COURSE
(Averaging Hip and Shoulder Firing Scores)
(Experimental N=12; Standard N=12)

	Experimental		Standard		Difference Between Means	t	p
	M	SD	M	SD			
Number of hits							
Targets	18.1	4.8	7.5	2.9	10.6	6.29	.001
Panels	88.2	23.9	51.9	17.9	36.3	4.04	.001
Number of rounds fired	232.2	54.2	170.8	32.5	61.4	3.22	.01 > p > .001
Number of men finishing assault	6.8	0.9	5.9	1.8	0.9	1.52	NS
Average distance traveled by squad member	41.6	6.6	31.0	10.7	10.6	2.79	.02 > p > .01

Table H-4

COMPARISON OF PERFORMANCE OF EXPERIMENTAL AND STANDARD SQUADS
ON THE CRITERION ASSAULT COURSE,
CONSIDERING HIP AND SHOULDER FIRING SCORES SEPARATELY
(Experimental N=12; Standard N=12)

	Experimental		Standard		Difference Between Means	t	p
	M	SD	M	SD			
Number of hits on target							
Hip	18.2	8.8	5.6	3.4	12.6	4.66	.001
Shoulder	18.0	6.5	9.4	5.4	8.6	3.52	.01 > p > .001
Number of hits on panel							
Hip	83.4	28.2	43.5	13.5	39.9	4.42	.001
Shoulder	93.1	30.4	60.3	30.1	32.8	2.65	.02 > p > .01
Number of rounds fired							
Hip	229.6	62.2	173.1	43.5	56.5	8.15	.001
Shoulder	234.8	58.4	168.4	43.0	66.4	10.03	.001
Number of men finishing assault							
Hip	6.8	1.2	5.9	1.2	0.9	1.10	NS
Shoulder	6.8	1.1	5.8	2.1	1.0	1.95	.10 > p > .05
Average distance traveled							
Hip	41.4	8.3	31.7	11.0	9.7	2.43	.03 > p > .02
Shoulder	41.7	7.2	30.2	11.4	11.5	2.95	.01 > p > .001

Table H-5

COMPARISON OF PERFORMANCE OF SQUADS SHOOTING FROM HIP AND SHOULDER
ON THE CRITERION ASSAULT COURSE,
CONSIDERING EXPERIMENTAL AND STANDARD SQUADS SEPARATELY
(N=12)

	Hip		Shoulder		Difference Between Means	t	p
	M	SD	M	SD			
Number of hits on target							
Experimental	18.2	8.8	18.0	6.5	0.2	.07	NS
Standard	5.6	3.4	9.4	5.4	3.8	1.85	.10 > p > .05
Number of hits on panel							
Experimental	83.4	28.2	93.1	30.4	9.7	.95	NS
Standard	43.5	13.5	60.3	30.1	16.8	1.86	.10 > p > .05
Number of rounds fired							
Experimental	229.6	62.2	234.8	58.4	5.2	.32	NS
Standard	173.1	43.5	168.4	43.0	4.7	.27	NS
Number of men finishing assault							
Experimental	6.8	1.2	6.8	1.1	0.0	—	NS
Standard	5.9	1.9	5.8	2.1	0.1	.14	NS
Average distance traveled							
Experimental	41.4	8.3	41.7	7.2	0.3	.45	NS
Standard	31.7	11.0	30.2	11.4	1.5	.80	NS

Table H-6

**SCORES OBTAINED BY 12 SQUADS FIRING WITH DIFFERENT WEAPONS
ON THE DEFENSE TRAINING COURSE**

Weapon	Flashing Targets		Dark Targets	
	Number of Hits per Squad ^a	Per Cent of Rounds Fired ^b	Number of Hits per Squad ^c	Per Cent of Rounds Fired ^d
Carbine	2.2	2.9	3.8	5.1
BAR	7.2	9.1	5.9	7.7
SMG	2.5	3.3	8.9	11.6
M1	5.2	6.9	7.0	9.2
LMG(A6)	4.7	6.1	1.5	2.1

^aAn over-all significance test (analysis of variance) indicates that these values differ significantly ($.01 > p > .001$).

^bAn average of 77.1 rounds was fired by each squad.

^cAn over-all significance test (analysis of variance) indicates that these values differ significantly ($.05 > p > .025$).

^dAn average of 74.8 rounds was fired by each squad.

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