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UNITED STATES MARINE CORPS
WEAPONS TRAINING BATTALION
MARINE CORPS COMBAT DEVELOPMENT COMMAND
QUANTICO, VIRGINIA 22134-5040

DETAILED INSTRUCTOR GUIDE

LESSON TITLE

RANGE ESTIMATION

COURSE TITLE

SUSTAINMENT LEVEL RIFLE MARKSMANSHIP (PHASE I, II, III)

UNITED STATES MARINE CORPS
Weapons Training Battalion
Marine Corps Combat Development Command
Quantico, Virginia 22134-5040

INSTRUCTOR PREPARATION CHECKLIST

ESSENTIAL DATA

LESSON DESIGNATOR	SLR.29
LESSON TITLE	Range Estimation
DATE PREPARED	1 October 1999
TIME	1 hr 30 min
METHOD	Lecture and practical application
LOCATION	Indoor/outdoor classroom
INSTRUCTORS REQUIRED	One Primary Marksmanship Instructor (PMI)
REFERENCE	MCRP 3-01A
TRAINING AIDS/EQUIPMENT	Targets at unknown distances and slide (sSLR.29-1)

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DETAILED OUTLINE

RANGE ESTIMATION

INTRODUCTION (3 MIN)

1. GAIN ATTENTION. Range estimation is the determination of the distance from your location to a distant point. The ability to determine range is a skill which must be developed by the Marine to engage targets at unknown distances in a combat environment. To engage a target in the field with accurate fire, you must take time to determine the distance between yourself and the target. Practice in acquiring range estimation skills will ensure quick and effective target engagement on the battlefield.

2. OVERVIEW. This lesson covers the techniques for determining the range to a target in a field environment.

3. INTRODUCE LEARNING OBJECTIVES. The Terminal Learning Objective and Enabling Learning Objectives pertaining to this lesson are as follows:

a. TERMINAL LEARNING OBJECTIVE. Given an M16A2 service rifle, sling, cartridge belt, magazines, magazine pouches, flak jacket, helmet, suspenders, ammunition, and targets, without the aid of references, engage targets at unknown distances with the rifle IAW MCRP 3-01A and to achieve a proficiency level IAW MCO 3574.2_. (PVTX.11.11)

b. ENABLING LEARNING OBJECTIVES

1) Without the aid of references, identify factors affecting range estimation IAW MCRP 3-01A. (PVTX.11.11a)

2) Given a target, without the aid of references, estimate range to the target IAW MCRP 3-01A. (PVTX.11.11b)

3) Given an M16A2 service rifle, sling, cartridge belt, magazines, magazine pouches, flak jacket, helmet, suspenders, ammunition, and targets, without the aid of references, apply a hasty sight setting IAW MCRP 3-01A. (PVTX.11.11c)

INSTRUCTOR'S NOTE: *A load-bearing vest may be substituted for magazine pouches and suspenders. Gear will be worn in accordance with the MBST Handbook.*

4. METHOD. This lesson will be taught in a classroom setting using lecture and will be followed by a period of practical application in the outdoor training area.

5. EVALUATION. Topics from this lesson will be evaluated in the comprehensive written examination for Phase III following completion of lessons SLR.19 - SLR.29 and via a performance checklist in the Unknown Distance Firing Exercise, SLR.29A.

TRANSITION: For a Marine to engage a target successfully, he must determine the range to the target. He should not be satisfied with a rough or "ballpark" estimate. Precision enhances accuracy and, ultimately, survival on the battlefield. In addition, accurate range determination will allow the Marine to determine if the target can be effectively engaged using his BZO or if a new sight setting should be placed on the rifle. There are many methods of range estimation that can provide accurate measurements. The most common are those methods that rely on the eye.

BODY (1 HR 25 MIN)

1. (15 MIN) ESTIMATING RANGE BY EYE

a. Unit of Measure. To determine the total distance to the target using this method, the Marine must visualize a distance of 100 meters on the ground, and then estimate how many of these units can fit between himself and the target.

1) The greatest limitation of the unit of measure method is that its accuracy is directly related to how much of the terrain is visible. This is particularly true at greater ranges. If a target appears at a range of 500 meters or more and only a portion of the ground between the Marine and the target can be seen, it becomes difficult to use the unit of measure method of range estimation with accuracy.

2) Proficiency in the unit of measure method requires constant practice. Throughout training, comparisons should be continually made between the range estimated by the Marine and the actual range as determined by pacing or other, more accurate measurement.

b. Appearance of Objects Method. To use this method, the Marine must be familiar with the sizes and details of personnel and equipment at known distances. Anything that limits the visibility (such as weather, smoke, or darkness) will also limit the effectiveness of this method. To use the appearance of objects method with accuracy, the Marine must be familiar with the characteristic details of objects as they appear at various ranges.

Refer to slide sSLR.29-1.

1) Rifle Front Sight Post Method. The area of the target that is covered by the front sight post of the rifle can be used to estimate range to the target. By comparing the appearance of the rifle front sight post on a target at known distances, the Marine can establish a mental reference point for determining range at unknown distances. Because the apparent size of the target changes as the distance to the target changes, the amount of the target that is covered by the front sight post will vary depending upon its range. In addition, the Marine's eye relief and perception of the front sight post will also affect the amount of the target that is visible. To utilize this method, use the following general guidelines:

a) The M16A2 service rifle front sight post will cover the width of a man's chest or body at approximately 300 meters. If the target is less than the width of the front sight post, you should assume the target is in excess of 300 meters. Therefore, your BZO cannot be used effectively.

b) If the target is wider than the front sight post, you can assume that the target is less than 300 meters and can be engaged point of aim/point of impact using your BZO.

2) Visible Detail Method. When observing a target, the amount of detail seen at various ranges gives the Marine a good indication of the target's distance. He should study the appearance of a man when he is standing at a range of 100 meters. He fixes the man's appearance firmly in his mind, carefully noting details of size and the characteristics of uniform and equipment. Next, he should study the same man in a kneeling position and then in a prone position. By comparing the appearance of these positions at known ranges from 100 meters to 500 meters, the Marine can establish a series of mental images that will help determine range on unfamiliar terrain. He should also study the appearance of other familiar objects such as weapons and vehicles. The following general guidelines apply:

a) At 100 yards/meters, the target can be clearly observed in detail, and facial features can be distinguished.

b) At 200 yards/meters, the target can be clearly observed, although there is a loss of facial detail. The color of the skin and equipment is still identifiable.

c) At 300 yards/meters, the target has a clear body outline, face color usually remains accurate, but remaining details are blurred.

d) At 400 yards/meters, the body outline is clear, but remaining detail is blurred.

e) At 500 yards/meters, the body shape begins to taper at the ends. The head becomes indistinct from the shoulders.

f) At 600 yards/meters, the body appears wedge-shaped with the appearance of no head.

c. Bracketing. This method of range estimation involves estimating the shortest possible distance and the greatest possible distance to the target. For example, the Marine might estimate that a particular target is as close as 300 meters away but could be as far as 500 meters away from his position. The estimated distances are then averaged to determine the estimated range to the target. In this example, the average of 300 meters and 500 meters is 400 meters.

d. Halving. The halving method of range estimation can be used to judge ranges out to 800 meters. Estimate the distance to the halfway point between your position and the target. Double that distance to get the total distance to the target. This method operates on the premise that it is easier to estimate 400 meters than 800 meters. The Marine must be careful when judging the distance to the halfway point. Any error made in judging the halfway distance will be doubled when estimating the total distance.

e. Combination of Methods. Most of the methods previously discussed require optimal conditions with regard to the target, terrain, and visibility. Therefore, it is likely that a more accurate estimate of range can be obtained by utilizing a combination of methods to support your estimate. For instance, two Marines could estimate range using different methods and compare their findings. The average of the two responses should be close to the range to the target.

Confirm by questions.

TRANSITION: With most methods of range estimation, there are specific factors that will affect the accuracy of estimation. The Marine must be aware of these factors when estimating range and attempt to compensate for these effects.

2. (4 MIN) FACTORS AFFECTING RANGE ESTIMATION

a. Nature of Target

1) An object with a regular outline such as a steel helmet, rifle, or vehicle on a clear day will appear to be closer than one with an irregular outline such as a camouflaged object.

2) A target that contrasts with its background will appear to be closer than one that blends in with its background.

3) A partially exposed object will appear to be farther away than it actually is.

4) A target will appear farther away if the target is smaller than the objects surrounding it.

b. Nature of Terrain

1) Upward sloping terrain gives the illusion of

shorter distance.

2) Downward sloping terrain gives the illusion of greater distance.

3) Terrain with dead space will tend to make the target appear to be closer.

4) Smooth terrain such as sand, water, or snow will give the illusion of greater distance.

c. Light Conditions

1) The more clearly a target can be seen, the closer it appears to be. Smoke, fog, rain, or anything else that obscures vision will give the illusion of greater distance.

2) The position of the sun will also affect estimation by eye. When the sun is behind the viewer, it lights the target better so the target will appear to be closer. When the sun is directly beyond the target, the glare will give the illusion of greater distance.

d. Position. Targets appear farther away if the observer is in a prone position.

Confirm by questions.

TRANSITION: Once the range to the target has been determined, the Marine must decide if the target can be engaged. Accurate range estimation will allow a Marine to determine if the target can be effectively engaged using his BZO or if a new sight setting should be placed on the rifle.

3. (1 MIN) POINT TARGETS AND HASTY SIGHT SETTING

a. Point Targets. Point targets are targets out to a range of 550 meters, the maximum effective range of the M16A2 service rifle. Targets the size of a man can be engaged with accuracy out to 550 meters with the service rifle.

b. Hasty Sight Setting. While a BZO is considered to be a true zero for 300 yards/meters, the Marine must be capable of engaging targets beyond this distance.

1) A hasty sight setting is a rear sight elevation setting that is temporarily applied to engage a target that is inside or outside of the BZO capability of the rifle. A setting of 8/3-2 at 200 yards (e.g., for precision shooting such as a head shot) is also considered a hasty sight setting.

2) The M16A2 service rifle sighting system design allows sight settings for distances out to 800 meters in 100 yard/meter increments. This is accomplished by dialing in the appropriate range numeral on the rear sight elevation knob that corresponds to the range to the target.

3) For example, if the rear sight elevation knob is set at 8/3 and a target appears at 500 meters, rotate the knob to the 5 setting to engage it. This is referred to as applying a hasty sight setting.

NOTE

Upon completion of firing with a hasty sight setting for extended ranges, return the sight to the BZO setting.

Confirm by questions.

TRANSITION: When a target is beyond the BZO capability of the rifle and there is no time to adjust the sights, an offset aiming technique is used to engage the target.

4. (5 MIN) POINT OF AIM TECHNIQUE FOR ENGAGING TARGETS AT UNKNOWN DISTANCES

When the distance to a target is beyond the BZO capability of the rifle and there is no time to adjust the sights, offset aiming techniques can be used. In the point of aim technique, predetermined points of aim sector the target horizontally. The tip of the front sight post held at shoulder level is considered one point of aim; the tip of the front sight post held at the top of the target’s head is considered two points of aim. To use the point of aim technique to engage a target beyond the rifle's BZO, the following guidelines apply:

a. When range to the target is estimated to be beyond 300 yards/meters out to 400 meters, hold one point of aim.

b. When the range to the target is estimated to be beyond

400 yards/meters out to 500 meters, hold two points of aim.

NOTE

It is difficult to hold two points of aim at this range; therefore, applying a hasty sight setting may be more effective. When time permits, a hasty sight setting should always be applied at ranges beyond 300 yards/meters.

Confirm by questions.

TRANSITION: To accurately estimate range takes practice. Precision enhances accuracy and, ultimately, survival on the battlefield. We will now move to the outdoor training area to practice estimating range.

5. (1 HR) PRACTICAL APPLICATION FOR RANGE ESTIMATION

INSTRUCTOR'S NOTE: *Range estimation can be ideally practiced on a football field (or similarly marked area) prior to moving to a field environment. This allows Marines to learn to reference distances in 100-yard increments.*

a. Exercise Setup

1) Set up the training site by placing several targets at various ranges out to 500 meters. Ensure targets are placed at accurate measurements so accurate student feedback can be provided.

2) Targets must be man-sized so that the instructional points of the lesson can be emphasized.

3) Camouflage or partially camouflage targets and equipment to provide realism. Place weapons with the targets to reinforce familiarity with what weapons and equipment look like at various distances.

4) Ensure Marines have their rifles so they can employ the rifle front sight post method of range estimation.

INSTRUCTOR'S NOTE: *Give Marines approximately 1 hour to estimate the range to various targets. The*

following points should be emphasized.

b. Range Estimating Methods

1) Unit of measure.

2) Appearance of objects.

a) Rifle front sight post method.

b) Visual detail method.

3) Bracketing.

4) Halving.

5) Combination of methods.

c. Factors Affecting Range Estimation

1) Nature of target.

2) Nature of terrain.

3) Light conditions.

4) Position.

Confirm by questions.

TRANSITION: This concludes the instruction for estimating range. Are there any questions?

OPPORTUNITY FOR QUESTIONS: (1 MIN)

1. Respond to questions from the class.

2. Prompt Marines with questions to the class.

a. QUESTION: When estimating the range to a target in 100- meter increments, the observer is using what type of range estimation technique?

ANSWER: Unit of measure.

b. QUESTION: The front sight post of the M16A2 service rifle will cover the chest of a man at approximately what distance?

ANSWER: 300 yards/meters.

c. QUESTION: Will bright light on a target make the target appear closer or farther away from the observer?

ANSWER: Closer.

d. QUESTION: Will terrain sloping upward from the observer give the illusion of greater or shorter distance?

ANSWER: Shorter.

e. QUESTION: What is a hasty sight setting?

ANSWER: A hasty sight setting is a rear sight elevation setting that is temporarily applied to engage a target that is inside or outside of the BZO capability of the rifle.

> ***INSTRUCTOR'S NOTE:*** *Ask Marines as many questions as necessary to ensure they fully understand the material presented in this lesson.*

SUMMARY: (1 MIN)

Your ability to estimate range is essential to engaging targets at unknown distances. Range estimation must be as accurate as possible to ensure the Marine engages the target with well-aimed fire. Continued practice using the techniques of range estimation can improve your range estimation skills and enhance your field firing and combat effectiveness.

SLIDES

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