U.S. ARMY SERGEANTS MAJOR ACADEMY

Primary Leadership Development Course (PLDC)

TRAINING SUPPORT PACKAGE

AC AND RC RESIDENT

"NO ONE IS MORE PROFESSIONAL THAN I"

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U.S. ARMY SERGEANTS MAJOR ACADEMY (PLDC)

W226 21 Jul 04

Land Navigation

CHANGE SHEET 1

1. Synopsis. This change sheet corrects errors in the 600 PLDC, and 600-PLDC Modified Course W226 Land Navigation Training Support Package (TSP). The change allows the commandant the discretion to allow soldiers to test out during PE-2 of TSP W226.

2. Pen and ink changes: None

3. Page changes: Replace the following pages in the TSP with the attached pages:

TSP Page	Attached Page
a. Page 9	Page 9
b. PE-2-1 through PE-2-3	PE-2-1 through PE-2-3

4. Additional changes that need explaining: none.

5. File this sheet in front of the TSP for reference purposes.

6. Approval of change sheet.

Name/Signature	Rank	Title	Date Signed
//ORIGINAL SIGNED// Frank W. Berta	GS-9	Training Specialist	7/28/2004
//ORIGINAL SIGNED// Victor A. LeGloahec	SGM	Chief, NCOES	7/28/2004
//ORIGINAL SIGNED// Marion Lemon	SGM	Chief, Curriculum, Design, and Development Division	7/28/2004

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TRAINING SUPPORT PACKAGE (TSP)

TSP Number / Title	W226 / Land Navigation
Effective Date	01 Oct 2003
Supersedes TSP(s) / Lesson(s)	M208, Land Navigation, Dec 99M208-RC, Land Navigation, Jun 01
TSP Users	600-PLDC Primary Leadership Development Course 600-PLDC (MOD), Primary Leadership Development Course (Modified)
Proponent	The proponent for this document is the Sergeants Major Academy.
Improvement Comments	Users are invited to send comments and suggested improvements on DA Form 2028, *Recommended Changes to Publications and Blank Forms.* Completed forms, or equivalent response, will be mailed or attached to electronic e-mail and transmitted to: COMDT USASMA ATTN ATSS D BLDG 11291 BIGGS FIELD FT BLISS, TX 79918-8002 Telephone (Comm): (915) 568-8875 Telephone (DSN): 978-8875 e-mail: atss-dcd@bliss.army.mil
Security Clearance / Access	Unclassified
Foreign Disclosure Restrictions	FD5. This product/publication has been reviewed by the product developers in coordination with the (installation/activity name) foreign disclosure authority. This product is releasable to students from all requesting foreign countries without restrictions.

PREFACE

Purpose

This Training Support Package provides the instructor with a standardized lesson plan for presenting instruction for:

Task Number	Task Title
Individual	
071-326-0515	Select a movement route using a map
071-329-1006	Navigate from one point on the ground to another point while dismounted.

This TSP Contains

TABLE OF CONTENTS

PAGE

Preface 2
Lesson Section I Administrative Data 4
Section II Introduction……8
Terminal Learning Objective - Implement the techniques of Map Reading and Land Navigation during daylight hours and the hours of darkeness…….....8
Section III Presentation……10
Enabling Learning Objective A - Develop ground navigation techniques…….....10
Enabling Learning Objective B - Navigate from one point to another while dismounted during daylight hours and the hours of darkness……22
Section V Student Evaluation…….. 24

Appendix A Viewgraph Masters A - ..... ….A-1

Appendix B Test(s) and Test Solution(s) (N/A) B - B-1

Appendix C Practical Exercises and Solutions C - C-1

Appendix D Student Handouts D -..... D-1

Land Navigation
W226 / Version 1
01 Oct 2003

SECTION I. ADMINISTRATIVE DATA

All Courses Including This Lesson

Course Number	Version	Course Title
600-PLDC	1	Primary Leadership Development Course
600-PLDC MOD	1	Primary Leadership Development Course (Modified)

Task(s) Taught(*) or Supported

Task Number	Task Title
	INDIVIDUAL
071-326-0515 (*)	Select a movement route using a map
071-329-1006 (*)	Navigate from one point on the ground to another point while dismounted.

Reinforced Task(s)

Task Number	Task Title

Academic Hours

The academic hours required to teach this lesson are as follows:

	Resident Hours/Methods
	1 hr 30 mins / Conference / Discussion
	10 hrs 20 mins / Practical Exercise (Performance)
Test	4 hrs
Test Review	0 hrs
Total Hours:	16 hrs

Test Lesson Number

	Hours	Lesson No.
Testing (to include test review)		N/A

Prerequisite Lesson(s)

Lesson Number	Lesson Title
W221	Map Reading
W223	Conduct Movement

Clearance Access

Security Level: Unclassified
Requirements: There are no clearance or access requirements for the lesson.

Foreign Disclosure Restrictions

FD5. This product/publication has been reviewed by the product developers in coordination with the USASMA foreign disclosure authority. This product is releasable to students from all requesting foreign countries without restrictions.

References

Number	Title	Date	Additional Information
FM 3-25.26	MAP READING AND LAND NAVIGATION	20 Jul 2001	
STP 21-1-SMCT	SOLDIER'S MANUAL OF COMMON TASKS SKILL LEVEL 1	01 Jun 2003	
STP 21-24-SMCT	SOLDIER'S MANUAL OF COMMON TASKS (SMCT) SKILL LEVELS 2-4	01 Apr 2003	

Student Study Assignments

Before class--Read Student Handout 1 for reading and study assignments.

During class--Participate in classroom discussion and practical exercises.

After Class--Turn in recoverable references after the examination for this lesson.

Instructor Requirements

1:8, SSG, PLDC graduate, ITC, and SGITC qualified

Additional Support Personnel Requirements

Name	Stu Ratio	Qty	Man Hours
None			

Equipment Required for Instruction

Id Name	Stu Ratio	Instr Ratio	Spt	Qty	Exp
1240-930-3833 BINOCULARS		1:16	No	0	No
5820-01-151-9915 RADIO SET		1:16	No	0	No
6230-00-264-8261 FLASHLIGHT	1:1	---	No	0	Yes
6730-00-577-4813 SCREEN, PROJECTION	1:16		No	0	No
6730-00-P53-8147 Projector, Overhead	1:16		No	0	No
7110-00-132-6651 CHALKBOARD	1:16	---	No	0	Yes
7510-00-161-6215 RULER, NONMETALLIC	1:1	---	No	0	Yes
7510-01-233-7686 PAGE (DOCUMENT) PROTECTOR	1:1		No	0	No
7520-01-424-4867 EASEL, DISPLAY AND TRAINING	1:16	---	No	0	Yes
7530-00-619-8880 PAD, WRITING PAPER	1:16	---	No	0	Yes
8415-01-110-9981 BAND, HELMET, CAMOUFLAGE	1:1	---	No	0	Yes
8415-01-303-8945 COVER, HELMET, CAMOUFLAGE PATTERN	1:1		No	0	No
8465-00-001-6471 SUSPENDERS, INDIVIDUAL EQUIPMENT	1:1		No	0	No
8465-00-001-6482 CASE, SMALL ARMS AMMUNITION	2:1		No	0	No

8465-00-165-6838 CUP, WATER CANTEEN	2:1		No	0	No
8465-00-860-0256 COVER, WATER CANTEEN	2:1		No	0	No
8465-00-935-6814 CASE, FIELD FIRST AID DRESSING-UN	1:1		No	0	No
8465-01-115-0026 CANTEEN, WATER	2:1		No	0	No
8465-01-120-0675 BELT INDIVIDUAL EQUIPMENT: WEBBING	1:1		No	0	No
8470-01-092-7435 CHIN STRAP	1:1		No	0	No
8470-01-092-7528 HELMET, GROUND TROOPS'-PARACHUTIS	1:1		No	0	No
8470-01-442-1429 HEADBAND, GROUND TROOPS'-PARACHUT	1:1	---	No	0	Yes
E63317 COMPASS LENSATIC	1:1		No	0	No

* Before Id indicates a TADSS

Materials Required

Instructor Materials:

- TSP
- Lensatic compass

Student Materials:

- SH-1, Advance Sheet in Appendix D.
- FM 3-25.26 Map Reading and Land Navigation or SH-2 in Appendix D.
- 1:50,000 map sheet of the local training area.
- Pencil and writing paper.

NOTE: Issued to students during inprocessing.

Classroom, Training Area, and Range Requirements

CLASSROOM (40X40 PER 16 STUDENTS)
FIELD TRAINING SITE 1 KM X 1 KM

Ammunition Requirements

Id	Name	Exp	Stu Ratio	Instr Ratio	Spt Qty
None					

Instructional Guidance

NOTE: Before presenting this lesson, instructors must thoroughly prepare by studying this lesson and identified reference material.

Before Class--

- Read and study all TSP material and be ready to conduct the class.
- This TSP has questions throughout to check learning or generate discussion among the group members. You may add any questions you deem necessary to bring a point across to the group or expand on any matter discussed.
- You must know the information in this TSP well enough to teach from it, not read from it.
- This TSP presents references at the beginning of some of the paragraphs. This allows you to inform your students of where they should look in the reference to follow your instruction.

During class--

· Conduct the class in accordance with this TSP.

After Class--

· Collect all recoverable materials after the examination for this lesson.

	Name	Rank	Position	Date
Proponent Lesson Plan Approvals	/s/ Joralmon, Grace /T/ Joralmon, Grace	Civilian	Training Developer	01 Oct 2003
	/s/ Barnes, Ronnie G. /T/ Barnes, Ronnie G.	MSG	Course Chief	01 Oct 2003
	/s/ Barnes, Ronnie G. /T/ Lawson, Brian H.	SGM	Chief, NCOES	01 Oct 2003
	/s/ Mays, Albert J. /T/ Mays, Albert J.	SGM	Chief, CDDD	01 Oct 2003

SECTION II. INTRODUCTION

Method of Instruction: Conference / Discussion
Technique of Delivery: Small Group Instruction (SGI)
Instructor to Student Ratio is: 1:8
Time of Instruction: 5 mins
Media: None.

Motivator

Land navigation is the ability to get from one place to another. It's an essential skill for all soldiers. Today's battles require rapid maneuver of forces on the battlefield. Success depends on how well you perform land navigation. A leader must provide soldiers with the training and practice necessary to develop and maintain high levels of proficiency in land navigation. This lesson--coupled with the map reading lesson you've just completed—provides you with the skills to conduct land navigation.

Terminal Learning Objective

NOTE: Inform the students of the following Terminal Learning Objective requirements.

At the completion of this lesson, you [the student] will:

Action:	Implement the techniques of map reading and land navigation during daylight hours and the hours of darkness.
Conditions:	In a classroom environment and a field environment of an unfamiliar terrain during hours of daylight and hours of darkness, given a lensatic compass, map of local area, GTA 5-2-12 (Coordinate Scale and Protractor), pencil, paper, pistol belt, two canteens of water, flashlight with red lens, eight-digit coordinates, and equipment required by the NCOA SOP.
Standards:	Implemented the techniques of map reading and land navigation IAW FM 3-25.26 and STP 21-2 SMCT by: • Led soldiers during hours of daylight and hours of darkness in unfamiliar terrain, during an STX, using a map, applying map reading and navigational skills, and finding known and unknown locations. • Found three of four points on the land navigation performance examination.

Safety Requirements

None

Risk Assessment Level	Low – Determined by the instructor.
Environmental Considerations	**NOTE:** It is the responsibility of all soldiers and DA civilians to protect the environment from damage. According to local environmental SOP.
Evaluation	• At the end of the land navigation block of instruction, you will participate in a performance test to evaluate your ability to navigate from one point to another using a map and a compass. You will have three hours to complete the test. You must locate a minimum of three of the four points to achieve a GO. • Your SGL will also evaluate your land navigation skills as part of your field leadership evaluation. • Should you fail to meet the standard, you will receive a retest. Should you fail the retest, your NCOA may eliminate you from PLDC. **NOTES:** • Inform the students where their test will take place as posted on the training schedule and when they will receive feedback on the test. Include any retest information. • Inform the students that they must turn in all recoverable reference material after the test. **SPECIAL NOTE FOR COMMANDANTS:** At your discretion, you may use the practice land navigation test (PE-2) as a means to allow students to test out providing they meet the following standards: • The practice course meets the same standards as the test course. • Students meet graduation standards of finding three of the four points.
Instructional Lead-In	You have already mastered the techniques of map reading in a classroom and hands on environment during W221, Map Reading. Now you will learn ground navigation techniques. You will combine your newly learned map reading skills with your ground navigation skills in a field environment.

SECTION III. PRESENTATION

NOTE: Inform the students of the Enabling Learning Objective requirements.

A. ENABLING LEARNING OBJECTIVE 1

ACTION:	Develop ground navigation techniques.
CONDITIONS:	In a classroom environment and a field environment of an unfamiliar terrain during daylight hours and hours of darkness, given a lensatic compass, map of local area, GTA 5-2-12 (Coordinate Scale and Protractor), 100 meter measured course, an obstacle to detour around, pencil, paper, pistol belt, two canteens of water, flashlight with red lens, eight-digit coordinates, and equipment required by the NCOA SOP.
STANDARDS:	Developed ground navigation techniques by: • Presetting compass and following an azimuth. • Moving by dead reckoning. • Determining a pace count. • Detouring around an obstacle. IAW FM 3-25.26 and STP 21-1 SMCT.

1. Learning Step / Activity 1. Presetting a Compass

Method of Instruction: Conference / Discussion
Technique of Delivery: Small Group Instruction (SGI)
Instructor to Student Ratio: 1:8
Time of Instruction: 25 mins
Media: VGT-1 thru VGT-3

Presetting a Compass

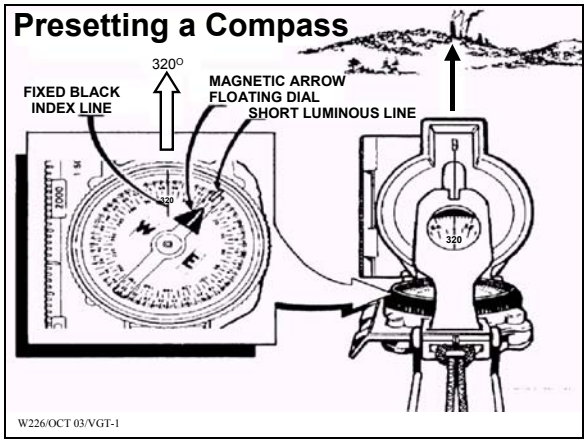
Ref: FM 3-25.26, para 9-4c, or SH-2, page SH-2-7 thru SH-2-9)

The fastest way to follow an azimuth with your compass is to preset it on the azimuth you want to travel. You will learn how to set your compass during daylight hours and hours of darkness.

NOTE: Ensure that all students have a compass. All instruction may take place outside the classroom since the end of the LS/A requires the soldiers to perform presetting of their compasses. They must be free of the building to ensure accuracy. If outdoors, use the hard copy of the visual aids in SH-3.

Although different models of the lensatic compass vary somewhat in the details of their use, the principles are the same.

SHOW VGT-1, PRESETTING A COMPASS



Daylight Hours or a Light Source

During daylight hours or when you have a light source:

- Hold the compass level in the palm of the hand.
- Rotate the compass until the desired azimuth falls under the fixed black index line, for example as shown on VGT-1, 320^{O} or SH-3, page SH-3-2.
- Maintaining the azimuth, turn the bezel ring until the luminous line aligns with the north-seeking arrow, VGT-1 or SH-3, page SH-3-2.
- Once aligned, the compass is preset.

To follow an azimuth:

- Assume the centerhold method.
- Turn your body until the north-seeking magnetic arrow floating dial aligns with the short luminous line.
- Proceed forward in the direction of the front cover's sighting wire, which aligns the fixed black index line that contains your desired azimuth, as in the example shown on VGT-1, 320 degrees, or SH-3, page SH-3-2.

REMOVE VGT-1

Limited Visibility, Click Method

During limited visibility, you can preset your compass by the click method. Remember that the bezel ring contains 3^{O} intervals (clicks):

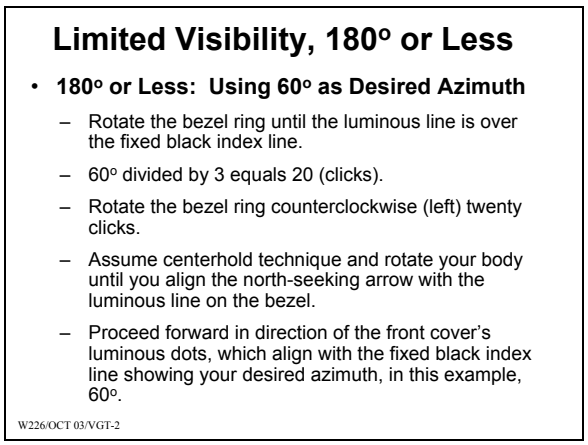
- Rotate the bezel ring until the luminous line is over the fixed black index line.
- Find the desired azimuth and divide it by three. We will use 60 degrees as an example--60 divided by 3 equals 20 (clicks)

- The result is the number of clicks that you have to rotate the bezel ring.
- You will turn the bezel ring to the right (clockwise) or to the left (counterclockwise) depending on whether your desired azimuth is less than or more than 180^{O}.

To ensure you understand the click method process, we will set our compasses using azimuths less than and more than 180^{O}.

VGT 2, or SH-3, page SH-3-3 describes how you can preset your compass when the desired azimuth is 180^{O} or less. The VGT uses 60^{O} as the desired azimuth.

SHOW VGT-2, LIMITED VISIBILITY, 180^{O} or Less

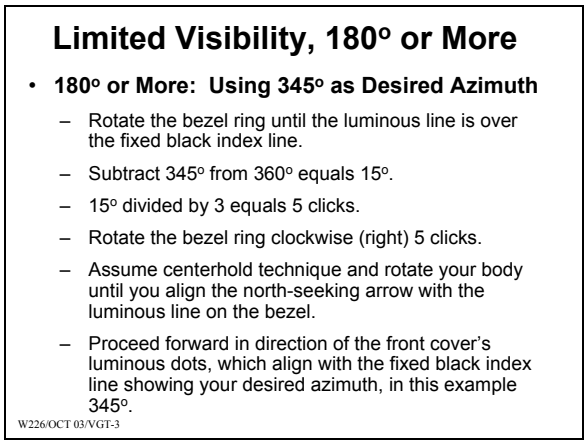


REMOVE VGT-2

Now let's preset our compasses using a desired azimuth that is 180^{O} or larger. In this example, we will use 345^{O} as the desired azimuth.

VGT-3 or SH-3, page SH-3-4, describes how you will preset your compass when the desired azimuth is 180^{O} or more.

SHOW VGT-3, LIMITED VISIBILITY, 180^{O} OR MORE



When you plan on using the compass in the dark, if possible, set an initial azimuth while light is still available, if not, then use artificial lighting observing light discipline. With the initial azimuth as a base, you can set any azimuth from that base azimuth--that is a multiple of three--using the clicking feature of your lensatic compass.

Keep in mind that your desired azimuth is not always exactly divisible by three, causing an option of rounding up or rounding down. If you round up, it causes an increase in the value of the azimuth, and the object you are seeking will be to the left. If you round the azimuth down, it causes a decrease in the value of the azimuth, and the object you seek will be to the right.

REMOVE VGT-3

Presetting a Compass, Hands-on Training

NOTE:
- If the class is not already outdoors, move the class outside so the building will not interfere with their compasses. They will perform some hands-on training with their compasses.
- Give the class an azimuth and direct the students to preset their compasses using the daylight method. Check to see if the students correctly performed the technique.
- Give the class two azimuths, one 180° or less, and the other 180° or more and have them preset their compasses using the limited visibility click method. Check to ensure the students preset their compasses correctly.

Answer any questions the students may have following the hands on performance.

2. Learning Step / Activity 2. Dead Reckoning

Method of Instruction: Conference / Discussion
Technique of Delivery: Small Group Instruction (SGI)
Instructor to Student Ratio: 1:8
Time of Instruction: 10 mins
Media: None

Dead Reckoning Ref: FM 3-25.26, para 11-6a, or SH-2, pages SH-2-11 thru SH-2-14

Dead reckoning is the simplest navigation method from one point to another. It consists of two fundamental steps.

Step One: Use a protractor and graphic scales to determine the direction and distance from one point to another on a map.

Step Two: Use a compass and some means of measuring distance, e.g., pace count, to apply the information you obtained from the map in step one to a point on the ground. In other words, dead reckoning begins with the determination of a polar coordinate on a map and ends with the act of finding it on the ground.

There are two advantages of dead reckoning:

- It's easy to teach and learn.
- It can be a highly accurate way of moving from one point to another if done carefully over short distances, even where few external cues, e.g., landmarks, are present to guide movement.

Never try to walk with your compass open and in front of you to try to stay on course, because the compass will not stay steady or level and; therefore, you will not get an accurate reading.

Dead reckoning is basically sighting your compass on a landmark located on the azimuth that you plan to travel. Upon reaching the landmark, you sight your compass again on another landmark and travel to that point. You continue that process until you reach your objective.

Never select landmarks from the map. You select them from the very start and as the march progresses. When you select landmarks to guide on, the landmarks

become "steering marks," and their selection is crucial to the success of dead reckoning.

QUESTION: What are some examples of steering marks?

ANSWER: Uniquely shaped trees, rocks, hilltops, posts, towers, and buildings--anything that you could easily identify.

Ref: FM 3-25.26, para 11-6a(5), or SH-2, page SH-2-12

QUESTION: If you cannot find a steering mark to your front, what can you do to guide you until you can find a steering mark?

ANSWER: Use a back azimuth to a feature behind you. You may consider sending a member of the squad forward. His position should be as far out as possible to reduce the number of chances for error as you move. Use arm-and-hand signals or a radio to place him on the correct azimuth. (You must know the enemy situation before sending a soldier out.)

Ref: FM 3-25.26, para 11-6a(5), or SH-2, page SH-2-12

Your best steering marks are those with color, shade of color, size, or shape that you can recognize as you approach. Also, it is extremely important that your steering mark is always visible as you travel towards it, the higher the steering mark, the better.

Select a steering point that is the furthest away if you have the option; however, it must be visible at all times.

QUESTION: What is the advantage of selecting a steering mark that is the furthest away?

ANSWER: It allows you to travel further with fewer references to the compass.

Ref: FM 3-25.26, para 11-6a(5)(b), or SH-2, page SH-2-13

You use dead reckoning without natural steering marks when the area through which you are traveling has no features or visibility is poor. At night you may send a member of the team out in front of your position to create your own steering mark in order to proceed. His position should be as far out as possible to reduce the number of chances for error as you move. Use arm-and-hand signals or a radio to place him on the correct azimuth.

Once he is in place, move forward to his position and repeat the process until you can identify some steering marks or you reach your objective.

There are some disadvantages to dead reckoning. The farther you travel without confirming your position in relation to the terrain and other features, the more errors you will accumulate during your movement.

QUESTION: How can you confirm and correct your estimated position?

ANSWER: By identifying a known feature that you come upon with your map, or by performing resection triangulation using two or more known points to pinpoint your position. Pace counts or any type of distance measurement should begin anew each time you confirm your position on the map.

Ref: FM 3-25.26, para 11-6a(11), or SH-2, page SH-2-14

While you may select a mountaintop far off in the distance to navigate towards, always remember to check your position by periodically performing resection or terrain association techniques to pinpoint your location on the map. A situation may arise--such as enemy contact--and you may need support immediately and you won't have time to pinpoint your location.

The more you have to use your compass, the more likely you are of making errors. When dead reckoning in highly vegetated areas, or during darkness or in fog you will have to use your compass more; therefore, you must use your resection and terrain association skills more.

Finally, dead reckoning is time consuming and demands constant attention to the compass. Errors accumulate easily and quickly. Every fold in the ground and detours as small as a single tree or boulder also complicate the measure of distance.

CHECK ON LEARNING: Conduct a check on learning.

Question: What are two advantages of dead reckoning?

Answer: It's easy to teach and learn, and it is a highly accurate way of moving, if done carefully over short distances.

Ref: FM 3-25.26, para 11-6a(3), or SH-2, page SH-2-12

Question: What are the landmarks called that you select to travel to when using dead reckoning?

Answer: Steering marks.

Ref: FM 3-25.26, para 11-6a(5), or SH-2, page SH-2-12

Question: What is the best steering mark to choose and why?

Answer: The best steering mark is the most distant object. It enables you to travel farther with fewer references to the compass. It must be continuously visible as you move toward it.

Ref: FM 3-25.26, para 11-6a(5)(b), or SH-2, page SH-2-13

3. Learning Step / Activity 3. Measuring Distance

Method of Instruction: Conference / Discussion
Technique of Delivery: Small Group Instruction (SGI)
Instructor to Student Ratio: 1:16
Time of Instruction: 25 mins
Media: VGT-4

Measuring Distance

Ref: STP 21-1-SMCT, and FM 3-25.26, para 5-3a, or SH-2, page SH-2-3

Once you have plotted an objective, oriented the map to the ground, and selected your first steering mark, you can begin moving toward the objective. Following your azimuth enables you to travel in the proper direction. The question is how will you keep track of the distance?

One method of determining distance--the one you will use in this course while moving--is by pace counting. A pace is equal to one natural step, about 30 inches long. Measuring by pacing is simply counting the paces between two points on the ground and converting this to map distance. Each soldier must know how many paces it takes to walk 100 meters. To determine this, you must walk an accurately measured course and count the number of paces you take. A pace course can be as short as 100 meters, or as long as 600 meters. The pace course, regardless of length, must be on similar terrain as the terrain you plan to travel.

To find your pace count on a 600-meter course, count the paces it took you to walk the 600 meters, then divide the total by 6, e.g., 720 paces over 600 meters equals a 120 pace count average for 100 meters. If the pace course is 300 meters, divide the total by 3. If you use a 100 meter course, you should walk it enough times to establish an average. For example, if you walk the 100 meter course three times, and your pace count for the three times is: 123, 118, and 122, you can find the average by totaling the three (363), and dividing the total by 3. Your pace count would be 121 paces.

It is important that your pace course is similar to the terrain you will travel. Varying conditions of weather and terrain, as well as the soldier and his equipment, affect pace length.

QUESTION: What are some of these conditions and what affect will they have?

ANSWER:
- Slopes: The pace lengthens on down slopes and shortens on upgrades.
- Winds: Head winds shorten the pace and tail winds lengthen the pace.
- Surfaces: Sand, gravel, mud, snow, and similar surfaces tend to shorten the pace.
- Elements: Falling snow, rain, or ice shortens the pace.
- Clothing: Excess weight of clothing shortens the pace.
- Visibility: Poor visibility shortens the pace.

Ref: FM 3-25.26, para 5-3a(2), or SH-2, page SH-2-3

Begin your count as soon as you start your move toward your objective. Keep track of how far you have gone by either tying a knot in a string, placing a pebble in your pocket for every 100 meters of distance traveled, or markings in a notebook. Repeat this procedure until you reach your destination.

Let's look at the following sample problem. You have to travel 775 meters and your pace count is 120 paces. Using the pebble method you will need 7 pebbles. This will take you 700 meters. But what about the other 75 meters?

Let's determine how many paces it will take to go the remaining 75 meters:

NOTE: Write the formula on the board or butcher board if possible, or have student write the problem on a piece of paper if outdoors.

- Multiply 75 (distance remaining) x 120 (pace count) equals 9,000.
- Crosss out the last two digits, leaving 90.
- 90 is how many paces it will take you to go the last 75 meters.

Break: TIME: 00:50 to 01:00

TIME: 01:00 to 01:10 (continue Learning Step/Activity 3, ELO 1)

Detouring an Obstacle

Ref: FM 3-25.26, para 9-4d, page or SH-2, page SH-2-9, and para 11-6a(7), or SH-2, page SH-2-13

As discussed earlier, the simplest navigating method from one point to another is dead reckoning. You determined your polar coordinate, converted it to a magnetic

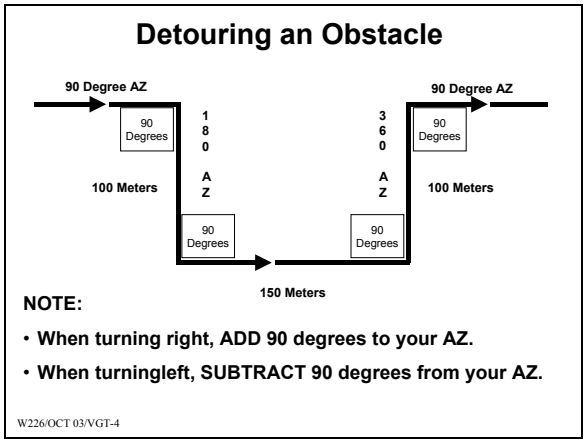
azimuth, calculated the distance, averaged your pace count, and you have sighted your first steering mark. Now you need to prepare yourself for the times when you will come upon an obstacle that you can't go over or through.

If you encounter an obstacle on the set course, then you must bypass the obstacle using the detour method. To do this, you complete a series of 90 degree turns until you bypass the obstacle and you are back on your original azimuth.

NOTE: Show VGT-4 or SH-3, page SH-3-5, or draw the following example on the chalkboard or easel and explain the detour procedure.

For this example, you determined that you should be able to clear the object by traveling 100 meters to the right, 150 meters to the left, and 100 meters to the left.

SHOW VGT-4, DETOURING AN OBSTACLE



Look at the VGT (Sketch or SH). You are moving on an azimuth of 90 degrees and wish to bypass/detour an obstacle or position. Follow these four steps: (The following steps describe your action when your first turn is to the right.)

Step 1: Turn right, add 90^{o} to your azimuth changing it to 180^{o}, and travel for 100 meters, ensuring you count your paces.

Step 2: Turn left, subtract 90^{o} from your 180^{o} azimuth, changing it to 90^{O}— your original course--and travel for 150 meters. Count your paces.

Step 3: Turn left, subtract 90^{o} from your 90^{o} azimuth, changing it to 0 or 360^{o}--the back azimuth from Step 1(180^{o})--and travel for 100 meters, ensuring your pace count is the same as your count in step one.

Step 4: Turn right, add 90^{O} to your 0 or 360^{O} azimuth changing your azimuth to 90^{O}--your original course. Don't forget to add your pace count from step two to your pace count when you arrived at the obstacle.

When detouring to the right, simply add 90 degrees to your original azimuth. If you detour to the left, then you subtract 90 degrees. Remember to make note of the number of paces taken between each azimuth.

Upon reaching the obstacle that you want to detour--if possible--find a steering mark that is beyond the obstacle, one you believe you will be able to see upon your arrival around the obstacle--the higher the steering mark, the better. If possible, you will be able to easily put yourself back on course. If you cannot find a steering mark beyond the obstacle, then your pace count is extremely important. Once you complete the detour, you should if possible, conduct resection to verify where you are on the map.

REMOVE VGT-4

NOTE: Conduct a check on learning and summarize the learning activity.

Question: Once you know your pace count for 100 meters, what methods can you use to keep count of how far you travel?

Answer:
- Tie a knot in a string or lacing, or
- Place a pebble in your pocket for every 100 meters of distance traveled, or
- Make marks in a notebook.

Ref: FM 3-25.26, para 5-3a(1), or SH-2, page SH-2-3

Question: When you detour around an object, and you are turning to the right, do you add or subtract 90 degrees to your traveling azimuth?

Answer: Add 90 degrees.

Ref: FM 3-25.26, para 11-6a(7), or SH-2, page SH-2-13

4. Learning Step / Activity 4. Night Navigation

Method of Instruction:	Conference / Discussion
Technique of Delivery:	Small Group Instruction (SGI)
Instructor to Student Ratio:	1:8
Time of Instruction:	5 mins
Media:	None

Darkness presents its own characteristics for land navigation because of limited or no visibility. However, the techniques and principles are the same as that used for day navigation. The success in nighttime land navigation depends on rehearsals during the planning phase before the movement, such as detailed analysis of the map to determine the type of terrain in which the navigation is going to take place and the predetermination of azimuths and distances. Night vision devices can greatly enhance night navigation.

The basic technique used for night land navigation is dead reckoning with several compasses recommended. The point man is in front of the navigator but just a few steps away for easy control of the azimuth. Smaller steps are taken during night navigation, so remember, the pace count is different. Establish your pace count on a 100-meter pace course at night.

In some areas, navigation using the stars is possible; however, you need a thorough knowledge of constellations and their locations in the sky.

You can find the four cardinal directions--north, south, east, west--at night by using the shadow-tip technique, except that you use the moon instead of the sun. However, the moon has to be bright enough to cast a shadow.

B. ENABLING LEARNING OBJECTIVE

ACTION:	Navigate from one point to another while dismounted during daylight hours and hours of darkness.
CONDITIONS:	In a classroom environment and a field environment of an unfamiliar terrain during daylight hours and hours of darkness, given a lensatic compass, map of local area, GTA 5-2-12 (Coordinate Scale and Protractor), pencil, paper, pistol belt, two canteens of water, flashlight with red lens, eight-digit coordinates, and equipment required by the NCOA SOP.
STANDARDS:	Navigated from one point to another while dismounted using a map during daylight hours and hours of darkness in unfamiliar terrain by: • Applying map reading skills. • Finding three of four points on the practice land navigation examination. IAW FM 3-25.26 and STP 21-1 SMCT

1. Learning Step / Activity 1. Practical Exercises 1, 2, and 3

Method of Instruction: Practical Exercise (Performance)
Technique of Delivery: Small Group Instruction (SGI)
Instructor to Student Ratio: 1:8
Time of Instruction: 10 hrs 20 mins
Media: None

NOTE: Conduct the three practical exercises in Appendix C over the next 10 hours and 20 minutes.

- Commandants may schedule the three PEs in any order with the exception of PE-2. Conduct PE-2 second or third.
- PE-2 is a practice performance test. Schedule 4 hours for the PE.
- Commandants will use the remaining 6 hours and 25 minutes to conduct PEs 1 and 3.
- Commandants may use any remaining time left over from PEs 1 and 3 to conduct any remedial training they deem necessary.

Course Set up:

- Follow the instructions in the PLDC Course Management Plan in setting up the course for PEs 1 and 2.
- For PE-3, follow the instructions in the PLDC Course Management Plan in setting up the course. The only exception will be the length of the legs. For the night course, legs should be no more than 300 meters and no less than 200 meters.

SECTION IV. SUMMARY

Method of Instruction: Conference / Discussion
Technique of Delivery: Small Group Instruction (SGI)
Instructor to Student Ratio is: 1:8
Time of Instruction: 10 mins
Media: None

Check on Learning

- Conduct an AAR.
- Answer any questions the students may have concerning land navigation.
- The PEs conducted during this lesson and the AARs conducted at the conclusion of them also acted as a check on learning.

Review / Summarize Lesson

In order to use a map and compass effectively in the field, you must develop your skills in land navigation techniques. You must practice these skills constantly utilizing the techniques provided to you in this lesson plan and the map reading lesson you received in this course. During this lesson we discussed and practiced how to:

- Preset a compass for day and night.
- Conduct dead reckoning.
- Determine distance while moving.
- Bypass obstacles using the detour method.

SECTION V. STUDENT EVALUATION

Testing Requirements

NOTE: Describe how the student must demonstrate accomplishment of the TLO. Refer student to the Student Evaluation Plan.

Land Navigation Performance Test

- Conduct the land navigation performance test found in Appendix B of this training support package.
- Conduct the performance test IAW the directions in Appendix B.
- Commandants may schedule the performance test where they deem appropriate. For example, prior to the STX (immediately following instruction of W223), during the STX, or following the STX.
- NCOAs will layout and properly mark all points as instructed by the PLDC Course Management Plan. Also, NCOAs will check all points prior to testing ensuring all are in place.
- Instruct all prerequisite lessons (W221, W223, and this TSP) prior to testing students.

Feedback Requirements

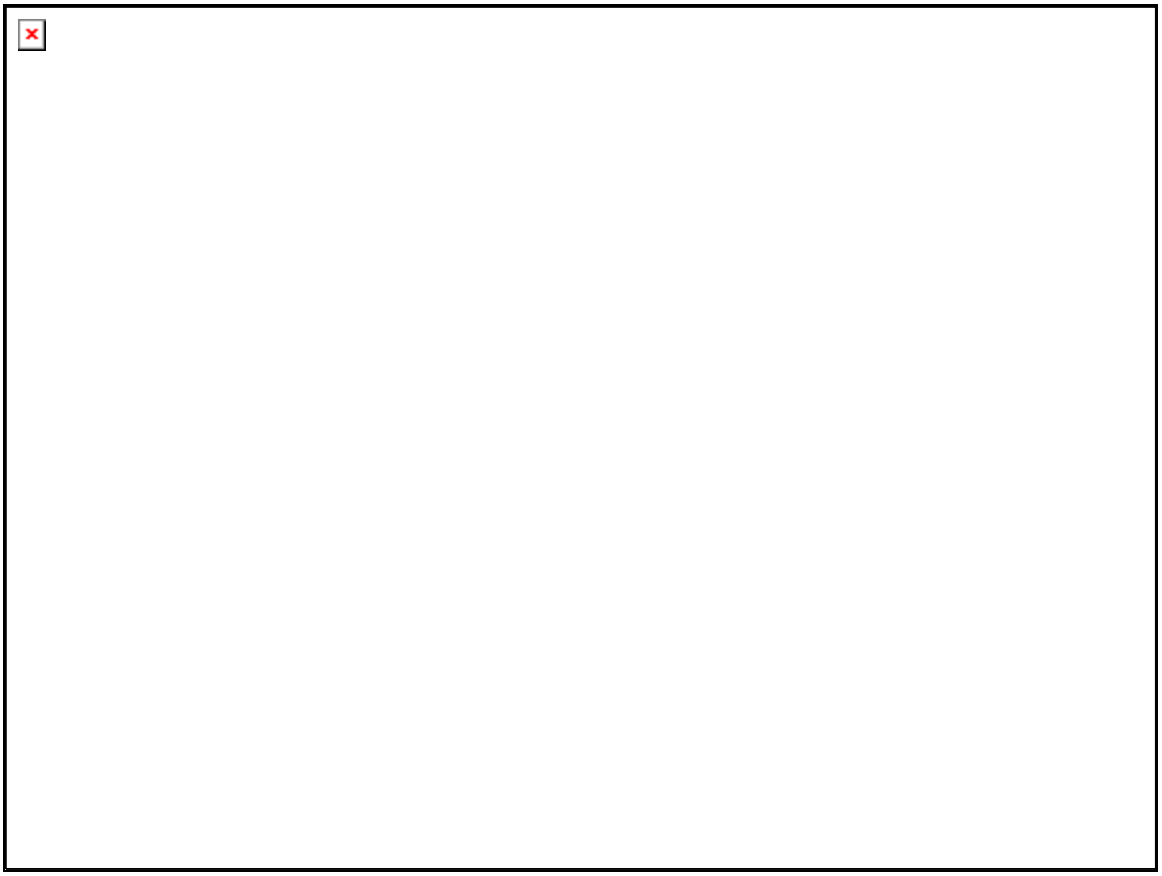
NOTE: Feedback is essential to effective learning. Schedule and provide feedback on the evaluation and any information to help answer students' questions about the test. Provide remedial training as needed.

None

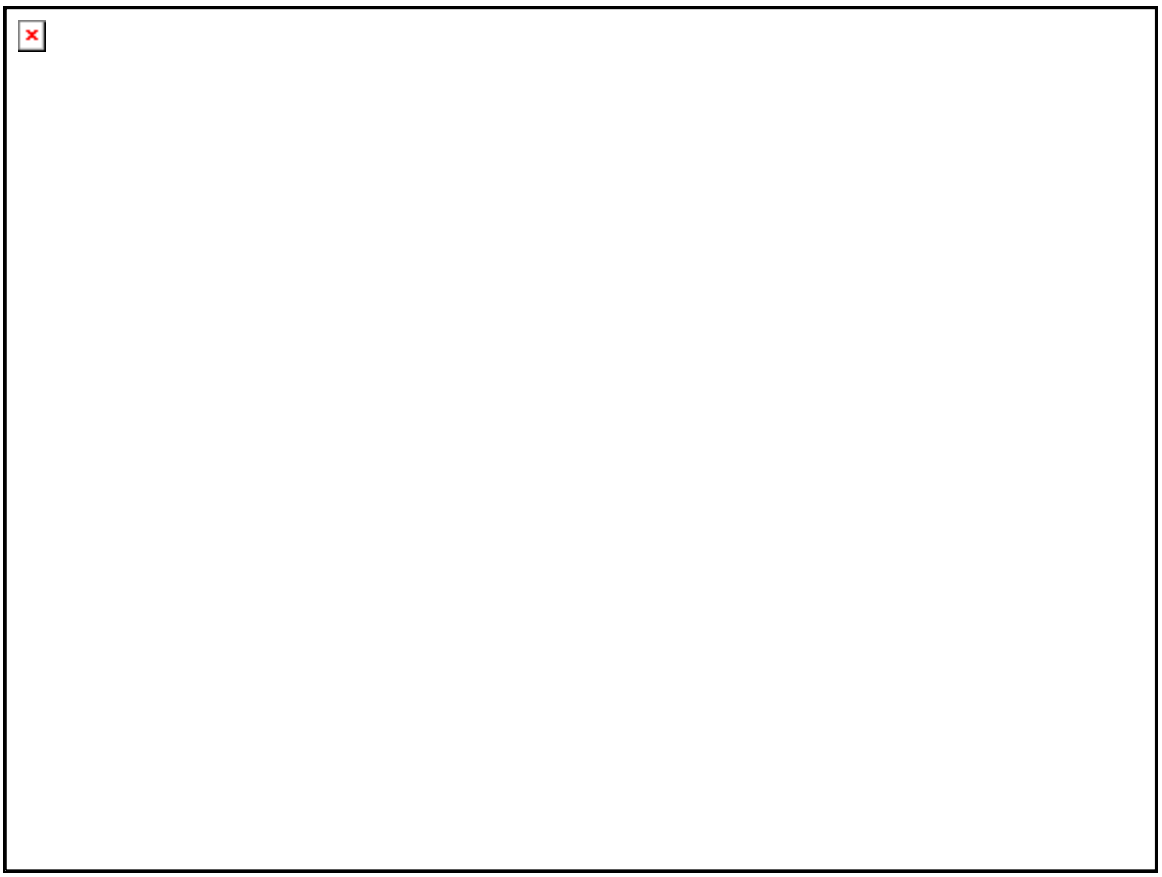
Enabling Learning Objective A

Learning Step 1

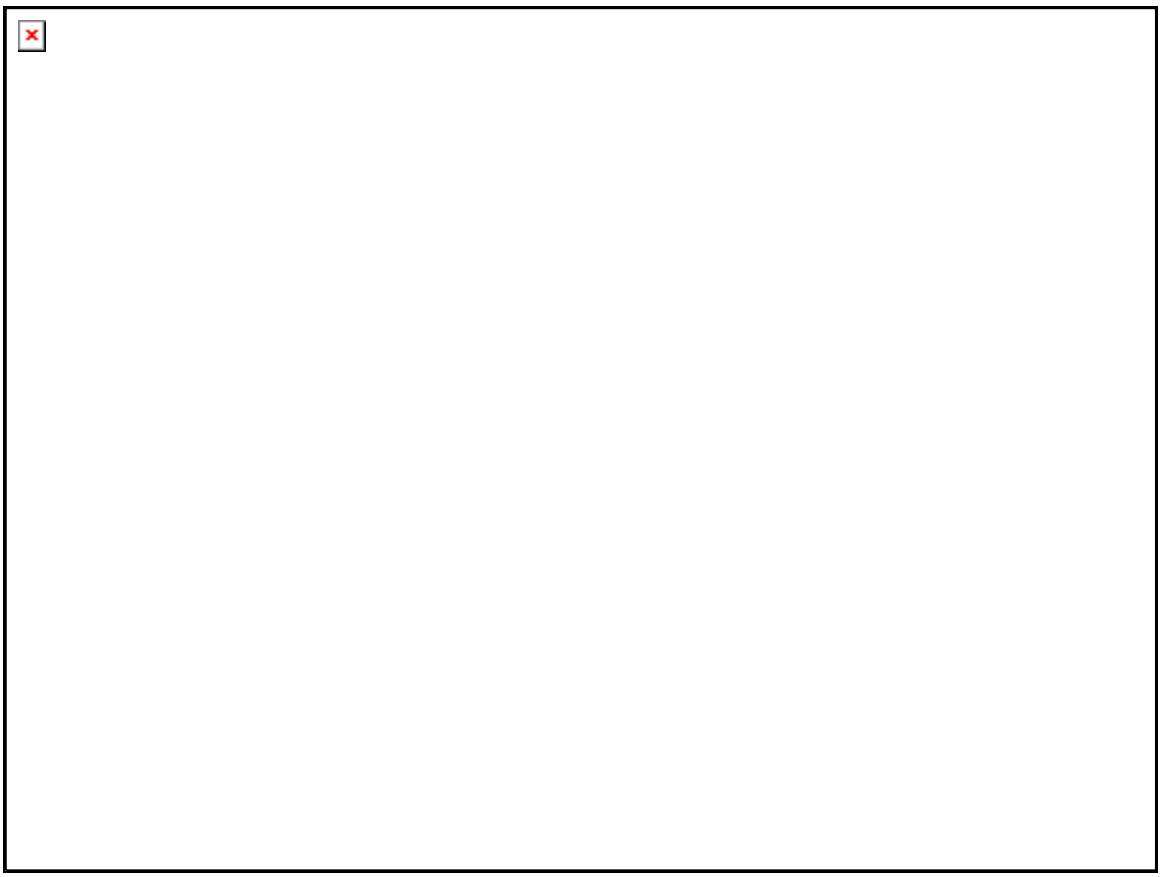
VGT-1, Presetting a Compass.



VGT-2, Limited Visibility, 180o or Less.

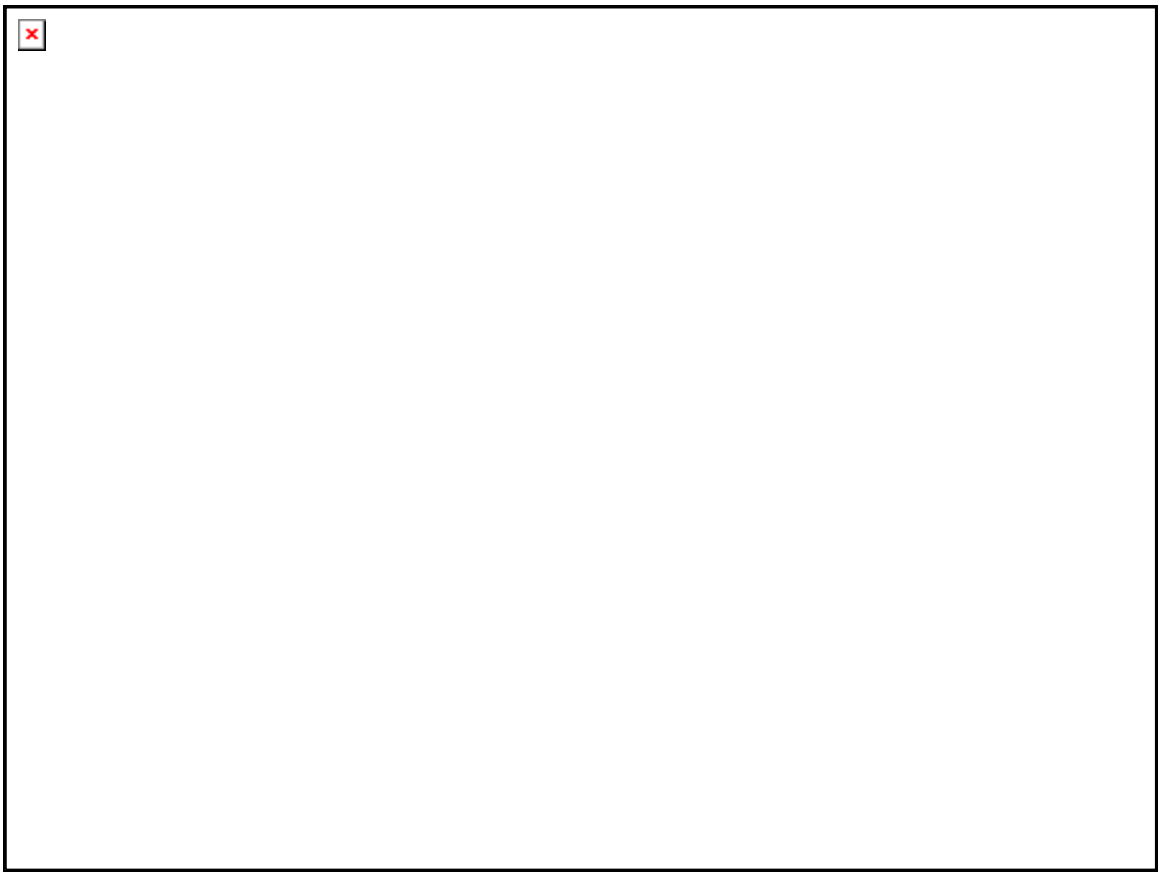


VGT-3, Limited Visibility, 180o or More.



Learning Step 3

VGT-4, Detouring an Obstacle.



Appendix B Test(s) and Test Solution(s)

This Appendix contains the items listed in this table—

Title/Synopsis	Pages
TE-1, Land Navigation Performance Test	TE-1-1 thru TE-1-5

NOTE: There is no performance test solution due to the fact that the academies will develop the solutions based on the locations at their training site.

Land Navigation Performance Test

Overview	This performance test measures the student's ability to navigate dismounted from one point on the ground to another point using a map and a compass during daylight. The compass course must have at least four points laid out as directed by the PLDC Course Management Plan.
Evaluation	**NOTE**: Commandants may schedule the performance test where they deem appropriate. For example, prior to the STX (immediately following instruction of W223), during the STX, or following the STX. The student must plot his four given points and must find three of the four points in the maximum time of three hours to receive the minimum passing score of 75 percent or a "GO." (Plotting the four given points is part of the three hour examination.) **NOTE:** NCOAs will allow an additional 15 minutes of time for soldiers to arrive at a central rally point for those NCOAs that do not utilize the fourth point as their rally point.
Administrative Time	Prior to beginning the test, SGLs must allot 30 minutes to brief risk assessment and safety. They will ensure students have all their required equipment. During this time students will verify their pace count and compass accuracy. Allot 20 minutes for accomplishing the following-- • Collect Performance Evaluation Test Sheets. • Grade student answers. • Account for all personnel. • Conduct AAR. **NOTE: Do Not** include these times in the three hours allotted for the students to complete the exam.
Safety Requirements	IAW local SOP and risk assessment level.. Ensure adequate medical personnel, communications equipment, and transportation are readily available.

Environmental Considerations	Inform students of any known environmental factors they must observe.
Risk Assessment Level	Low. However, conduct risk assessment IAW FM 100-14 for local area hazards and climatic conditions.
Break	There are no formally scheduled breaks during this evaluation. Schedule breaks as appropriate.
List of Personnel, Equipment, and Materials Required	Personnel— • Number of students to test: 8 • Number of evaluators: 1 Equipment and material (one per individual) unless otherwise indicated— • Lensatic compass. • 1:50,000 map sheet with grid coordinates and distances to the points. • Land Navigation Performance Test Sheet in a document protector. (See page TE-1-5, this appendix, or page PTS-6-1 in the PLDC CMP) • GTA 5-2-12 (Coordinate Scale and Protractor). • Pencil or marker. • Paper (two sheets per individual). • Kevlar helmet, Load Carrying Equipment (LCE), or authorized issued equivalent with two canteens of water. • Any other equipment IAW NCOA SOP. Training area large enough to accommodate a 1:8 instructor to student ratio for the NCOA's maximum class size.
Introduction/ Briefing	Welcome to the land navigation course. Today you will demonstrate for record your ability to navigate from one point on the ground to another using a map and a compass. This course will test your ability to apply fundamental map reading and land navigation techniques. You must plot four points on your map and locate three out of the four points in the maximum time of three hours to receive a minimum passing score of 75 percent or a "GO." (**NOTE**: If the NCOA utilizes a rally point separate from the fourth point, students will have an additional 15 minutes.)

Introduction/ Briefing, continued

Each of you received your coordinates and distances to four points. **When the time starts,** you may plot each of your points on the map, then double check that you correctly plotted the coordinates. (Plotting is part of the 3 hour examination.)

Choose the best route that leads you to each point. Remember to check the type of terrain on the map that you must traverse. The shortest route may not always be the best. Watch for hills, streams, or valleys that will make your travel difficult. Once you choose a route of travel, determine your grid azimuth to the points.

DO NOT FORGET TO CONVERT YOUR GRID AZIMUTHS TO MAGNETIC AZIMUTHS, and compute your pace count from the distance. (Suggest that you determine the data from the start point to the first point. Once you have found the first point, then determine the data to the second point. This will prevent you from mixing up the data to the different points).

Brief the following based on local requirements—

- Course boundaries.
- Safety precautions.
- Evaluation termination time.
- Environmental consideration.
- Identification of course control points and markers.
- Procedures for evacuation of injured personnel.
- Location of medical aid station/personnel.
- Heat or cold injury precautions.
- Reporting of hazard (fire, safety).
- Location of turn-in point for scorecard.
- Distress signal.

Avoid mistakes by following these simple rules—

- **DO** adhere strictly to safety precautions and course boundaries.
- **DO** check all work carefully.
- **DO** use all time wisely.
- **DO** recheck all work before you turn in your scorecard (test sheet).
- **DO** be constantly aware of your surroundings.
- **DO NOT** take short cuts.
- **DO NOT** rush.

Introduction/ Briefing, continued

Remind students of the affect that certain metals have on a lensatic compass. Doctrine suggests the following separation distances to ensure proper functioning of a lensatic compass--

- High-tension power lines 55 meters.
- Field gun, truck, or tank 18 meters.
- Telegraph/telephone or barbed wire 10 meters.
- Machine gun 2 meters.
- Steel helmet or rifle 1/2 meter.

Have students inspect their compasses to ensure--

- The floating dial containing the magnetic needles does not stick.
- The sighting wire is straight.
- Does not contain broken glass and crystal parts.
- The numbers on the dial are readable.

Warn students who may have an older compass that the scale may read 1:25,000. They can use the scale with a 1:50,000 scale map, but they must double the values to obtain the correct reading.

You have the responsibility to accomplish the following--

- Be responsible for all solutions to the course requirements.
- Confirm your pace count.
- Verify your compass accuracy.
- Turn in your Performance Test Sheet to receive credit.
- Conduct all work on your own.

Should you fail to receive a GO, you will receive remedial training and take a retest. Should you fail the retest, the academy may drop you from the course.

LAND NAVIGATION
PERFORMANCE TEST SHEET (W226)

Student Name:	**Signature:**	**Date:**
Student #:	**Initial:**	
Rank:	**Retest:**	
SGL Name:	**Comments:**	

First Start Point:	**First Test**	
Land Navigation Course	**GO**	**NO GO**
Control Point One:		
Control Point Two:		
Control Point Three:		
Control Point Four:		
Overall Evaluation Results		
Second Start Point:		
Land Navigation Course		
Control Point One:		
Control Point Two:		
Control Point Three:		
Control Point Four:		
Overall Evaluation Results		

NOTE TO STUDENT

All work is an individual student effort.
You may not work with or coordinate with another student.
You must personally visit each point you indicate on your Land Navigation Performance Test Sheet.

REMARKS:

Appendix C Practical Exercises and Solutions

This Appendix contains the items listed in this table—

Title/Synopsis	Pages
PE-1, Practice Land Navigation Course (Terrain Walk)	PE-1-1 thru PE-1-3
PE-2, Practice Land Navigation Performance Test	PE-2-1 thru PE-2-3
PE-3, Practice Land Navigation Course (Night)	PE-3-1 thru PE-3-3

PRACTICAL EXERCISE SHEET PE-1

Title	Practice Land Navigation Course (Terrain Walk)
Lesson Number/Title	W226 version 1 / Land Navigation
Introduction	We are now going to conduct a terrain walk of the area covering the land navigation course, a reconnaissance if you will. You will put into practice what you learned during the map reading class and this class.
Motivator	You will quickly earn the respect and trust of your soldiers when you lead them from one point to another in unfamiliar terrain without getting lost. However, the opposite is also true, your soldiers will loose confidence in you fast if you get them lost.
Learning Step/Activity	**NOTE:** The instructor should inform the students of the following Learning Step/Activity requirements. (ELO B.1) At the completion of this lesson, you [the student] will: **Action:** Practical Exercises 1, 2, and 3
Safety Requirements	SGLs will ensure students-- • Receive a safety briefing prior to terrain walks and practical exercises. • Know how to exercise caution during the PE when encountering local wildlife and plants. • Have all necessary equipment for the PEs; to include any additional equipment required by the NCOA SOP. • Have two canteens full of water and know to drink plenty of water during the exercise. • Know the locations of the water points. • Receive a briefing on heat injury symptoms or cold weather injury symptoms, whichever may apply. • Know how to evacuate or treat injured soldiers IAW the NCOA SOP.
Risk Assessment Level	Determined by the instructor.
Environmental Considerations	According to local environmental SOP.
Evaluation	This is a **nongraded** PE. Your performance on this PE will not have negative consequences on your academic standings. However, you will need the skills you learned in this PE when you negotiate the graded performance land navigation course. You will also need these skills when you lead your squad back at your unit.

Instructional Lead-In

Small group leaders (SGLs) will conduct a cadre-led terrain familiarization walk. Each small group leader will accompany his eight students on the walk providing his students an opportunity to practice the techniques of land navigation. These techniques include—

- Determining an azimuth.
- Dead reckoning.
- Presetting compasses.
- Using a lensatic compass.
- Orienting a map to the ground.
- Determining distance while moving.
- Bypassing obstacles using the detour method.

The group of eight students will have the opportunity to perform each of the above techniques. Each group will work independently of the others. Each group will work together during the walk by breaking down into four teams:

1. Trailbreaker team.
2. Pace counter team.
3. Navigator team.
4. Compass team.

The trailbreakers clear trails through thick brush (when necessary) and act as points of aim for the compass men when no other points are available.

The compass men maintain the azimuth headings determined by the navigators and keep the group traveling in the correct direction.

The pace counters maintain distance calculations by counting the number of paces taken to each objective.

The navigators monitor and note the movement of the group on the map and provide the compass men with azimuth headings and the pace men with distance requirements to each objective.

Note: SGLs. Ensure your group moves in the right direction; answer all questions and ensure that each working team rotates through all the different tasks so that all members of the group perform each task.

Each group member will have an opportunity to bypass obstacles using the detour method.

NOTE: SGL: If no natural obstacles exist, then designate off-limits and Contaminated areas that students will have to bypass.

Once you have had a chance to practice the techniques of land navigation, you should be ready to go out by yourself for the practice land navigation course. There, you will have a chance to demonstrate your skills in land navigation.

Resource Requirements

Instructor Materials:

- Water trailer or two Lyster bags filled with potable water.
- TSP
- Lensatic compass

Student Materials:

Each student will have--

- Pistol belt with two canteens of water.
- Lensatic compass.
- 1:50,000 map sheet of the area.
- GTA 5-2-12 (Coordinate Scale and Protractor).
- Pencil and writing paper.
- Other equipment as prescribed by the NCOA SOP.

Special Instructions

None

Procedures

NOTE: Each academy will develop this portion of the lesson based on their individual resources and restrictions. Therefore, there is no solution sheet provided for this PE.

Feedback Requirements

This practical exercise will allow you to evaluate your ability to navigate from one point on the ground to another. Upon completion of this PE, you will participate in an AAR. You will learn from the AAR the things you did right or wrong and what you need to improve upon. You will also learn what you can do to improve on your weaknesses. If you have difficulties, then come and see me. I will give you some additional training prior to the land navigation performance exam.

PRACTICAL EXERCISE SHEET PE-2

Title	Practice Land Navigation Performance Test
Lesson Number/Title	W226 version 1 / Land Navigation
Introduction	This practice land navigation performance test can serve two purposes: 1. To provide you the opportunity to practice your land navigation skills on the type of course you must negotiate for the land navigation performance test. 2. At the commandant's discretion, to serve as a pre test to allow you to test out providing you meet the land navigation graduation requirement.
Motivator	This practice performance test will-- • Provide you with the practical training you need to prepare for the performance test. • At the commandant's discretion, allow you to test out if you find three of the four points of this PE.
Learning Step/Activity	**NOTE:** The instructor should inform the students of the following Learning Step/Activity requirements. (ELO B.1) At the completion of this lesson, you [the student] will: **Action:** Practical Exercises 1, 2, and 3
Safety Requirements	SGLs will ensure students— • Receive a safety briefing prior to the practical exercises. • Know how to exercise caution during the PE when encountering local wildlife and plants. • Have all necessary equipment for the PEs, to include any additional equipment required by the NCOA SOP. • Have two full canteens of water and know to drink plenty of water during the exercise. • Know the locations of the water points. • Receive a briefing on heat injury symptoms or cold weather injury symptoms, whichever may apply. • Know how to evacuate or treat injured soldiers IAW the NCOA SOP. NCOA: Establish an SOP that addresses how to evacuate or treat injured soldiers.
Risk Assessment Level	Determined by the instructor.

Environmental Considerations	According to local environmental SOP.
Evaluation	• This is a **nongraded** PE. Your performance on this PE will not have negative consequences on your academic standings. You will need the skills you will learn in this PE when you negotiate the graded land navigation course. You will also need these skills when you lead your team back at your unit. • At the commandant's discretion, if you do meet the standards of finding three of the four points, you will have met the land navigation PLDC graduation requirement, and you will not have to take the land navigation test scheduled later in this course.
Resource Requirements	**Instructor Materials:** • Water trailer or two Lyster bags filled with potable water. • TSP • Lensatic compass **Student Materials:** Each student will have— • Pistol belt with two canteens of water, plus any other equipment required by the NCOA SOP. • Lensatic compass. • 1:50,000 map sheet of the area. • GTA 5-2-12 (coordinate scale and protractor). Pencil and writing paper.
Special Instructions	SGLs will conduct a safety briefing prior to the practical exercise. **Note to Commandant:** • At your discretion, you may use this PE as a pre test, and those soldiers who find three out of the four points do not have to take the land navigation test scheduled later in the course. • The practice course must meet the same standards as the test course. • Conduct this PE exactly as you will conduct the performance test: one hour for preparation, collection of answer sheets, and after action review, and three hours to negotiate the course. • If your course utilizes a rally point, separate from the fourth, and allow the students an additional 15 minutes to get from the fourth point to the rally point. **Note to the Students:** • Each of you received your coordinates and distances to four points. When the time starts, you may plot each of your points on the map, and then double

Special Instructions, cont'd

check that you correctly plotted the coordinates. (Plotting is part of the 3 hours.)

- Choose the best route that leads you to each point. Remember to check the type of terrain on the map that you must traverse. The shortest route may not always be the best. Watch for hills, streams, or valleys that can make your travel difficult.
- Once you choose a route of travel, determine your grid azimuth and distance to each point.
- Convert your grid azimuths to magnetic azimuths and compute your pace count from the distance. (Suggest that you determine the data from the start point to the first point. Once you have found the first point, then determine the data to the second point. This will prevent you from mixing up the data to the different points.)

Procedures

NOTES:

- Each academy will develop this portion of the lesson based on its individual resources and restrictions. Therefore, there is no solution sheet provided for this PE. NCOAs may design their own score sheets or use the form in Appendix B, page TE-1-5.
- Provide the students with eight-digit coordinates at their starting point.
- Identify the starting point coordinates to the student on the ground.
- Provide students the eight-digit grid coordinates to the four points that they must find.
- You have 30 minutes to (not part of the 3-hour exercise)--

  - Complete administrative requirements.
  - Conduct a risk assessment.
  - Conduct safety brief.
  - Ensure students have all required equipment.
  - Allow students to verify their pace count on the pace course.
  - Allow students to check their compasses for accuracy using the compass checkpoints.

- Observe students throughout the exercise and assist when necessary.

NOTE: Upon the conclusion of the three-hour portion of this PE, conduct a student led AAR

Feedback Requirements

- This portion of the practical exercise allows you to evaluate your ability to navigate from one point on the ground to another. Upon completion of this PE, you will participate in an AAR. You will learn from the AAR the things you did right or wrong and what you need to do to improve.
- If you have difficulties, come see me. I will give you some additional training.

PRACTICAL EXERCISE SHEET PE-3

Title	Practice Land Navigation Course (Night)
Lesson Number/Title	W226 version 1 / Land Navigation
Introduction	The night land navigation course will challenge your navigational skills, because the most difficult time to navigate is during the hours of darkness.
Motivator	You will not always be able to navigate in the daytime. In areas that have no cover and concealment, such as the desert, it will be to your advantage to travel at night. This will not only shield you from the enemy but also protect you from the heat of the day. If you perform well here, then you will perform well on the STX.
Learning Step/Activity	**NOTE:** The instructor should inform the students of the following Learning Step/Activity requirements. (ELO B.1) At the completion of this lesson, you [the student] will: **Action:** Practical Exercises 1, 2, and 3
Safety Requirements	SGLs will ensure students: • Know that during the PE they will have to exercise caution when encountering local wildlife and plants. • Have two canteens full of water and know to drink plenty of water during the exercise. • Know where the established water points are so they can replenish their water. • Receive a brief on heat injury symptoms or cold weather injury symptoms, whichever applies. • Receive instructions to watch out for each other and to observe the special instructions you gave them during the safety briefing/risk assessment. • Know how to evacuate or treat injured soldiers IAW the NCOA SOP.
Risk Assessment Level	Low Determined by the instructor.
Environmental Considerations	As determined by the local commander and NCOA.
Evaluation	This is a **nongraded** PE. Your performance on this PE will not have negative consequences on your academic standings. However, you will need the skills you learned in this PE when you lead your squad/section during the STX. You will also need these skills when you lead your soldiers back in your unit.

Instructional Lead-In

This is your night land navigation course. The course legs of the night course are much shorter than the practice course. The primary purpose of this exercise is to build your confidence in navigation at night. You will perform your work as a team. You may use your flashlights with red lenses, but you must observe strict light and noise discipline.

Note: SGLs will accompany their group to ensure they are moving in the right direction and to answer any questions they may have on navigating techniques.

Resource Requirements

Instructor Materials:

- Water trailer or 2 Lyster bags filled with potable water.
- TSP
- Lensatic compass

Student Materials:

Each student will have:

- Pistol belt with 2 canteens of water.
- Lensatic compass.
- 1:50,000 map sheet of the area.
- GTA 5-2-12 (Coordinate Scale and Protractor).
- Flashlight with red lens.
- Pencil and writing paper.
- Any other equipment IAW the NCOA SOP.

Special Instructions

SGLs will conduct a risk assessment prior to the practical exercise.

When you finish, turn in your solution sheet to your SGL.

Procedures

NOTE: Each academy will develop this portion of the lesson based on its individual resources and restrictions. Therefore, there is no solution sheet provided for this PE. You may use the solution sheet found on page TE-1-5, Appendix B of this TSP. Ensure you cover:

- Administrative requirements.
- Risk assessment.
- Safety briefing.
- Check that students have all required equipment.

NOTE: The legs of the night land navigation course will be no farther than 300 meters and no less than 200 meters.

NOTE: Divide each group of eight into two teams of four.

- Verify your pace counts, you will take smaller steps during night navigation.

- You will use the dead reckoning method to find the points.

- Each team must select a navigator, compass man, pace counter, and point man
- The navigator can also perform the duties of the trailbreaker, if necessary.
- If there is a team of only three, then the compass man can also perform the duties of the pace counter.

NOTE: Ensure all team members perform the duties of navigator, compass man, pace counter, and point man.

- Each team will find a minimum of three points during the time allocated by the commandant.

Feedback Requirements

This practical exercise will allow you to evaluate your ability to navigate from one point on the ground to another during hours of darkness. Upon completion of this PE, you will participate in an AAR. You will learn from the AAR the things you did right, wrong, and what you need to improve upon. You will also learn what you can do to improve on your weaknesses. If you have any difficulties, come see me. I will give you some additional training prior to the STX.

This Appendix Contains

This appendix contains the items listed in this table--

Title/Synopsis	Pages
SH-1, Advance Sheet.	SH-1-1 and SH-1-2
SH-2, Extracts from FM 3-25.26, Map Reading and Land Navigation.	SH-2-1 thru SH-2-17
SH-3, Visual Aid Handouts	SH-3-1 thru SH-3-5

Student Handout 1

This student handout contains Advance Sheet.

Student Handout 1

Advance Sheet

Lesson Hours

This lesson consists of one hour and twenty-five minutes of small group instruction, ten hours and twenty-five minutes of practical exercises, and four hours of performance testing.

Overview

You will learn the basic fundamentals of land navigation on how to get from one place to another. It is an essential skill for all soldiers. Soldiers will depend on you to lead them and train them in land navigation.

Learning Objective

Terminal Learning Objective (TLO).

Action:	Implement the techniques of map reading and land navigation during daylight hours and hours of darkness.
Conditions:	In a classroom environment and a field environment of unfamiliar terrain during daylight hours and hours of darkness, given a lensatic compass, map of local area, GTA 5-2-12 (Coordinate Scale and Protractor), pencil, paper, pistol belt, two canteens of water, flashlight with red lens, eight-digit coordinates, and equipment required by the NCOA SOP.
Standard:	Implemented the techniques of map reading and land navigation by: • Led soldiers during hours of daylight and hours of darkness in unfamiliar terrain, during an STX, using a map, applying map reading and navigational skills, and finding known and unknown locations. •· Found three of four points on the land navigation performance examination. IAW FM 3-25.26 and STP 21-1 SMCT

ELO A Develop ground navigation techniques.
ELO B Navigate from one point to another while dismounted during daylight hours and hours of darkness.

Assignment

The student assignments for this lesson are:

- Study task: 071-329-1006, Navigate from one point on the ground to another point while dismounted, in STP 21-1-SMCT, Soldier's Manual of Common Tasks, dated Apr 03, pages 3-150 thru 3-157.
- Study the following in FM 3-25.26, Map Reading and Land Navigation, 20 July 2001.

  - Chapter 5, para 5-3a, or SH-2, page SH-2-3.
  - Chapter 9, para 9-4c and 9-4d, 9-6, or SH-2, pages SH-2-4 thru SH-2-10.
  - Chapter 11, para 11-6 and 11-6a, and para 11-7, or SH-2, pages SH-2-11 thru SH-2-17.

Additional Subject Area Resources	None
Bring to Class	• STP 21-1-SMCT, Skill Levels 1, dated Apr 03. • FM 3-25.26, Map Reading and Land Navigation, or SH-2. • Lensatic compass. • GTA 5-2-12 (Coordinate Scale and Protractor). • 1:50,000 local map sheet. • Pencil and writing paper.
Note to Students	It is your responsibility to do the homework prior to class. PLDC expects you to come to class prepared. You will participate in small group discussions. You will participate in the classroom and outside the classroom practical exercises contained in this lesson. We expect you to participate in the discussion and exercises providing information you learned from your study. Failure to study and read the assignments above will result in your inability to participate with the rest of the group. Also, without a full understanding of land navigation, you can end up getting your group lost on the land navigation course and during the STX.

Student Handout 2

This student handout contains 16 pages of extracted material from FM 3-25.26, Map Reading and Land Navigation, dated 20 July 2001.

CHAPTER 5

SCALE AND DISTANCE

A map is a scaled graphic representation of a portion of the earth's surface. The scale of the map permits the user to convert distance on the map to distance on the ground or vice versa. The ability to determine distance on a map, as well as on the earth's surface, is an important factor in planning and executing military missions.

5-1. REPRESENTATIVE FRACTION

The numerical scale of a map indicates the relationship of distance measured on a map and the corresponding distance on the ground. This scale is usually written as a fraction and is called the representative fraction. The RF is always written with the map distance as 1 and is independent of any unit of measure. (It could be yards, meters, inches, and so forth.) An RF of 1/50,000 or 1:50,000 means that one unit of measure on the map is equal to 50,000 units of the same measure on the ground.

a. The ground distance between two points is determined by measuring between the same two points on the map and then multiplying the map measurement by the denominator of the RF or scale (Figure 5-1, page 5-2).

EXAMPLE:

The map scale is 1:50,000

RF = 1/50,000

The map distance from point A to point B is 5 units

5 x 50,000 = 250,000 units of ground distance

b. Since the distance on most maps is marked in meters and the RF is expressed in this unit of measurement in most cases, a brief description of the metric system is needed. In the metric system, the standard unit of measurement is the meter.

1 meter contains 100 centimeters (cm).

100 meters is a regular football field plus 10 meters.

1,000 meters is 1 kilometer (km).

10 kilometers is 10,000 meters.

Appendix C contains the conversion tables.

c. The situation may arise when a map or sketch has no RF or scale. To be able to determine ground distance on such a map, the RF must be determined. There are two ways to do this:

(1) ***Comparison with Ground Distance***.

(a) Measure the distance between two points on the map—map distance (MD).

(b) Determine the horizontal distance between these same two points on the ground—ground distance (GD).

(c) Use the RF formula and remember that RF must be in the general form:

$$RF = \frac{1}{X} = \frac{MD}{GD}$$

5-3. OTHER METHODS

Determining distance is the most common source of error encountered while moving either mounted or dismounted. There may be circumstances where you are unable to determine distance using your map or where you are without a map. It is therefore essential to learn methods by which you can accurately pace, measure, use subtense, or estimate distances on the ground.

a. **Pace Count**. Another way to measure ground distance is the pace count. A pace is equal to one natural step, about 30 inches long. To accurately use the pace count method, you must know how many paces it takes you to walk 100 meters. To determine this, you must walk an accurately measured course and count the number of paces you take. A pace course can be as short as 100 meters or as long as 600 meters. The pace course, regardless of length, must be on similar terrain to that you will be walking over. It does no good to walk a course on flat terrain and then try to use that pace count on hilly terrain. To determine your pace count on a 600-meter course, count the paces it takes you to walk the 600 meters, then divide the total paces by 6. The answer will give you the average paces it takes you to walk 100 meters. It is important that each person who navigates while dismounted knows his pace count.

(1) There are many methods to keep track of the distance traveled when using the pace count. Some of these methods are: put a pebble in your pocket every time you have walked 100 meters according to your pace count; tie knots in a string; or put marks in a notebook. Do not try to remember the count; always use one of these methods or design your own method.

(2) Certain conditions affect your pace count in the field, and you must allow for them by making adjustments.

(a) *Slopes*. Your pace lengthens on a downslope and shortens on an upgrade. Keeping this in mind, if it normally takes you 120 paces to walk 100 meters, your pace count may increase to 130 or more when walking up a slope.

(b) *Winds*. A head wind shortens the pace and a tail wind increases it. (c) *Surfaces*. Sand, gravel, mud, snow, and similar surface materials tend to shorten the pace.

(d) *Elements*. Falling snow, rain, or ice cause the pace to be reduced in length.

(e) *Clothing*. Excess clothing and boots with poor traction affect the pace length.

(f) *Visibility.* Poor visibility, such as in fog, rain, or darkness, will shorten your pace.

b. **Odometer**. Distances can be measured by an odometer, which is standard equipment on most vehicles. Readings are recorded at the start and end of a course and the difference is the length of the course.

(1) To convert kilometers to miles, multiply the number of kilometers by 0.62.

EXAMPLE:

16 *kilometers* = 16 x 0.62 = 9.92 *miles*

(2) To convert miles to kilometers, divided the number of miles by 0.62.

EXAMPLE:

10 *miles* = 10 *divided by* 0.62 = 16.12 *kilometers*

PART TWO
LAND NAVIGATION

CHAPTER 9
NAVIGATION EQUIPMENT AND METHODS

Compasses are the primary navigation tools to use when moving in an outdoor world where there is no other way to find directions. Soldiers should be thoroughly familiar with the compass and its uses. Part One of this manual discussed the techniques of map reading. To complement these techniques, a mastery of field movement techniques is essential. This chapter describes the lensatic compass and its uses, and some of the field expedient methods used to find directions when compasses are not available.

9-1. TYPES OF COMPASSES

The **lensatic compass** is the most common and simplest instrument for measuring direction. It is discussed in detail in paragraph 9-2. The **artillery M2 compass** is a special-purpose instrument designed for accuracy; it will be discussed in Appendix G. The **wrist/pocket compass** is a small magnetic compass that can be attached to a wristwatch band. It contains a north-seeking arrow and a dial in degrees. A **protractor** can be used to determine azimuths when a compass is not available. However, it should be noted that when using the protractor on a map, only grid azimuths are obtained.

9-2. LENSATIC COMPASS

The lensatic compass (Figure 9-1) consists of three major parts: the cover, the base, and the lens.

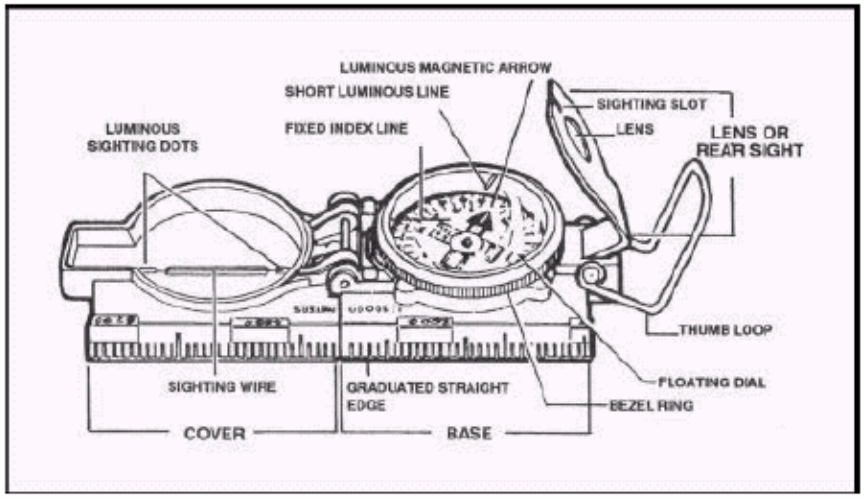


Figure 9-1. Lensatic compass.

a. **Cover.** The compass cover protects the floating dial. It contains the sighting wire (front sight) and two luminous sighting slots or dots used for night navigation.

b. **Base.** The body of the compass contains the following movable parts:

(1) The floating dial is mounted on a pivot so it can rotate freely when the compass is held level. Printed on the dial in luminous figures are an arrow and the letters E and W. The arrow always points to magnetic north and the letters fall at east (E) 90□and west (W) 270□on the dial. There are two scales; the outer scale denotes mils and the inner scale (normally in red) denotes degrees.

(2) Encasing the floating dial is a glass containing a fixed black index line.

(3) The bezel ring is a ratchet device that clicks when turned. It contains 120 clicks when rotated fully; each click is equal to 3□. A short luminous line that is used in conjunction with the north-seeking arrow during navigation is contained in the glass face of the bezel ring.

(4) The thumb loop is attached to the base of the compass.

c. **Lens.** The lens is used to read the dial, and it contains the rear-sight slot used in conjunction with the front for sighting on objects. The rear sight also serves as a lock and clamps the dial when closed for its protection. The rear sight must be opened more than 45□to allow the dial to float freely.

NOTE: When opened, the straightedge on the left side of the compass has a coordinate scale; the scale is 1:50,000 in newer compasses.

WARNING

Some older compasses will have a 1:25,000 scale. This scale can be used with a 1:50,000-scale map, but the values read must be halved. Check the scale.

9-3. COMPASS HANDLING

Compasses are delicate instruments and should be cared for accordingly.

a. **Inspection.** A detailed inspection is required when first obtaining and using a compass. One of the most important parts to check is the floating dial, which contains the magnetic needle. The user must also make sure the sighting wire is straight, the glass and crystal parts are not broken, the numbers on the dial are readable, and most important, that the dial does not stick.

b. **Effects of Metal and Electricity.** Metal objects and electrical sources can affect the performance of a compass. However, nonmagnetic metals and alloys do not affect compass readings. The following separation distances are suggested to ensure proper functioning of a compass:

High-tension power lines ....55 meters.
Field gun, truck, or tank..... ...18 meters.
Telegraph or telephone wires and barbed wire.....10 meters.
Machine gun..... ..2 meters.
Steel helmet or rifle..... .....1/2 meter.

c. **Accuracy.** A compass in good working condition is very accurate. However, a compass has to be checked periodically on a known line of direction, such as a surveyed azimuth using a declination station. Compasses with more than 3□variation should not be used.

d. **Protection.** If traveling with the compass unfolded, make sure the rear sight is fully folded down onto the bezel ring. This will lock the floating dial and prevent vibration, as well as protect the crystal and rear sight from damage.

9-4. USING A COMPASS

Magnetic azimuths are determined with the use of magnetic instruments, such as lensatic and M2 compasses. The techniques employed when using the lensatic compass are as follows:

a. **Using the Centerhold Technique.** First, open the compass to its fullest so that the cover forms a straightedge with the base. Move the lens (rear sight) to the rearmost position, allowing the dial to float freely. Next, place your thumb through the thumb loop, form a steady base with your third and fourth fingers, and extend your index finger along the side of the compass. Place the thumb of the other hand between the lens (rear sight) and the bezel ring; extend the index finger along the remaining side of the compass, and the remaining fingers around the fingers of the other hand. Pull your elbows firmly into your sides; this will place the compass between your chin and your belt. To measure an azimuth, simply turn your entire body toward the object, pointing the compass cover directly at the object. Once you are pointing at the object, look down and read the azimuth from beneath the fixed black index line (Figure 9-2). This preferred method offers the following advantages over the sighting technique:

(1) It is faster and easier to use.
(2) It can be used under all conditions of visibility.
(3) It can be used when navigating over any type of terrain.
(4) It can be used without putting down the rifle; however, the rifle must be slung well back over either shoulder.
(5) It can be used without removing eyeglasses.

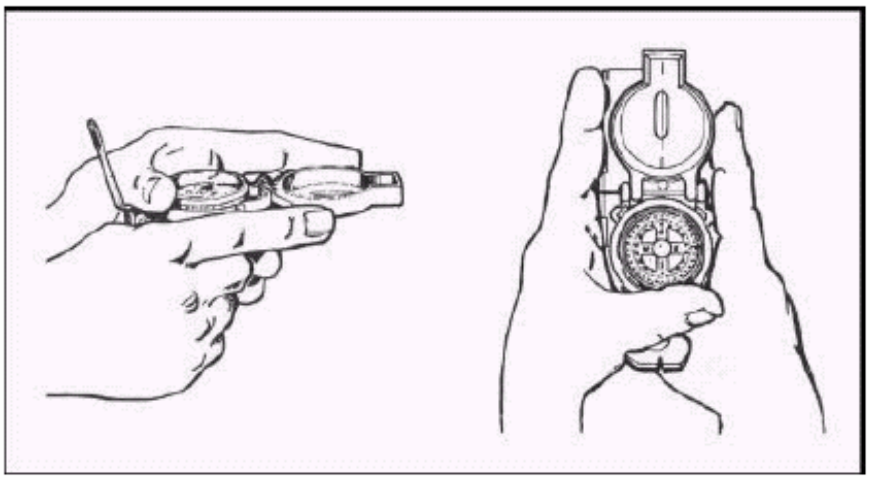


Figure 9-2. Centerhold technique.

b. **Using the Compass-to-Cheek Technique.** Fold the cover of the compass containing the sighting wire to a vertical position; then fold the rear sight slightly forward. Look through the rear-sight slot and align the front-sight hairline with the desired object in the distance. Then glance down at the dial through the eye lens to read the azimuth (Figure 9-3).

NOTE: The compass-to-cheek technique is used almost exclusively for sighting, and it is the best technique for this purpose.

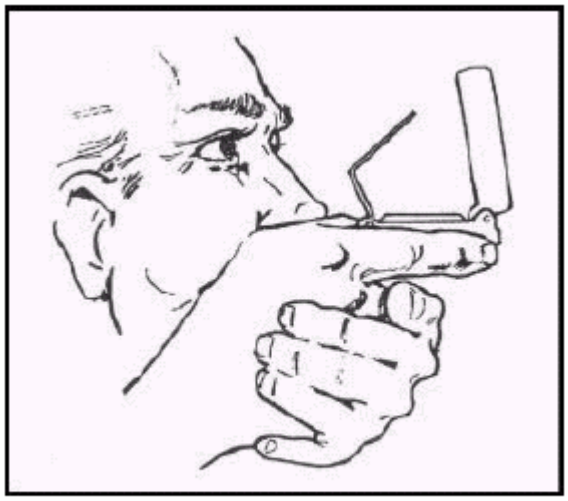


Figure 9-3. Compass-to-cheek technique.

c. **Presetting a Compass and Following an Azimuth.** Although different models of the lensatic compass vary somewhat in the details of their use, the principles are the same.

(1) During daylight hours or with a light source:

(a) Hold the compass level in the palm of the hand.

(b) Rotate it until the desired azimuth falls under the fixed black index line (for example, 320□), maintaining the azimuth as prescribed (Figure 9-4).

(c) Turn the bezel ring until the luminous line is aligned with the north-seeking arrow. Once the alignment is obtained, the compass is preset.

(d) To follow an azimuth, assume the centerhold technique and turn your body until the north-seeking arrow is aligned with the luminous line. Then proceed forward in the direction of the front cover's sighting wire, which is aligned with the fixed black index line that contains the desired azimuth.

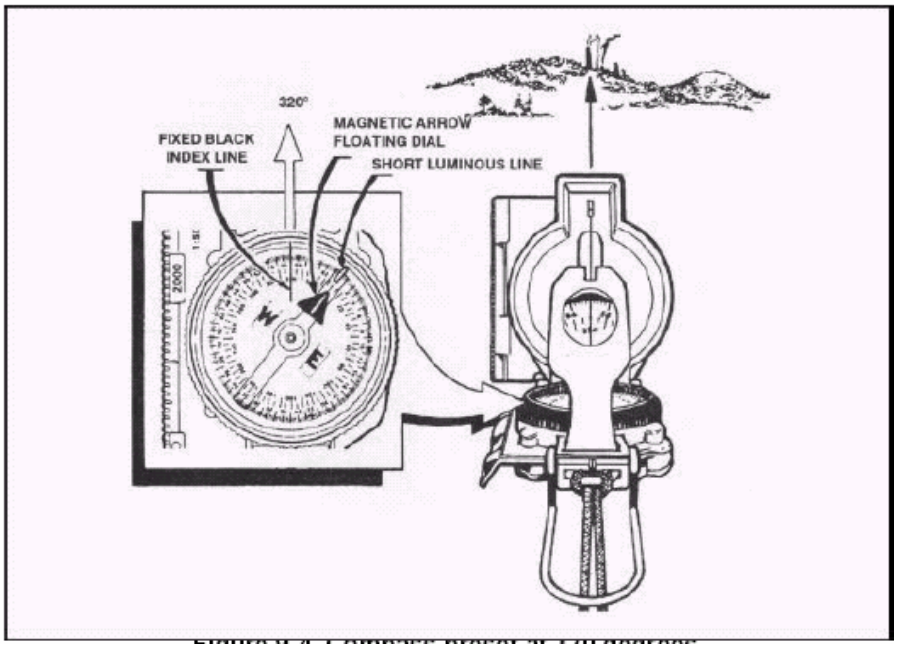


Figure 9-4. Compass preset at 320 degrees

(2) During limited visibility, an azimuth may be set on the compass by the click method. Remember that the bezel ring contains 3□intervals (clicks).

(a) Rotate the bezel ring until the luminous line is over the fixed black index line.

(b) Find the desired azimuth and divide it by three. The result is the number of clicks that you have to rotate the bezel ring.

(c) Count the desired number of clicks. If the desired azimuth is smaller than 180□, the number of clicks on the bezel ring should be counted in a counterclockwise direction. For example, the desired azimuth is 51□. Desired azimuth is 51□□3 = 17 clicks counterclockwise. If the desired azimuth is larger than 180□, subtract the number of degrees from 360□and divide by 3 to obtain the number of clicks. Count them in a clockwise direction. For example, the desired azimuth is 330□; 360□-330□= 30 □3 = 10 clicks clockwise.

(d) With the compass preset as described above, assume a centerhold technique and rotate your body until the north-seeking arrow is aligned with the luminous line on the bezel. Then proceed forward in the direction of the front cover's luminous dots, which are aligned with the fixed black index line containing the azimuth.

(e) When the compass is to be used in darkness, an initial azimuth should be set while light is still available, if possible. With the initial azimuth as a base, any other azimuth that is a multiple of three can be established through the use of the clicking feature of the bezel ring.

NOTE: Sometimes the desired azimuth is not exactly divisible by three, causing an option of rounding up or rounding down. If the azimuth is rounded up, this causes an

increase in the value of the azimuth, and the object is to be found on the left. If the azimuth is rounded down, this causes a decrease in the value of the azimuth, and the object is to be found on the right.

d. **Bypassing an Obstacle**. To bypass enemy positions or obstacles and still stay oriented, detour around the obstacle by moving at right angles for specified distances.

(1) For example, while moving on an azimuth of 90□change your azimuth to 180□and travel for 100 meters. Change your azimuth to 90□and travel for 150 meters. Change your azimuth to 360□and travel for 100 meters. Then, change your azimuth to 90□and you are back on your original azimuth line (Figure 9-5).

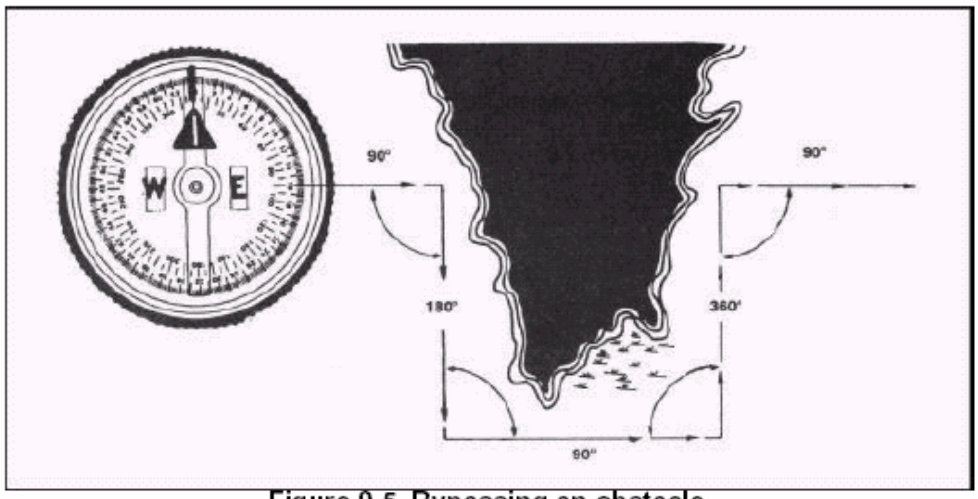


Figure 9-5. Bypassing an obstacle.

(2) Bypassing an unexpected obstacle at night is a fairly simple matter. To make a 90□turn to the right, hold the compass in the centerhold technique; turn until the center of the luminous letter E is under the luminous line (*do not* move the bezel ring). To make a 90□turn to the left, turn until the center of the luminous letter W is under the luminous line. This does not require changing the compass setting (bezel ring), and it ensures accurate 90□turns.

e. **Offset.** A deliberate offset is a planned magnetic deviation to the right or left of an azimuth to an objective. Use it when the objective is located along or in the vicinity of a linear feature such as a road or stream. Because of errors in the compass or in map reading, the linear feature may be reached without knowing whether the objective lies to the right or left. A deliberate offset by a known number of degrees in a known direction compensates for possible errors and ensures that upon reaching the linear feature, the user knows whether to go right or left to reach the objective. Ten degrees is an adequate offset for most tactical uses. Each degree offset moves the course about 18 meters to the right or left for each 1,000 meters traveled. For example, in Figure 9-6, the number of degrees offset is 10. If the distance traveled to "x" in 1,000 meters, then "x" is located about 180 meters to the right of the objective.

9-6. GLOBAL POSITIONING SYSTEM

The GPS is a space-based, global, all-weather, continuously available, radio positioning navigation system. It is highly accurate in determining position location derived from signal triangulation from a satellite constellation system. It is capable of determining latitude, longitude, and altitude of the individual user. It is being fielded in hand-held, manpack, vehicular, aircraft, and watercraft configurations. The GPS receives and processes data from satellites on either a simultaneous or sequential basis. It measures the velocity and range with respect to each satellite, processes the data in terms of an earth-centered, earth-fixed coordinate system, and displays the information to the user in geographic or military grid coordinates.

a. The GPS can provide precise steering information, as well as position location. The receiver can accept many checkpoints entered in any coordinate system by the user and convert them to the desired coordinate system. The user then calls up the desired checkpoint and the receiver will display direction and distance to the checkpoint. The GPS does not have inherent drift, an improvement over the Inertial Navigation System, and the receiver will automatically update its position. The receiver can also compute time to the next checkpoint.

b. Specific uses for the GPS are position location; navigation; weapon location; target and sensor location; coordination of firepower; scout and screening operations; combat resupply; location of obstacles, barriers, and gaps; and communication support. The GPS also has the potential to allow units to train their soldiers and provide the following:

- Performance feedback.
- Knowledge of routes taken by the soldier.
- Knowledge of errors committed by the soldier.
- Comparison of planned versus executed routes.
- Safety and control of lost and injured soldiers.

(See Appendix J for more information of the GPS.)

CHAPTER 11

TERRAIN ASSOCIATION

Failure to make use of the vast amounts of information presented by the map and available to the eye on the ground reduces the chances for success in land navigation. The soldier who has repeatedly practiced the skills of identifying and discriminating among the many types of terrain and other features knows how these features are mapped. He can begin to visualize the shape of the land by studying the map, estimate distances, and perform quick resection from the many landmarks he sees is the one who will be at the right place to help defeat the enemy on the battlefield. This chapter tells how to orient a map with and without a compass, how to find locations on a map as well as on the ground, how to study the terrain, and how to move on the ground using terrain association and dead reckoning.

11-1. ORIENTING THE MAP

The first step for a navigator in the field is orienting the map. A map is oriented when it is in a horizontal position with its north and south corresponding to the north and south on the ground. Some orienting techniques follow:

a. **Using a Compass**. When orienting a map with a compass, remember that the compass measures magnetic azimuths. Since the magnetic arrow points to magnetic north, pay special attention to the declination diagram. There are two techniques used.

(1) ***First Technique***. Determine the direction of the declination and its value from the declination diagram.

(a) With the map in a horizontal position, take the straightedge on the left side of the compass and place it alongside the north-south grid line with the cover of the compass pointing toward the top of the map. This procedure places the fixed black index line of the compass parallel to north-south grid lines of the map.

(b) Keeping the compass aligned as directed above, rotate the map and compass together until the magnetic arrow is below the fixed black index line on the compass. At this time, the map is close to being oriented.

(c) Rotate the map and compass in the direction of the declination diagram.

(d) If the magnetic north arrow on the map is to the left of the grid north, check the compass reading to see if it equals the G-M angle given in the declination diagram. The map is then oriented (Figure 11-1, page 11-2).

that represent elevation changes of at least two contour intervals such as hills, depressions, spurs, and draws. Primary reliance upon cultural features and vegetation is cautioned against because they are most likely to have changed since the map was last revised.
(3) Checkpoints located at places where changes in direction are made mark your **decision points**. Be especially alert to see and recognize these features during movement. During preparation and planning, it is especially important to review the route and anticipate where mistakes are most likely to be made so they can be avoided.
(4) Following a valley floor or proceeding near (not on) the crest of a ridgeline generally offers easy movement, good navigation checkpoints, and sufficient cover and concealment. It is best to follow terrain features whenever you can—not to fight them.
(5) A lost or a late arriving unit, or a tired unit that is tasked with an unnecessarily difficult move, does not contribute to the accomplishment of a mission. On the other hand, the unit that moves too quickly and carelessly into a destructive ambush or leaves itself open to air strikes also have little effect. Careful planning and study are required each time a movement route is to be selected.
c. **Stay on the Route (Step 3).** In order to know that you are still on the correct route, you must be able to compare the evidence you encounter as you move according to the plan you developed on the map when you selected your route. This may include watching your compass reading (dead reckoning) or recognizing various checkpoints or landmarks from the map in their anticipated positions and sequences as you pass them (terrain association). A better way is to use a combination of both.
d**. Recognize the Objective (Step 4).** The destination is rarely a highly recognizable feature such as a dominant hilltop or road junction. Such locations as this are seldom missed by the most inexperienced navigators and are often dangerous places for soldiers to occupy. The relatively small, obscure places are most likely to be the destinations.
(1) Just how does a soldier travel over unfamiliar terrain for moderate to great distances and know when he reaches the destination? One minor error, when many are possible, can cause the target to be missed.
(2) The answer is simple. Select a checkpoint (reasonably close to the destination) that is not so difficult to find or recognize. Then plan a short, fine-tuned last leg from the new *expanded objective* to the final destination. For example, you may be able to plan and execute the move as a series of sequenced movements from one checkpoint or landmark to another using both the terrain and a compass to keep you on the correct course. Finally, after arriving at the last checkpoint, you might follow a specific compass azimuth and pace off the relatively short, known distance to the final, pinpoint destination. This procedure is called *point navigation*. A short movement out from a unit position to an observation post or to a coordination point may also be accomplished in the same manner.

11-6. NAVIGATION METHODS
Staying on the route is accomplished through the use of one or two navigation techniques--dead reckoning and terrain association. These methods are discussed in detail below.

a. **Moving by Dead Reckoning.** Dead reckoning consists of two fundamental steps. The first is the use of a protractor and graphic scales to determine the direction and distance from one point to another on a map. The second step is the use of a compass and some means of measuring distance to apply this information on the ground. In other words, it begins with the determination of a polar coordinate on a map and ends with the act of finding it on the ground.

(1) Dead reckoning along a given route is the application of the same process used by a mapmaker as he establishes a measured line of reference upon which to construct the framework of his map. Therefore, triangulation exercises (either resection or intersection) can be easily undertaken by the navigator at any time to either determine or confirm precise locations along or near his route. Between these position-fixes, establish your location by measuring or estimating the distance traveled along the azimuth being followed from the previous known point. You might use pacing, a vehicle odometer, or the application of elapsed time for this purpose, depending upon the situation.

(2) Most dead reckoned movements do not consist of single straight-line distances because you cannot ignore the tactical and navigational aspects of the terrain, enemy situation, natural and man-made obstacles, time, and safety factors. Another reason most dead reckoning movements are not single straight-line distances is because compasses and pace-counts are imprecise measures. Error from them compounds over distance; therefore you could soon be far afield from your intended route even if you performed the procedures correctly. The only way to counteract this phenomenon is to reconfirm your location by terrain association or resection. Routes planned for dead reckoning generally consist of a series of straight-line distances between several checkpoints with perhaps some travel running on or parallel to roads or trails.

(3) There are two advantages to dead reckoning. First, dead reckoning is easy to teach and to learn. Second, it can be a highly accurate way of moving from one point to another if done carefully over short distances, even where few external cues are present to guide the movements.

(4) During daylight, across open country, along a specified magnetic azimuth, never walk with the compass in the open position and in front of you. Because the compass will not stay steady or level, it does not give an accurate reading when held or used this way. Begin at the start point and face with the compass in the proper direction, then sight in on a landmark that is located on the correct azimuth to be followed. Close the compass and proceed to that landmark. Repeat the process as many times as necessary to complete the straight-line segment of the route.

(5) The landmarks selected for this purpose are called *steering marks*, and their selection is crucial to success in dead reckoning. Steering marks should never be determined from a map study. They are selected as the march progresses and are commonly on or near the highest points that you can see along the azimuth line that you are following when they are selected. They may be uniquely shaped trees, rocks, hilltops, posts, towers, and buildings—anything that can be easily identified. If you do not see a good steering mark to the front, you might use a back azimuth to some feature behind you until a good steering mark appears out in front. Characteristics of a good steering mark are:

(a) It must have some characteristics about It, such as color, shade of color, size, or shape (preferably all four), that will assure you that it will continue to be recognized as you approach it.

(b) If several easily distinguished objects appear along your line of march, the best steering mark is the most distant object. This procedure enables you to travel farther with fewer references to the compass. If you have many options, select the highest object. A higher mark is not as easily lost to sight as is a lower mark that blends into the background as you approach it. A steering mark should be continuously visible as you move toward it.

(c) Steering marks selected at night must have even more unique shapes than those selected during daylight. As darkness approaches, colors disappear and objects appear as black or gray silhouettes. Instead of seeing shapes, you begin to see only the general outlines that may appear to change as you move and see the objects from slightly different angles.

(6) Dead reckoning without natural steering marks is used when the area through which you are traveling is devoid of features, or when visibility is poor. At night, it may be necessary to send a member of the unit out in front of your position to create your own steering mark in order to proceed. His position should be as far out as possible to reduce the number of chances for error as you move. Arm-and-hand signals or a radio may be used in placing him on the correct azimuth. After he has been properly located, move forward to his position and repeat the process until some steering marks can be identified or until you reach your objective.

(7) When handling obstacles/detours on the route, follow these guidelines:

(a) When an obstacle forces you to leave your original line of march and take up a parallel one, always return to the original line as soon as the terrain or situation permits.

(b) To turn clockwise (right) 90 degrees, you must add 90 degrees to your original azimuth. To turn counterclockwise (left) 90 degrees from your current direction, you must subtract 90 degrees from your present azimuth.

(c) When making a detour, be certain that only paces taken toward the final destination are counted as part of your forward progress. They should not be confused with the local pacing that takes place perpendicular to the route in order to avoid the problem area and in returning to the original line of march after the obstacle has been passed.

(8) Sometimes a steering mark on your azimuth of travel can be seen across a swamp or some other obstacle to which you can simply walk out around. Dead reckoning can then begin at that point. If there is no obvious steering mark to be seen across the obstacle, perhaps one can be located to the rear. Compute a back azimuth to this point and later sight back to it once the obstacle has been passed in order to get back on track.

(9) You can use the deliberate offset technique. Highly accurate distance estimates and precision compass work may not be required if the destination or an intermediate checkpoint is located on or near a large linear feature that runs nearly perpendicular to your direction of travel. Examples include roads or highways, railroads, power transmission lines, ridges, or streams. In these cases, you should apply a deliberate error (offset) of about 10 degrees to the azimuth you planned to follow and then move, using the lensatic compass as a guide, in that direction until you encounter the linear feature. You will know exactly which way to turn (left or right) to find your destination or checkpoint, depending upon which way you planned your deliberate offset.

(10) Because no one can move along a given azimuth with absolute precision, it is better to plan a few extra steps than to begin an aimless search for the objective once you reach the linear feature. If you introduce your own mistake, you will certainly know how to correct it. This method will also cope with minor compass errors and the slight variations that always occur in the earth's magnetic field.

(11) There are disadvantages to dead reckoning. The farther you travel by dead reckoning without confirming your position in relation to the terrain and other features, the more errors you will accumulate in your movements. Therefore, you should confirm and correct your estimated position whenever you encounter a known feature on the ground that is also on the map. Periodically, you should accomplish a resection triangulation using two or more known points to pinpoint and correct your position on the map. Pace counts or any type of distance measurement should begin anew each time your position is confirmed on the map.

(a) It is dangerous to select a single steering mark, such as a distant mountaintop, and then move blindly toward it. What will you do if you must suddenly call for fire support or a medical evacuation? You must periodically use resection and terrain association techniques to pinpoint your location along the way.

(b) Steering marks can be farther apart in open country, thereby making navigation more accurate. In areas of dense vegetation, however, where there is little relief, during darkness, or in fog, your steering marks must be close together. This, of course, introduces more chance for error.

(c) Finally, dead reckoning is time-consuming and demands constant attention to the compass. Errors accumulate easily and quickly. Every fold in the ground and detours as small as a single tree or boulder also complicate the measurement of distance.

b. **Moving by Terrain Association**. The technique of moving by terrain association is more forgiving of mistakes and far less time-consuming than dead reckoning. It best suits those situations that call for movement from one area to another. Once an error has been made in dead reckoning, you are off the track. Errors made using terrain association are easily corrected, however, because you are comparing what you expected to see from the map to what you do see on the ground. Errors are anticipated and will not go unchecked. You can easily make adjustments based upon what you encounter. After all, you do not find the neighborhood grocery store by dead reckoning—you adjust your movements according to the familiar landmarks you encounter along the way (Figure 11-8). Periodic position fixing through either plotted or estimated resection will also make it possible to correct your movements, call for fire, or call in the locations of enemy targets or any other information of tactical or logistical importance.

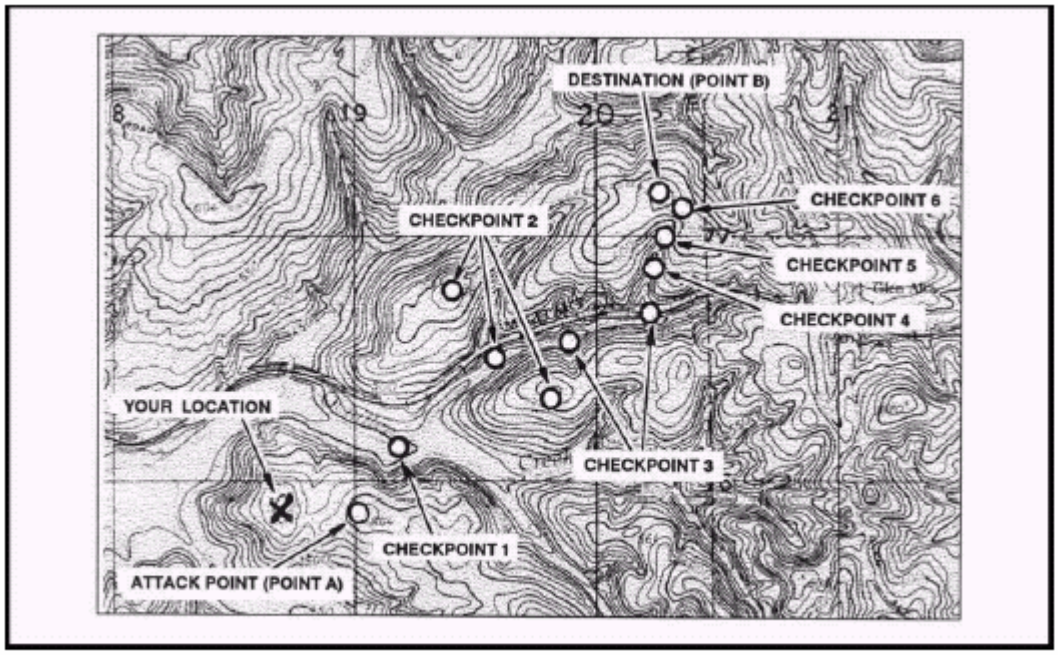


Figure 11-8. Terrain association navigation.

(1) ***Identifying and Locating Selected Features***. Being able to identify and locate the selected features, both on the map and on the ground, are essential to the success in moving by terrain association. The following rules may prove helpful.

(a) Be certain the map is properly oriented when moving along the route and use the terrain and other features as guides. The orientation of the map must match the terrain or it can cause confusion.

(b) To locate and identify features being used to guide the movement, look for the steepness and shape of the slopes, the relative elevations of the various features, and the directional orientations in relation to your position and to the position of the other features you can see.

(c) Make use of the additional cues provided by hydrography, culture, and vegetation. All the information you can gather will assist you in making the move. The ultimate test and the best practice for this movement technique is to go out in the field and use it. The use of terrain, other natural features, and any man-made objects that appear both on the map and on the ground must be practiced at every opportunity. There is no other way to learn or retain this skill.

(2) ***Using Handrails, Catching Features, and Navigational Attack Points***. First, because it is difficult to dead reckon without error over long distances with your compass, the alert navigator can often gain assistance from the terrain.

(a) **Handrails** are linear features like roads or highways, railroads, power transmission lines, ridgelines, or streams that run roughly parallel to your direction of travel. Instead of using precision compass work, you can rough compass without the use of steering marks for as long as the feature travels with you on your right or left. It acts as a handrail to guide the way.

(b) Second, when you reach the point where either your route or the handrail changes direction, you must be aware that it is time to go your separate ways. Some prominent feature located near this point is selected to provide this warning. This is called a *catching feature*; it can also be used to tell you when you have gone too far.

(c) Third, the catching feature may also be your *navigational attack point*; this point is the place where area navigation ends and point navigation begins. From this last easily identified checkpoint, the navigator moves cautiously and precisely along a given azimuth for a specified distance to locate the final objective. The selection of this navigational attack point is important. A distance of 500 meters or less is most desirable.

(3) ***Recognizing the Disadvantages of Terrain Association***. The major disadvantage to navigation by terrain association is that you must be able to interpret the map and analyze the world around you. Recognition of terrain and other features, the ability to determine and estimate direction and distance, and knowing how to do quick-in-the-head position fixing are skills that are more difficult to teach, learn, and retain than those required for dead reckoning.

c. **Combination of Techniques.** Actually, the most successful navigation is obtained by combining the techniques described above. Constant orientation of the map and continuous observation of the terrain in conjunction with compass-read azimuths, and distance traveled on the ground compared with map distance, used together make reaching a destination more certain. One should not depend entirely on compass navigation or map navigation; either or both could be lost or destroyed.

NOTE: See Appendix F for information on orienteering.

11-7. NIGHT NAVIGATION

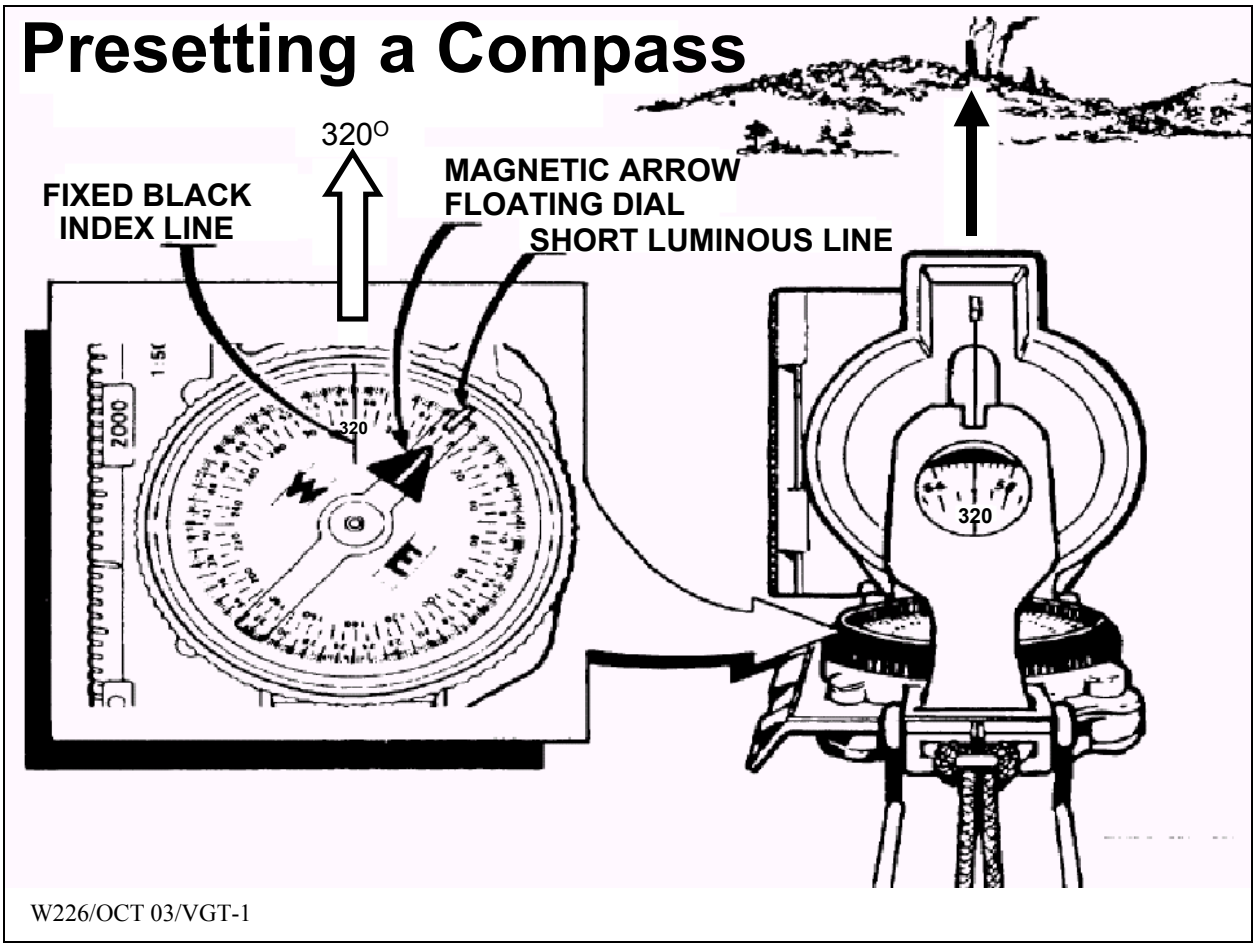
Darkness presents its own characteristics for land navigation because of limited or no visibility. However, the techniques and principles are the same as that used for day navigation. The success in nighttime land navigation depends on rehearsals during the planning phase before the movement, such as detailed analysis of the map to determine the type of terrain in which the navigation is going to take place and the predetermination of azimuths and distances. Night vision devices (Appendix H) can greatly enhance night navigation.

a. The basic technique used for nighttime land navigation is dead reckoning with several compasses recommended. The point man is in front of the navigator but just a few steps away for easy control of the azimuth. Smaller steps are taken during night navigation, so remember, the pace count is different. It is recommended that a pace count obtained by using a predetermined 100-meter pace course be used at night.

b. Navigation using the stars is recommended in some areas; however, a thorough knowledge of constellations and location of stars is needed (paragraph 9-5c). The four cardinal directions can also be obtained at night by using the same technique described for the shadow-tip method. Just use the moon instead of the sun. In this case, the moon has to be bright enough to cast a shadow.

Student Handout 3

This student handout contains four visual aid handouts that you can use if this TSP is outdoors.


Presetting a Compass
320O
FIXED BLACK INDEX LINE
MAGNETIC ARROW FLOATING DIAL
SHORT LUMINOUS LINE
320
320
W226/OCT 03/VGT-1

Limited Visibility, 180° or Less

- **180° or Less: Using 60° as Desired Azimuth**
  - Rotate the bezel ring until the luminous line is over the fixed black index line.
  - 60° divided by 3 equals 20 (clicks).
  - Rotate the bezel ring counterclockwise (left) twenty clicks.
  - Assume centerhold technique and rotate your body until you align the north-seeking arrow with the luminous line on the bezel.
  - Proceed forward in direction of the front cover's luminous dots, which align with the fixed black index line showing your desired azimuth, in this example, 60°.

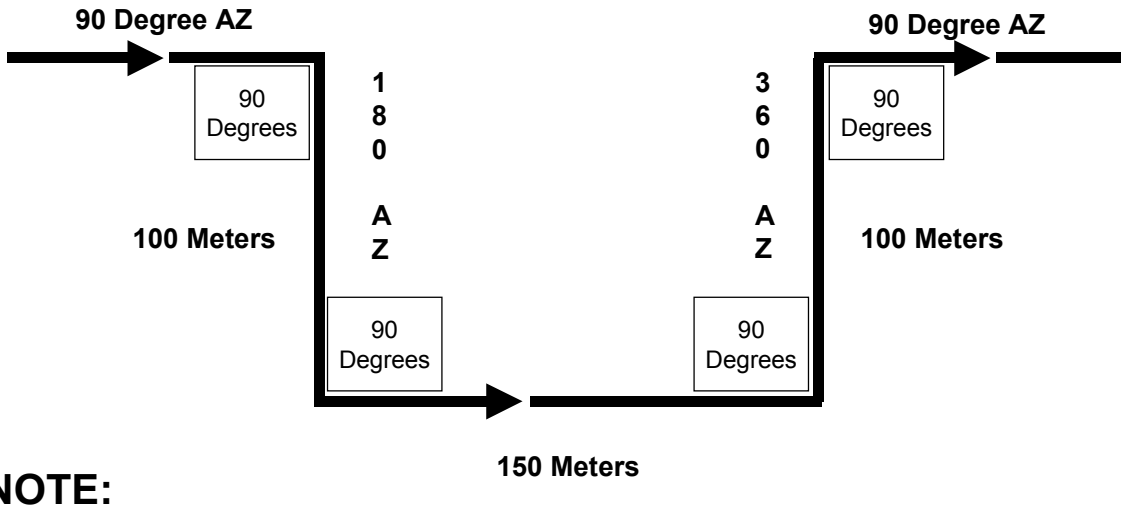
W226/OCT 03/VGT-2

Limited Visibility, 180° or More

- **180° or More: Using 345° as Desired Azimuth**
  - Rotate the bezel ring until the luminous line is over the fixed black index line.
  - Subtract 345° from 360° equals 15°.
  - 15° divided by 3 equals 5 clicks.
  - Rotate the bezel ring clockwise (right) 5 clicks.
  - Assume centerhold technique and rotate your body until you align the north-seeking arrow with the luminous line on the bezel.
  - Proceed forward in direction of the front cover's luminous dots, which align with the fixed black index line showing your desired azimuth, in this example 345°.

W226/OCT 03/VGT-3

Detouring an Obstacle



NOTE:

- **When turning right, ADD 90 degrees to your AZ.**
- **When turningleft, SUBTRACT 90 degrees from your AZ.**

W226/OCT 03/VGT-4