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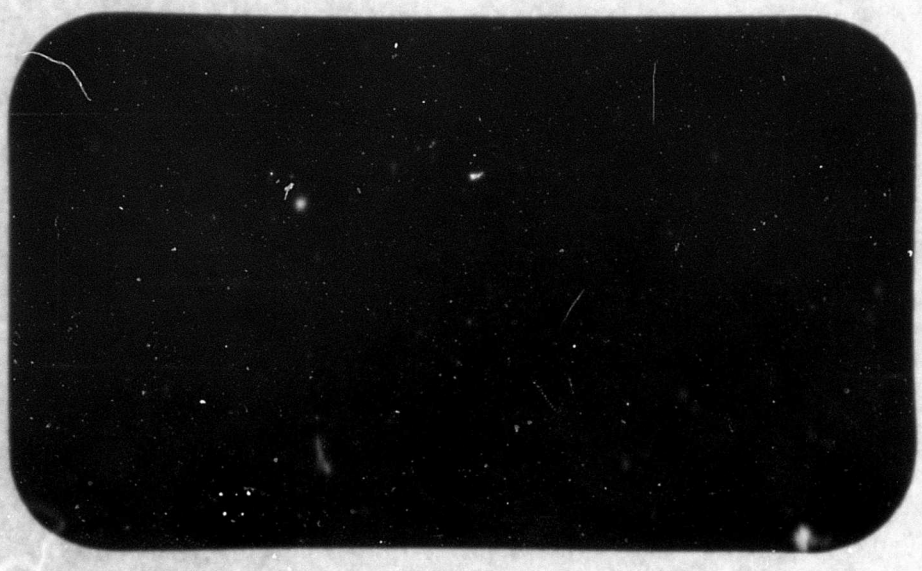

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RESEARCH MEMORANDUM

INSTRUCTOR'S GUIDE

ADVANCED LAND NAVIGATION: A PROTOTYPE COURSE

By

Staff, RIFLEMAN V

July 1963

Approved:

CARL J. LANGE
Director of Research

U.S. Army Infantry
Human Research Unit
Fort Benning, Georgia

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Composition of Research Team

The research team responsible for this effort consisted of the Task Leader, Dr. Thomas F. Nichols; the Subtask Leader, Mr. Theodore R. Powers; Lt Col Frank L. Brown (Ret); and Mr. Henry S. Rosenquist. They were assisted by MSgt David D. Sellers, SP 4 Ralph C. Nuss, SP 4 Richard C. Beacham, Pfc John E. Hesson, and Pfc Norman D. Cartledge.

Capt Harry K. L. Tom was Chief of the U. S. Army Infantry Human Research Unit at the completion of this study. When the Task was initiated, Lt Col Lyman H. Clark was Chief of the Unit.

This Instructor's Guide for Advanced Land Navigation is the product of research conducted by RIFLEMAN V to design and evaluate a program of instruction for land navigation at the level of Advanced Individual Training.

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ERRATA

The transparencies (T) GTA 21-6-1 (1 thru 48) listed in letter, ATIT-TNG-RSH, Hq CONARC, 6 Sep 63, Subject: HumRRO Developed Course in Advanced Land Navigation, are listed in the Instructor's Guide in numerical sequence by chapters.

The table below identifies each transparency according to the period in which it is to be used with regard to each numbering system.

INSTRUCTOR'S GUIDE Slide Numbers	TRANSPARENCY Numbers	INSTRUCTOR'S GUIDE Slide Numbers	TRANSPARENCY Numbers
1 - 1	(T) GTA 21-6-1 (1)	2 - 7	(T) GTA 21-6-1 (28)
1 - 2	" (2)	2 - 8	" (29)
1 - 3	" (3)	2 - 9	" (30)
1 - 4	" (4)	2 - 10	" (31)
1 - 5	" (5)	2 - 11	" (32)
1 - 6	" (6)	2 - 12	" (33)
1 - 7	" (7)	2 - 13	" (34)
1 - 8	" (8)	2 - 14	" (35)
1 - 9	" (9)	2 - 15	" (36)
1 - 10	" (10)	2 - 16	" (37)
1 - 11	" (11)	2 - 17	" (38)
1 - 12	" (12)	2 - 18	" (39)
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1 - 19	" (19)	3 - 6	" (46)
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2 - 6	" (27)		

PART I

Administration of Advanced Land Navigation Program

PART I

Administration of Advanced Land Navigation Program

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Chapter 1

INTRODUCTION

This Guide is intended to acquaint the instructor with the basic concepts and principles of the Advanced Land Navigation (ALN) Program. It is to be used in conjunction with the Lesson Plans included in Part II of this volume. It is hoped that the majority of questions that will arise during the implementation of the Program are answered in this Guide. Before giving an Advanced Land Navigation class, an instructor should read this Guide carefully in order to avoid errors in the interpretation of the instructional material.

The Program is divided into six periods. An outline of these periods is shown in Table I.

TABLE I

OUTLINE OF THE ALN PROGRAM

PERIOD	TITLE	TIME (Hours)
One	Review of Dead Reckoning	1
Two	Basic Skills in Map Interpretation	2
Three	Basic Skills in Map Interpretation	1
Four	Detouring Obstacles and Distance Determination	1
Five	Night Navigational Exercise	2
Six	Day Navigational Exercise	3

PURPOSE OF THE PROGRAM

This Program was designed to be given in Infantry Advanced Individual Training (ATP 7-18). It is aimed at the Light Weapons Infantryman (MOS 111), E-2 to E-4 in grade, who will be a member of a rifle company. A trainee who successfully passes this Program of Instruction should be able to navigate alone or in groups over most types of rough terrain, under all conditions of visibility, for distances of at least 3 kilometers, and arrive at an objective that is no more than 50 meters in width.

SIZE OF CLASS

This Program was designed for teaching ALN to a class of 150 to 225 students in 10 hours. Classes that are larger than this can also be trained in this Program, but more time will be required to conduct the field training.

NUMBER OF CADRE

During the classroom part of the Program (Periods One through Three), one principal instructor (PI) is required. The number of assistant instructors (AI) required will depend upon the size of the class, but it is suggested that there should be at least one assistant instructor for every 40 students.

One principal instructor and five assistant instructors will be required in Period Four, and two principal instructors and six assistant instructors will be needed in both Periods Five and Six. Thus, eight cadremen will be the maximum required for any period.

PRESENTATION OF THE PROGRAM

The Lesson Plans for the six periods are closely timed; however, if the principal instructor feels that he has an amusing story that will add to a teaching point, he may insert this type material, but he should always remain aware of the time limit imposed upon each period.

Perhaps the principal instructor will find that he presents the various teaching points in slightly different language than its written form in the Lesson Plans. This is quite acceptable, but it should be clearly understood that no deletions of basic concepts should be made.

This Program has been designed so that material that is presented in the early periods serves as a basis for the learning that takes place in the later periods. Therefore, there should be no deviation from the sequence of presentation, either in the periods themselves or in material within the periods.

Chapter 2

INSTRUCTIONAL AIDS

SLIDES

Colored slides are introduced in appropriate places in Periods One, Two, and Three to facilitate the teaching of specific points. There are twenty-one (21) slides for Period One, nineteen (19) slides for Period Two, and eight (8) slides for Period Three.

Reproductions of all slides are located in the Annex for the instructor's reference. The slides themselves are items of issue.

COMPASSES

Each student is furnished a lensatic compass for use in Periods One, Two, Four, Five, and Six. Prior to issue, each compass should be checked for accuracy and preset for line-over-arrow use on the first azimuth prescribed in Period One.

Instructions have been written for the new standard lensatic compass. This compass shows all degree markings in red, as they appear on the slides accompanying the Lesson Plans. In units where the older compass, with all dial markings in black, is still in use, the instructor must modify the Lesson Plans accordingly.

It is important that compasses given the trainees are serviceable. The following is an outline of the procedure for determining the serviceability of compasses.

1. Visual Inspection for Missing Parts
    a. All the compasses should first be opened to see that the cover glass is not broken, clouded, or cracked.
    b. The front cover should be inspected to see that the sight wire is not missing or bent.
    c. The eyepiece should be placed flat against the cover glass. The index line on the cover glass should bisect the sight slot. Then, with the compass closed, it should be noted that the sight wire also bisects the sight slot. This procedure will ensure that the eyepiece is not bent.
2. Inspection for Accuracy
    a. Select an outdoor area free from the influence of metal or powerlines where a working distance of 100 to 150 feet, cleared of obstructions to the line of sight, is available.
    b. At the inspection point, build a wooden platform upon which the compass may rest during the inspection. Set a 4 x 4-inch timber firmly in the ground with a 6 x 6-

inch board fastened to the top (below eye level) with wooden dowels. Nails (metal) must not be used in the platform.

c. Establish an aiming stake 100 to 150 feet away in a direction coinciding with any one of the 5-degree tick marks appearing on the compass dial. The exact location of the stake may be established by use of an aiming circle, an engineer transit, or, in the absence of either of these, a compass selected from among several that appear to agree exactly.

d. Trace the outline of the compass on the sighting platform so that each compass can thereafter be positioned quickly.

e. A compass to be inspected is positioned and sighted on the aiming stake, and then the dial is read. If the compass deviates more than two degrees in either direction, it should not be issued to students.

3. Inspection for Night Clarity

a. All compasses to be inspected should be opened and exposed to either natural or artificial light for at least 60 seconds prior to inspection.

b. After the inspector has adapted himself to darkness for one-half hour, he should read the dial of each compass. Also, he should align the luminous line and the luminous arrow. Compasses which are difficult to read because of poor luminosity should not be issued to students.

Normal eyesight is essential, of course, if the inspector is to make accurate decisions. After learning to read the compass, students should be directed to present for inspection any compass that may be read only with great difficulty. Again the question of visual acuity versus the defective compass must be answered.

THE BACK AZIMUTH AND DETOURING TRAINING AID

A Back Azimuth and Detouring Training Aid is to be provided for each student in Period One. It is reproduced in Figure 11, Period One of the Lesson Plan. Plastic replicas of this Training Aid should be standard issue for the ALN Program; however, if they are not available, the instructor must construct Training Aids for the students from Figure 11.

The Training Aid is first introduced in conjunction with the illustration of steering marks in Period One. The instructor should fully demonstrate its use at this point.

The Training Aid is to be used as a help in learning what procedures are necessary to compute the various azimuth changes. It should be stressed that this is a training aid only and will not be available to the Infantryman when actual navigation is demanded.

WORKSHEET

A drawing of the 360-degree part of the compass dial, showing only the north arrow and a series of short tick marks, is given each student in

Period One. He is to reproduce, using the Training Aid, the marking system used on the compass dial, and return the worksheet at the next class.

MAPS

There are two types of maps introduced in Period Two. The first type of map is a standard topographic map having a scale of 1:50,000. This particular scale is now the standard scale for tactical use at the level of the rifle company. Therefore, in the ALN Program, all topographic maps used by the trainees, both in the classroom and the field, should have a scale of 1:50,000.

It is understood that the declination diagram on maps is currently undergoing revision. It is suggested that the margin of the map sheet that is used in training be consulted for an explanation of how the magnetic declination is computed and presented for that particular map.

As will be seen, the Lesson Plans were written for the Columbus, Georgia, map sheets (Sheet 4048 IV, Series V745, Edition 3-AMS). This is because all experimental work for the Program took place at Fort Benning, Georgia. If the local conditions are such that the Columbus sheets are unavailable, or if their use is not desired, the Lesson Plans can be easily adapted to use any standard topographic map sheet. If other map sheets are used, appropriate changes must be made in the Lesson Plans.

The second type of map is a special plastic training map that will be available for issue. A map of this kind absolutely must be used when the material in Period Two is presented. In our research, we used map 100549, printed by Army Map Service, Corps of Engineers.

HANDOUTS

Period Two. A handout, "Measuring Distance Along a Curved Road," is given each student on which he must find the distance between two points on a curved road. This handout is to be used in conjunction with the Practical Exercise in Section V. A copy of this handout is attached to Section V, Period Two, of the Lesson Plan.

Period Four. A handout, "Detouring Major Obstacles of Unknown Dimensions," is given each student in Section I for use in learning how to detour large obstacles. A copy of this handout is attached to Section I, Period Four, of the Lesson Plan.

PACE CORDS

One pace cord is provided for each student for use in Periods Four, Five, and Six. Pace cords should be approximately 5 mm in diameter and 70-cm long.

RECORD CARDS, DISTANCE DETERMINATION COURSE

One Record Card is to be provided for each student for use in Section

II (Distance Determination) of Period Four. One side of the Record Card is tc be used by trainees and instructors in determining standard pace count. The reverse side of the Record Card contains instructions for the student pertaining to the Distance Determination Course. The Record Card is shown in Figures 12 and 13 of Period Four of the Lesson Plan. Reproductions of Record Cards for trainees are to be made from these Figures.

Prior to class, the instructor should enter a start stake number on each Record Card. Assignment to the 18 start stakes is to be evenly distributed among the trainees. Each trainee puts his name on his Record Card.

As each student completes the Distance Determination Course, instructors will determine (by reference to the Pace Count Conversion Card) the standard pace count for each student and will complete the appropriate portion of his Record Card.

PACE COUNT CONVERSION CARD

One Pace Count Conversion Card (Figure 14) will be provided for the PI and one for each AI for use in Section II (Distance Determination) of Period Four. To determine a student's standard pace count, instructors will read the total number of paces entered on the trainee's Record Card in the space marked "E to SS," find the 600-meter range into which the total falls, and use the data on the Conversion Card to fill in the appropriate portion of the trainee's Record Card.

The Conversion Data can be typed on a 2 1/2 x 3-inch card and covered in clear plastic for protection against wear and weather. It will be necessary to use both sides of the card.

CENTER CIRCLE STEERING MARK

Instructional aids used in the Distance Determination Section will be affixed to the center circle steering mark during the briefing of students in Period Four. These aids should be attached to the center circle steering mark in a manner that will allow quick removal after the briefing. The aids and their positions on the center pole are shown in Figure 5.

Steering Mark Panels

Two of the white steering mark panels, like the ones used on the actual course will be affixed to the center pole for demonstration. One will be marked, in red letters and numbers, as the panels appear in odd numbered lanes; and one will be marked in black letters and numbers, as the panels appear in even numbered lanes.

Intermediate Markers

Two of the intermediate markers like the ones used on the actual course will be affixed to the center pole for demonstration. These markers, white with diagonal stripes, will also be marked, one in black and one in red, to demonstrate their use in odd and even numbered lanes.

Blown Up Record Card

The enlarged top portion of a Record Card will be attached to the center pole above the other aids. Figures should be entered on this aid to emphasize the necessity for maintaining a continuous count over the assigned lane.

This card should measure 3 1/2 x 4 feet for a class of 200 men. It should be made from heavy card stock and covered in clear plastic for protection against wear and weather. The blown-up Record Card is shown in Figure 6.

ROUTE CARDS

One Route Card will be provided for each student in Period Five. A sample Route Card (Figure 15) is attached to Period Five of the Lesson Plan.

FLASHLIGHTS

One flashlight with a red filter will be provided for each pair of students in Period Five (Night Navigational Exercise).

COMBINATION MAP AND ROUTE CARDS

One Combination Map and Route Card will be provided for each student in Period Six (Day Navigational Exercise). A sample Combination Map and Route Card, Figure 16, is attached to Period Six of the Lesson Plan. This was printed at the Third Army Field Printing Plant at Fort Benning, Georgia. It is suggested that, if these are not available locally, an excellent substitute can be made by cutting the appropriate area out of a standard topographic map and pasting it on a route card. These cards can be encased in acetate and reused many times so that it is not necessary to use a new set of maps for each training company.

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Chapter 3

COURSE CONSTRUCTION

Detailed notes are presented in this chapter for the construction of field facilities. It is important that the Distance Determination Course, the Night Navigational Course, and the Day Navigational Course be properly constructed to ensure that the purpose of the Advanced Land Navigation Program is accomplished.

DISTANCE DETERMINATION COURSE

The Distance Determination Course is used in Period Four for determining the individual pace count for each trainee.

Terrain Requirements[1]

The course is based on one circle 650 meters in diameter and a second circle 50 meters in diameter located on a common center. Eighteen pacing lanes radiate from the smaller circle. These lanes are each 300-meters long. Since a trainee paces out and back, his pace count is established over a 600-meter course. Our research indicates that a pacing course must be at least 500 meters in length for an individual to get a reliable estimate of his pace count.

The aim in constructing this course is to provide each man with a lane of approximately equal difficulty that is typical of the area where the pace count will be used in navigation. For the course to remain reasonably constant in difficulty during use by many troops throughout the year, it should run through areas of more permanent type vegetation. An area covered by larger trees and second growth vegetation past the age of showing marked seasonal variation is to be preferred.

Course Layout and Construction[2]

Inner circle (see Figure 1). Select the common center point of the circles and set a flat-topped wooden post at a height slightly below eye level. Use the post as a rest for the compass while installing stakes and steering marks. Commencing at 360 degrees magnetic azimuth, set a start stake 25 meters from the center point every 20 degrees of arc around the full circle.

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1 Based on local terrain characteristics. Terrain should be typical of that over which the pace count will be applied.

2 The course can be laid out with the standard lensatic compass. If a transit and trained survey crew are available from an Artillery or Engineer Unit, employ them.

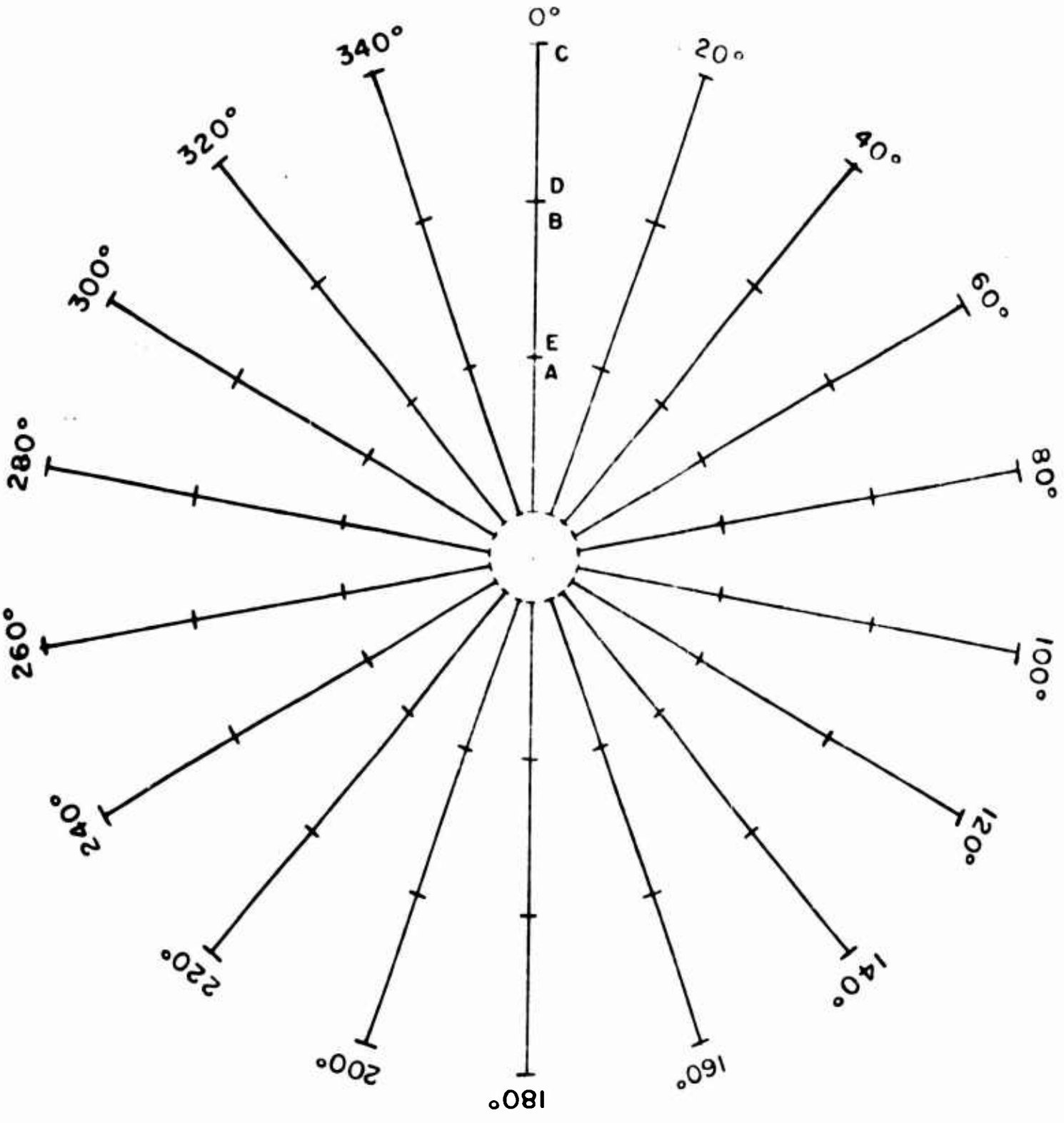

FIGURE 1. LAYOUT OF DISTANCE DETERMINATION COURSE

A common steering mark is located at the center of the circle. Diameter of the inner circle formed by the 18 start point stakes is 50 meters. Steering marks A/E, B/D, and C are 100 meters apart. All azimuths are measured from the center of the small circle before the common steering mark is erected.

Start stakes (see Figure 2). Paint eighteen 1" x 4" x 48" stakes white, and mark serially from SS 1 through SS 18 on both sides; the letters and numerals are approximately 5" high, 1" stroke. Odd-numbered stakes are lettered and numbered in red; even-numbered stakes are lettered and numbered in black. Set all start stakes 12" deep. Painting all surfaces prior to setting them in the ground may delay rotting.

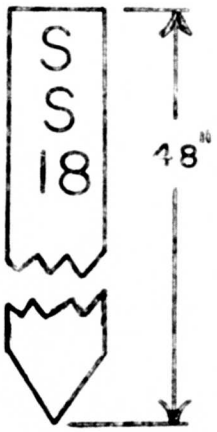

FIGURE 2. MARKING ON BOTH SIDES OF START STAKES

Steering marks (see Figure 3). Three steering mark panels are required for each of 18 lanes, a total of 54. Large panels are stapled to 1" x 4" x 54" boards with double-pointed tacks (staples), 3/4" long. Paint (or spray) the board and panels with two coats of white exterior paint on all surfaces. Letters and numbers on even-numbered lanes are in black; letters and numbers on odd-numbered lanes are in red. Both letters and numbers are 14" high, 3" stroke. A dash is placed between the letter and the number on each steering mark panel. Marine plywood is recommended for use as steering mark panels.

The numerals on each set of three steering marks correspond to the numerals on the start stakes (1-18, incl.). The steering mark in Figure 3 would be marked E-18 on the reverse side. Each A/E steering mark is 100 meters from its start stake. B/D steering marks are 200 meters from the start stake, and C steering marks are 300 meters from the start stakes. Each set of three steering marks must be on the same azimuth, from the center post over the start stake, at intervals of 100 meters. (Pacers move out from the start stake to steering mark "A," then to "B," then to "C." At "C," they face about and move back over the same route to "D" (reverse side of "B"), then to "E" (reverse side of "A"), and from "E" to the original start stake.)

Distance of 100 meters from the start stake to the first steering mark and between all steering marks must be exact. The first steering mark or intermediate marker must be clearly visible from its start stake and each

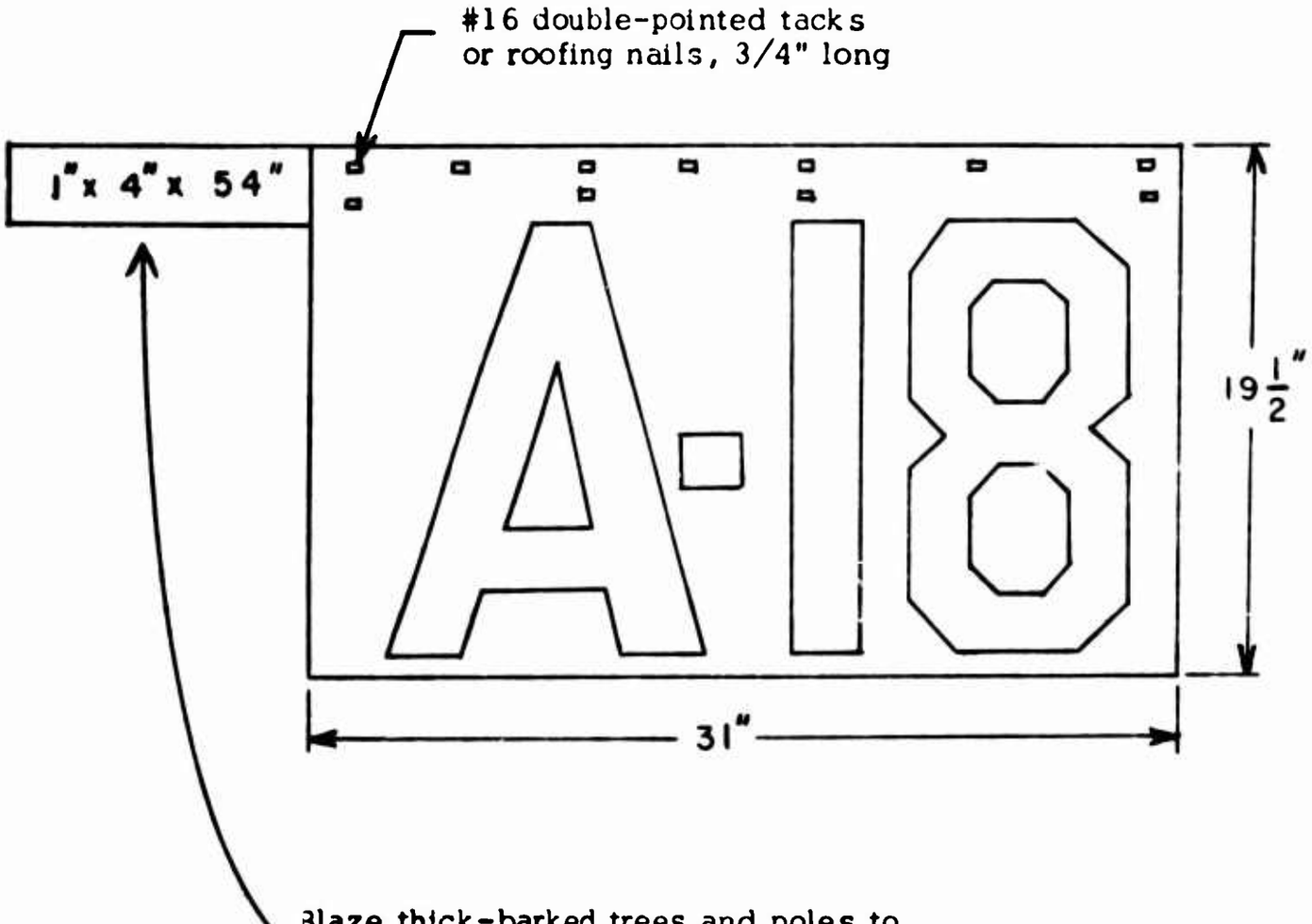

FIGURE 3. STEERING MARK PANEL USED ON DISTANCE DETERMINATION COURSE

steering mark or intermediate marker must be clearly visible from the one preceding it. Fasten the steering marks to poles or trees at the height giving best visibility. Remember that the successive steering marks must be visible on the way out and on the return after facing about at steering mark "C." Some cutting of limbs or trees may be necessary. Deviation of one or two paces from the lane azimuth can be tolerated to increase visibility without cutting limbs or trees, but the 100-meter distances must be rigidly controlled.

Intermediate markers (see Figure 4). In thickly wooded terrain, it may be impossible to mount the large steering mark panels so the panels can be read at 100-meter intervals. In such cases, use 1" x 4" x 48" intermediate markers to keep subjects on course between the larger steering mark panels shown in Figure 3. Intermediate markers are painted white on both sides with alternating 4" diagonal stripes. On even-numbered lanes, intermediate markers are black on white; on odd-numbered lanes, intermediate markers are red on white. The lane number, 3 1/2" high, 3/4" stroke, appears in the center on both sides of intermediate markers.

FIGURE 4. INTERMEDIATE MARKER

Center circle steering mark (see Figure 5). This pole, located at the center of the circle formed by the start stakes, serves as a common steering mark for all lanes during the last 100 meters from steering mark "E" to soldier's assigned start stake. The man guides on the marker, but halts at his start stake.

The steering mark panels, intermediate markers, and blown-up section of the Record Card (see Figure 6) are used during the briefing to ensure that the men are familiar with them. They should be removed from the pole before the men begin navigating on this course.

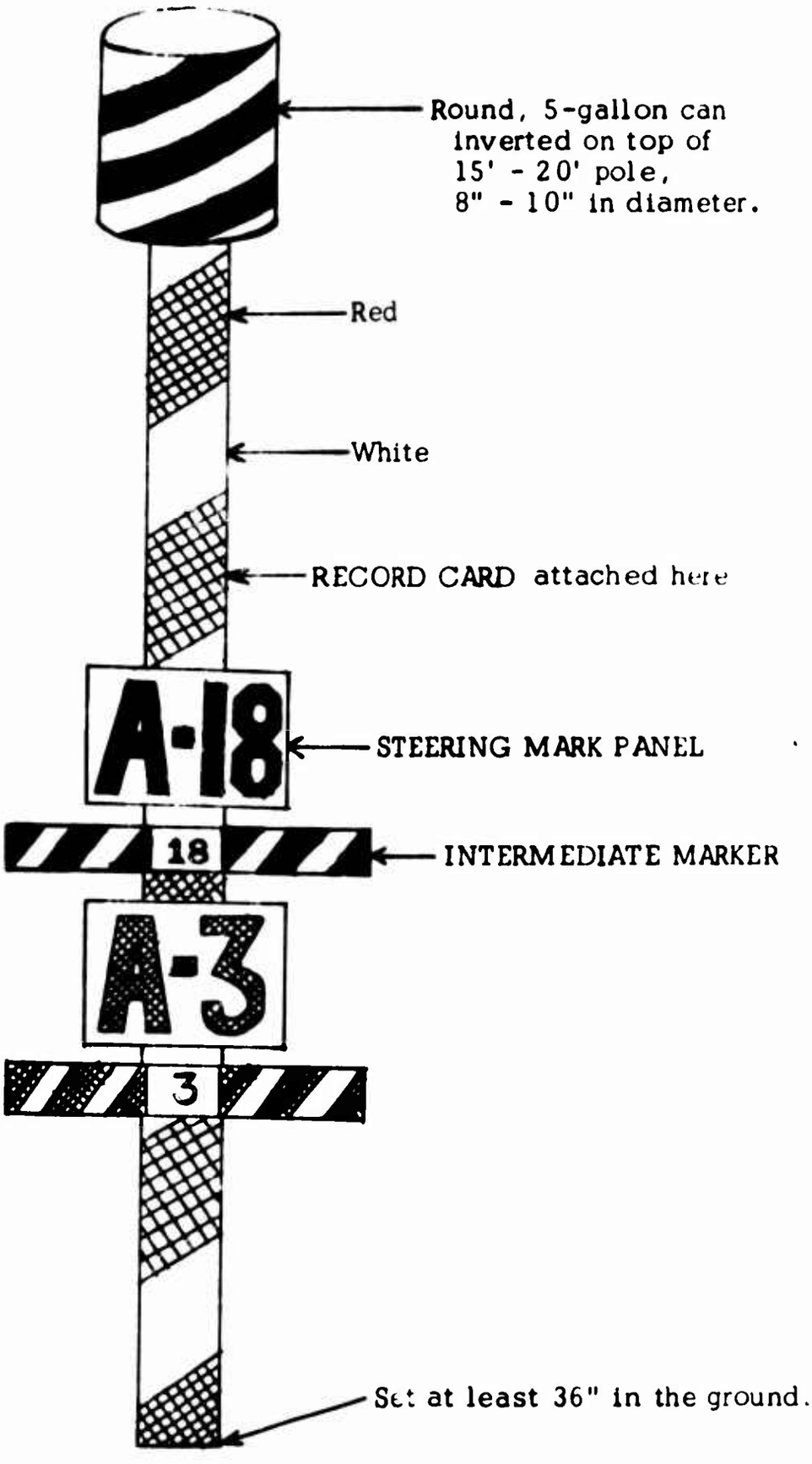

FIGURE 5. CENTER CIRCLE STEERING MARK

A blown-up section of the Record Card is given in Figure 6. The displays on the pole should be attached in a manner that allows quick removal after the briefing.

RECORD CARD
DISTANCE DETERMINATION COURSE

NAME BRITT, JAMES A.

START STAKE NO. 1

RECORD YOUR TOTAL PACE COUNT AT EACH STEERING MARK; DO NOT START A NEW COUNT AT EACH STEERING MARK.

SS to A	119	Paces
A to B	233	Paces
B to C	353	Paces
(Face about at C)		
C to D	471	Paces
D to E	593	Paces
E to SS	722	Paces

NUMBER OF KNOTS IN PACE CORD 6

GIVE CARD TO INSTRUCTOR

FIGURE 6. BLOWN-UP SECTION OF RECORD CARD, DISTANCE DETERMINATION COURSE.

This training aid should be at least 3 1/2 by 4 feet for a class of 200 men. The figures shown above are typical. Figures must be entered on the training aid to emphasize the necessity for maintaining a continuous count over the assigned lane. The training aid is made from heavy card stock and covered with clear acetate to protect it from wear and weather. It should be hung on the center steering mark pole above the panels and intermediate markers while in use.

NIGHT NAVIGATIONAL COURSE

Course Construction

The Night Navigational Course for Period Five will be laid out as shown in Figure 7.

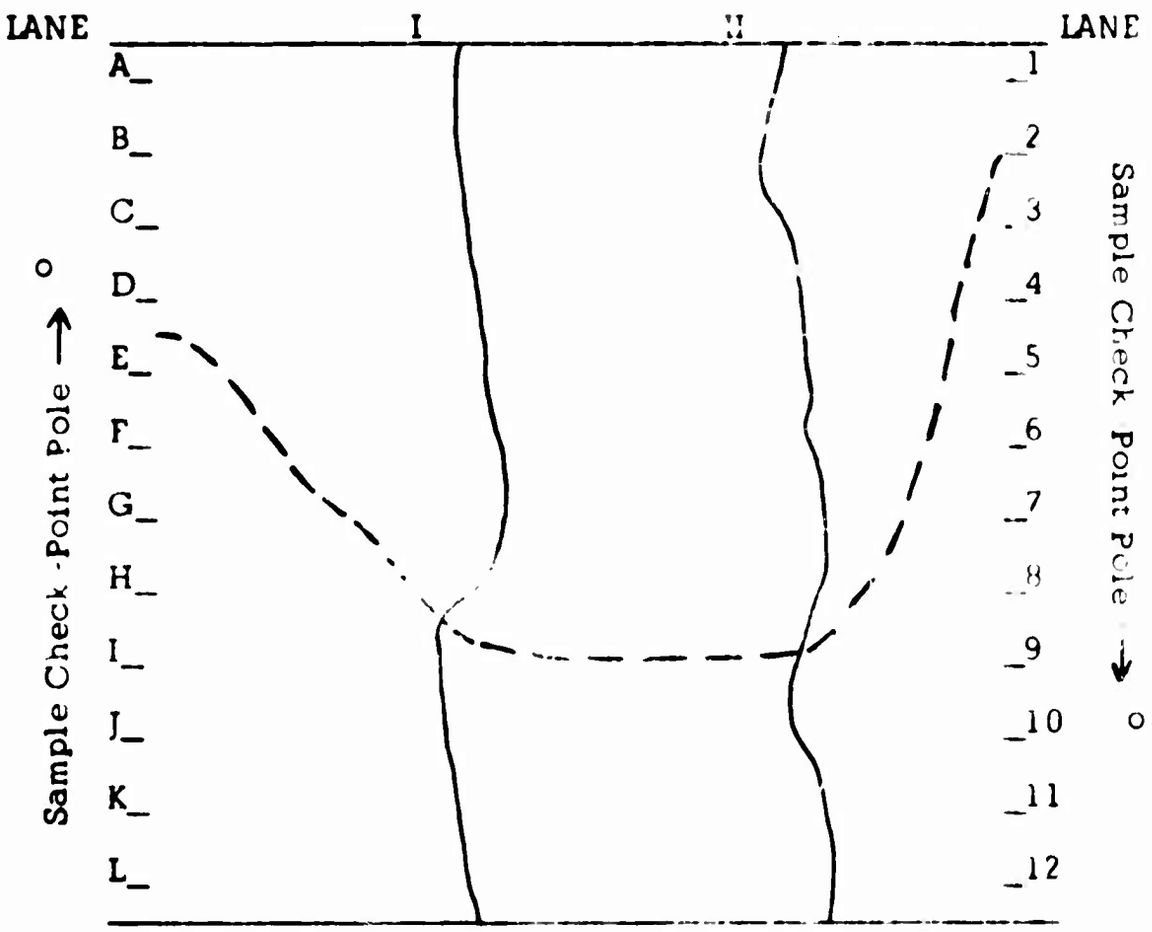

FIGURE 7. DIAGRAM OF THE NIGHT NAVIGATIONAL COURSE

Measurements of the course are 1600 meters on the long axis and 480 meters on the short axis. There are 40 meters between each of the 12 starting points at each side of the course. The starting points on the west side of the course are labeled A to L and those on the east side of the course are numbered 1 to 12. Routes that traverse the area between the two sides of the course are plotted. Since routes are not plotted in a straight line, the total course distance will be over 1600 meters. In the experimental course, total distances were approximately 1700 meters.

The course has three line-type check points crossing the entire width of the layout. Only two[1] of these line-type check points (I and II

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1 The third check point is used in the day course.

in Figure 7) are used in the night course. They should be natural terrain features spaced equally throughout the course.

Up and down the length of each line-type check point are the individual route check points. This is illustrated by the letters and numbers in the circles on the map in Figure 9. Thus, for any one route a specific point is selected on the line-type check point and this point is the check point for the particular route.

In the experimental program, we used two roads and a stream bed as the line-type check points. The terrain on either side of these features was varied enough so that map-terrain association easily could be accomplished. More important, these features entirely crossed the total width of the course and were essentially parallel to the starting points. It is suggested that if you cannot locate an area with such excellent line-type check points, an engineering company can be called upon to furnish a bulldozer. In about half a day, three simulated roads can be scraped across any area, and these roads can be hand drawn on the training maps.

Along these line-type check points and near the individual route check points are located yellow and black striped poles (trees may be used if permission can be gained from local sources) about ten-feet tall (see Figure 8). A red light is attached to each pole for use during the night exercise. On each pole is a map showing each individual route check point (see Figure 9). In the experimental program, a scale of about 1:2,500 was used and these were hand drawn. Since these were to be permanent, they were covered with acetate and have withstood the weather very well

Note that these striped map poles are <u>not</u> located exactly on a specific check point. They are distributed along the length of the chosen terrain features about 75 meters apart and at least 25 meters from the actual check point. They <u>must</u> be <u>visible</u> from the check point. The reason is that a trainee must go to what he thinks is his check point on the ground and then to a map pole. At the map pole he must determine (1) his location and (2) the location of his check point. Locating the map poles some distance away from the check points forces him to use map-terrain association. The locations of map poles are <u>not</u> indicated on the training maps; only the check-point positions are indicated.

<u>Routes</u>

There are 12 starting points on each side of the course. Twelve different routes are plotted between these points, but, since trainees are started concurrently on both ends of the course, there are, in reality, 24 different routes in use. These routes should be plotted according to local conditions. However, it is suggested that the following considerations be taken into account when the routes are plotted.

1. All routes should be approximately the same length.
2. All routes should have approximately the same amount of vegetation on them.

3. If possible, a training area should be selected that gives a wide variety of types of terrain over the length of the course. Since this course is designed to equip the navigator to move over difficult terrain, few areas should be rejected because they offer extremely dense vegetation or radical relief.
4. The terrain on either side of the line-type check points should be varied so that map-terrain association can be accomplished from maps mounted on poles near the route check points.
5. At the end of each leg of the route and on the line-type check point, there should be a recognizable terrain feature. This may be as distinct as a hilltop, for example, but can be such things as a bend in a road or stream.
6. All routes should be free of hazards.

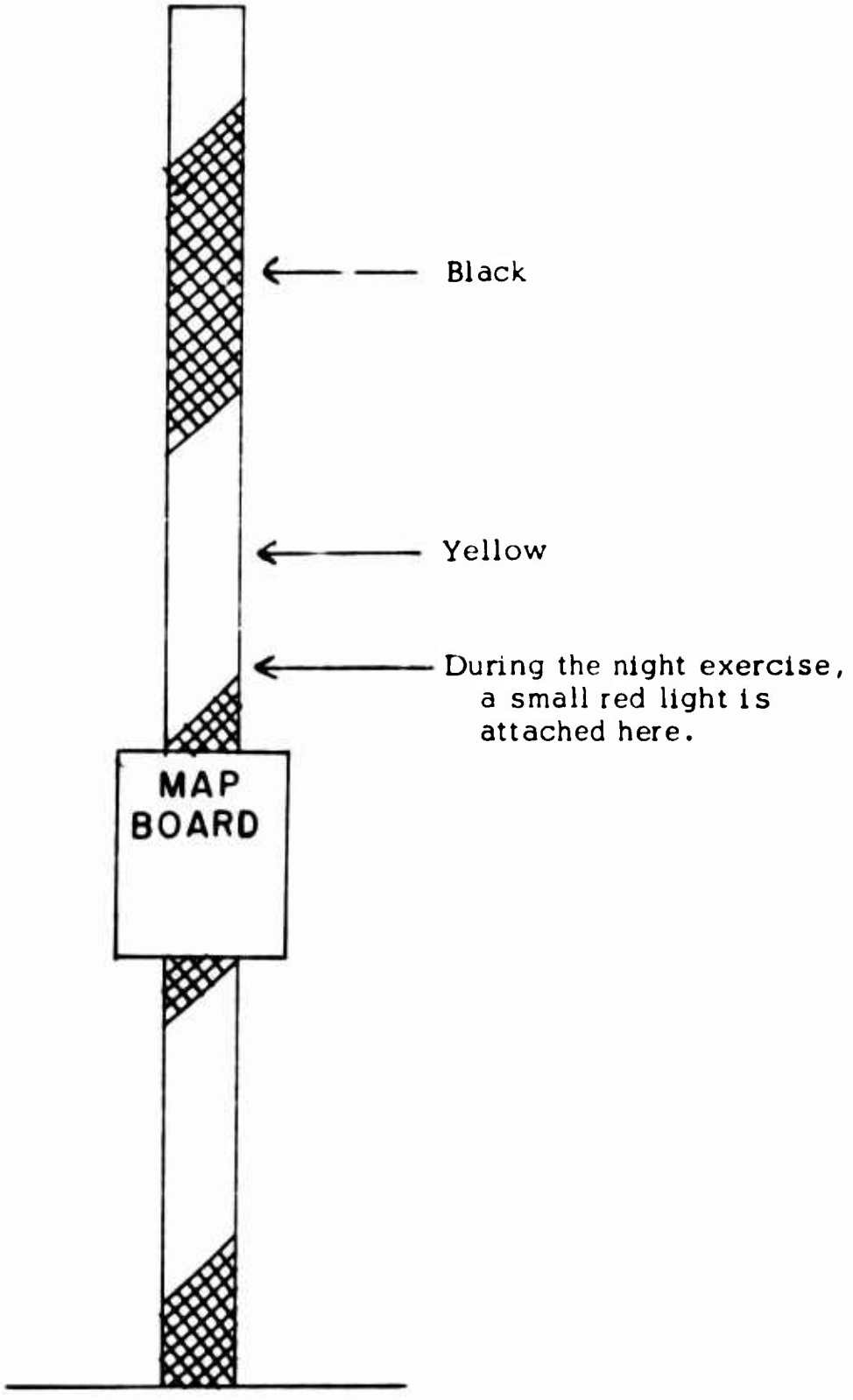


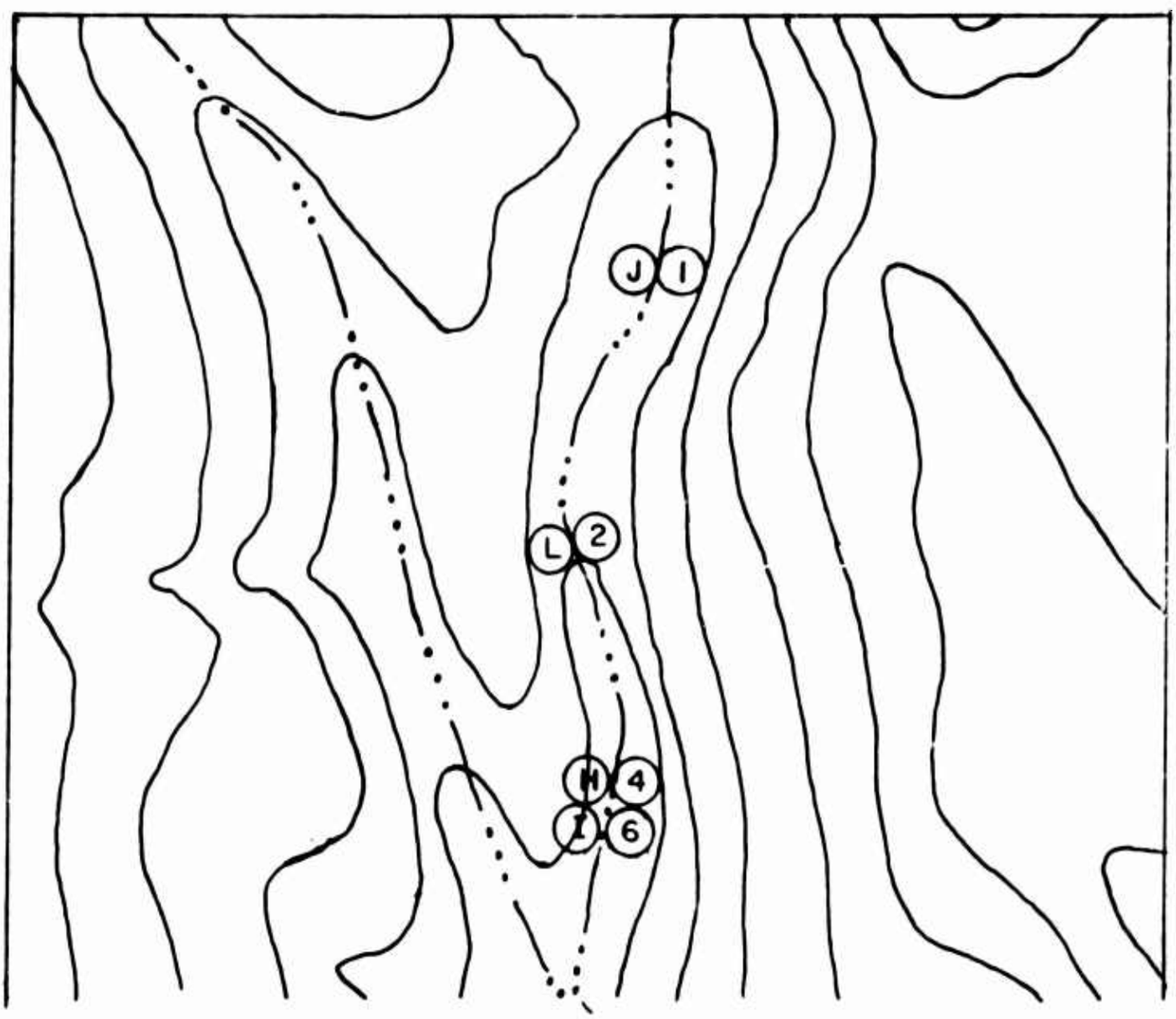
FIGURE 8. POLES USED IN NAVIGATIONAL COURSE

IF YOU HAVE NOT YET DETERMINED WHERE YOU THINK YOUR CHECK POINT IS ON THE GROUND, DO THAT FIRST AND THEN GO TO THE NEAREST POLE.

THIS POLE IS NOT A CHECK POINT.

HOWEVER BY LOOKING AT THIS MAP YOU SHOULD BE ABLE TO DETERMINE WHERE YOUR CHECK POINT IS ON THE GROUND.

1. The red letters and the green numbers indicate check-point positions.
2. Look on your route card and find the letter or number of the route.
3. Now look on this map, find the correct letter or number, and by map-terrain association determine whether you have arrived at your check point.
4. If you have arrived correctly, return to your check point and start on the next leg of your route.
5. If you have not arrived correctly, determine where your check point is on the ground and move to that point. Then start on the next leg of your route.



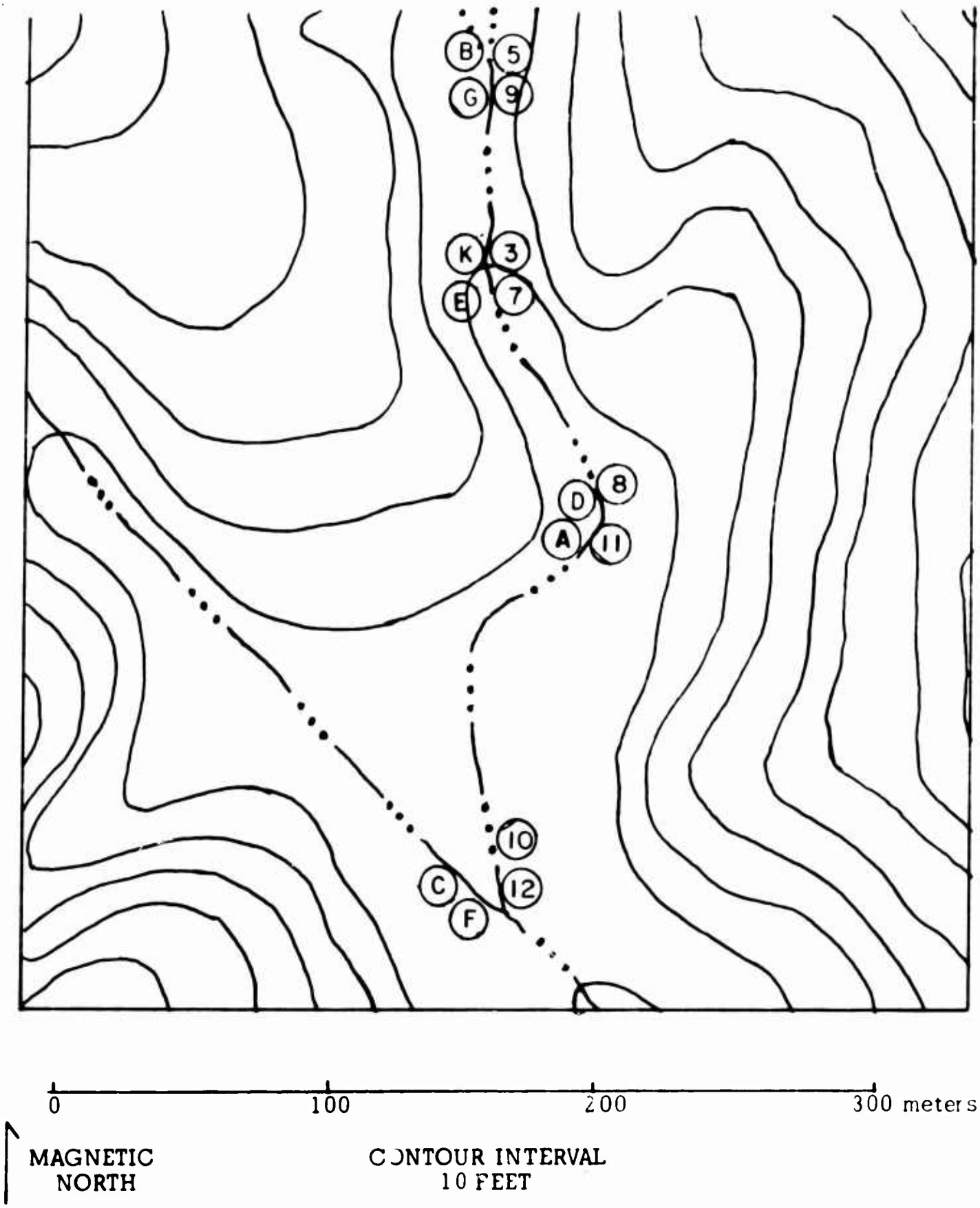


FIGURE 9. SAMPLE OF MAP INFORMATION ATTACHED TO POLES

NOTE: On the map board, these two sections are on a continuous sheet. They have been divided here for inclusion purposes.

DAY NAVIGATIONAL COURSE

The Day Navigational Course for Period Six will be laid out as shown in Figure 10.

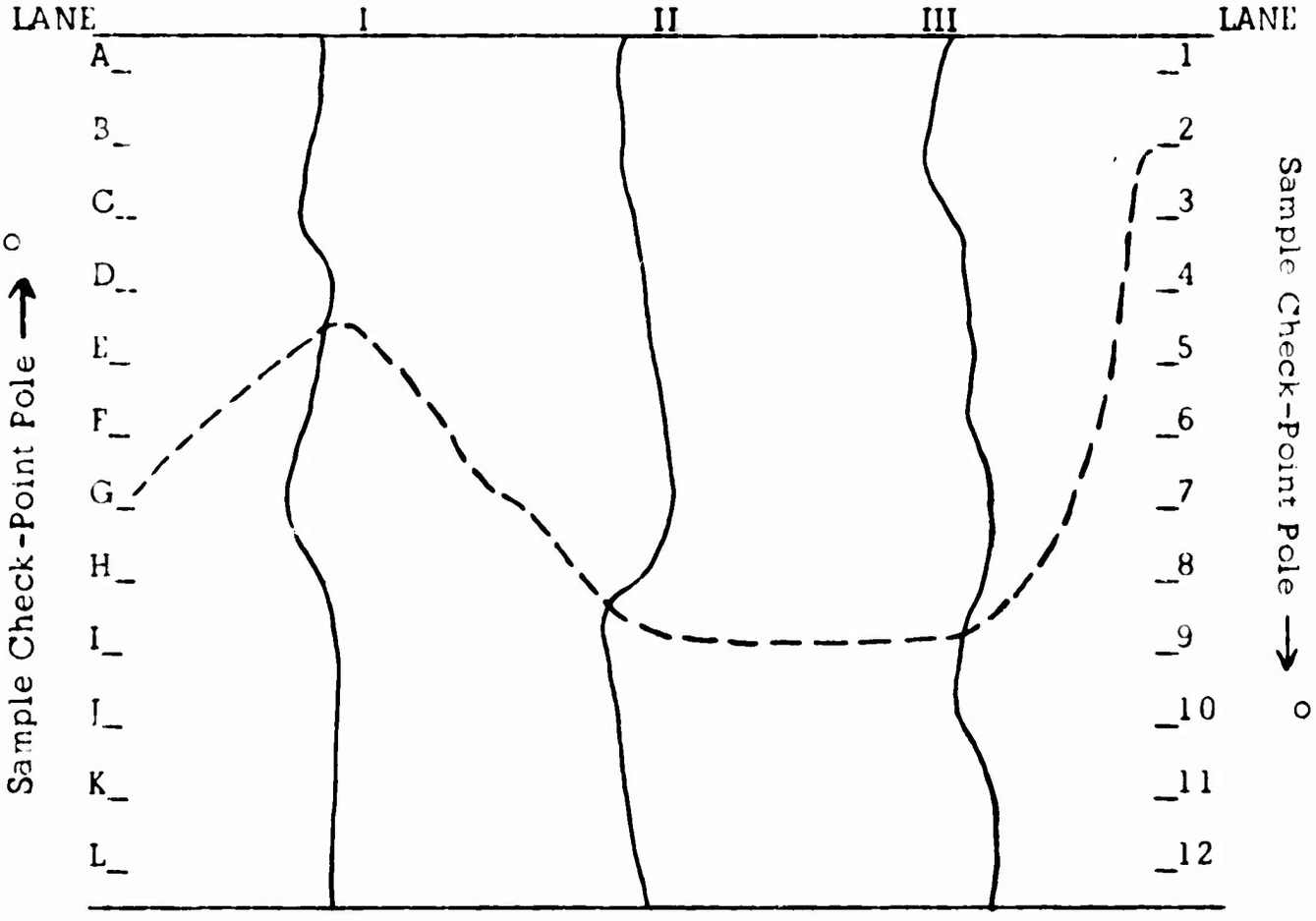


FIGURE 10. DIAGRAM OF THE DAY NAVIGATIONAL COURSE

The same course is used in this period as was used in Period Five with one modification. The starting points on only one side of the course are moved about 400 meters back from their night position. Thus, the starting points for the night routes on that side now become the first check points on that side for the day exercise. At the other side, the starting points remain unchanged. The day course is 2000 meters in length; the width remains the same. Again, routes that traverse the area between the two sides of the course are plotted. These routes should require the individual to navigate a full 2300-meter course.

There are now three line-type check points (I, II, III in Figure 10), which are natural terrain features, spaced equally throughout the course. Between the night and day exercises, yellow and black striped poles must be placed in the vicinity of the additional check points. This may be done at the time the start stakes are moved back 400 meters.

Chapter 4

SPECIFIC INSTRUCTIONS FOR CONDUCTING THE ADVANCED LAND NAVIGATION PROGRAM

PERIOD ONE

Compass Technique

The Advanced Land Navigation Program teaches a different compass-holding method than has previously been taught to trainees. This is called the center-hold technique and requires the navigator to position the compass approximately halfway between his chin and belt and to look out over the front cover to determine the direction of his azimuth. Along with this the compass should always be set on the desired azimuth by turning the bezel ring and aligning the north-seeking arrow with the luminous line on the cover glass.[1] This is usually referred to as the line-over-arrow technique.

Our research has indicated that the center-hold method, utilizing the line-over-arrow technique, is just as accurate as the more familiar sighting method. More important, the center-hold technique offers the following advantages over the sighting technique.

1. It is faster to use.
2. It is easier to use, as the number of steps required for efficient operation has been reduced from seven to two.
3. It can be used under <u>all</u> conditions of visibility
4. It can be used when navigating over all types of terrain.
5. It can be used without putting down the rifle; however, the rifle must be slung well back over either shoulder.

Trainees should be made to realize that the center-hold method of using the compass replaces the sighting technique; thus, the sighting technique should not be used in training.[2]

When using the center-hold method utilizing the line-over-arrow technique, steering marks may or may not be used. They should be used if the terrain is open and there are many good steering marks available, since this will enable the navigator to walk long distances on his azimuth without referring to the compass. They should not be used if the vegetation is very thick or if there are no suitable steering marks available. In these instances, the navigator should make frequent reference to his compass.

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1 Some older compasses may have two luminous lines on the cover glass. If this occurs, tell the trainee to use the <u>longer</u> line.

2 Sighting technique may be used in detouring large obstacles at night. See Period Four Lesson Plan.

Practice in Using the Compass

We have found that field practice in using the compass does not ensure success when actual navigation is tried. That is, a trainee may be able to demonstrate that he is capable of using the compass in a proficiency test, but he may become lost within a short period of time when actual land navigation is attempted. For this reason, we practice the center-hold compass technique in the classroom for only a short period of time, and the remainder of compass practice occurs during actual navigation.

Our research indicates that the lack of relationship between proficiency testing of compass usage and land navigational ability extends to most other land navigational skills. Therefore, if a unit commander wants to keep a record to indicate the land navigational ability of his company, he should not set up an individual skills proficiency test. Rather, he must set up an actual land navigational route and keep track of the number of trainees that are able to arrive at an objective within a time limit. Thus, if a proficiency check is desired in the present Program, it is suggested that a record be kept of the number of trainees hitting their objective during Periods Five and Six.

The commander should not expect 100 per cent of the class to reach the objective. Because of many variables over which we have no control, an acceptable level of proficiency is not specified. The commander must determine his own standards which should be in harmony with proficiency levels in other areas of training.

Questions and Answers

The questions and answers at the back of the Lesson Plan are supplied to the instructor to be used only when necessary. The actual instruction in the period requires approximately 50 minutes, but the questions and answers may be used if the instructor has some time left for a general review.

PERIOD TWO

Our research has indicated that the Infantryman will profit more from a complete understanding of six basic skills necessary for map reading than he will from just a passing acquaintance of the numerous skills that make up the entire area of map reading. These basic skills, which have been identified[1] as being necessary for the LWI to know, are thoroughly covered in Period Two.

Section I. Introduction to Map Reading

The important things to stress in this section are (1) the map presents

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1 Cogan, E. A., Willmorth, N. E., Findlay, D. C., A Survey of Map Skills Requirements, Technical Report 43, U. S. Army Armor Human Research Unit, Fort Knox, Kentucky, Human Resources Research Office, The George Washington University, Washington, D. C., September 1957.

a view of the ground as it appears from directly above, and (2) the map reader should make use of the printed information on the map if he is to interpret it correctly.

Section II. Grid Coordinates

In this section, the trainee is taught to compute and interpret correctly a six-digit grid coordinate. We teach only six digits because (1) more digits than this are extremely hard to determine accurately on a map with a scale of 1:50,000, unless a coordinate scale is used, and (2) it is extremely unlikely that the LWI would have occasion to be more precise than this in using grid coordinates.

It should be noted that the use of a plastic coordinate scale is not specified in the Lesson Plan. Our research has indicated that the trainee is capable of determining a six-digit coordinate by the "eyeball" method with enough accuracy for his purposes. The reason for not specifying a coordinate scale was simply that under ordinary combat conditions the LWI does not have one of these available for his use.

Section III. Topographic Symbols

The only concept to be stressed in this section on topographic symbols is that the ten rules presented are principles which should be applied to interpret various groups of map symbols. Thus, the instructor should not, when the slide dealing with water is presented, for example, discuss each type of water portrayed by the solid blue color. Rather he should stress that, by applying one basic principle, the trainee will be able to identify this particular symbol as some type of water which is always present, whether it be lake, river, creek, etc.

The use of basic principles to interpret topographic symbols has two main advantages. The first of these is that, by utilizing these ten specific principles, at least 72 different topographic symbols can be identified accurately. The second is that our research has indicated that many LWI's do not retain the required knowledge for specific symbols, but are able to retain a basic principle which may be applied to a wide variety of cases.

Section IV. Contour Interpretation

In this section, the student is taught how contour lines on a map show the relief of the land and how interpretation of these contour lines enables the map reader to identify five primary terrain features.

It is in this section that the plastic training map (see Chapter 2) is used the most. The important thing here is to have the trainee realize that the flat map on the left represents a two-dimensional view of the relief map on the right. Thus, when he looks at the flat map, he should visualize, in his mind, a picture of the terrain as it appears in the three-dimensional map on the right. To accomplish this end, there are several instances in which the trainee is asked to compare an area on the flat map with the same area on the relief map. The PI and the AI's should monitor the class closely to see that the trainees are making this comparison.

After the trainees are taught how contour lines show the relief of

the land, they are shown how these lines can be used to identify five primary terrain features. These five primary features have been established in order to standardize the labeling of terrain features in all sections of the world. By having a standardized description, all map readers will be able to communicate more effectively.

Section V. Map Distance Measurement

The important concept to stress in this section is that a map reader should be as careful as possible when he measures distances on the map. Even small errors in map measurement can cause large errors on the ground.

The trainee is required to make three measurements in practical exercises. The measurement points referred to in the Lesson Plan were arbitrarily chosen; therefore, the instructor must select similar points for the map sheet he uses. Whatever the distance selected, the class should be allowed a tolerance of 25 meters on each side of the desired answer, since measurements more accurate than this are extremely difficult to make.

Section VI. Map Orientation

Map orientation is a very simple concept, but many trainees do not understand it. The AI's should be very careful to check and see that all trainees have oriented their maps correctly since they must know this procedure in order to determine azimuths, which is taught in the next section.

The trainee is required to orient both the plastic and the topographic maps. The plastic map has a given declination of 13 degrees. It is important that, whatever topographic map sheet is used, it should have a different declination from the plastic map, so the trainees will realize that declination is not the same from map sheet to map sheet.

Section VII. Determining Azimuths

In this section, the student learns to determine magnetic azimuths between points on a map. In teaching this section, emphasize that the map must be oriented, that the map should not be moved from its oriented position, and that the compass cover should extend in the direction of travel. If the latter is not done, the back azimuth will be obtained, which yields a 180-degree error.

In the practical exercise, it is permissible to let the trainees use the Back Azimuth and Detouring Training Aid to solve problems on back azimuths and detour azimuths. However, stress that the exact procedure for making these computations must be learned, since the Training Aids are not available in navigational situations.

PERIOD THREE

Section I, Check-Point Recognition

Although the Infantryman will rarely plot his own route, it is important for him to know the limitations of any route that is given hi , the various types of check points he will encounter as he navigates, and the advantages

and disadvantages of each of these types of check points.

It is important to stress to the trainees that the examples given in the conference and demonstration are not the only check points that may be encountered. They should realize that knowing the advantages and disadvantages of the types of check points is what is important, not information about a specific check point.

Section II. Geographical Orientation

Geographical orientation is probably an entirely new concept to the trainees. The instructor should make clear to them that basically, in this section, they are being taught to make "mental notes" as they navigate, so they will be able to walk in any general direction even without a map or a compass.

This period is not as closely timed as some of the other periods, therefore, the instructor should feel free to ask a few appropriate questions at the end of the period.

Section III. Sun-Stick-Shadow Method of Determining Direction

This method was first published in the January 1962 issue of Field and Stream in an article by Robert Owendoff. We realize the limitations of this natural method of direction finding. It is many times not altogether accurate as a method of determining direction; however, if the limitations listed below are observed, it can be very useful as a general method of indicating direction.

1. If possible, use the method between 1000 hours and 1400 hours.
2. Be extremely accurate in marking the tips of the shadow, since a small mistake in marking can yield a large directional error.
3. The method is best used between 60 degrees north and south latitude.

The more familiar watch and sun method of direction finding is only accurate for short periods during the spring and fall of the year, and at other times may yield errors up to 23 degrees. There is also the obvious disadvantage that the watch and sun method does require a piece of equipment, while the sun-stick-shadow method merely requires objects gathered in the field.

Section IV. A Review of Methods of Land Navigation

Two methods of land navigation, dead reckoning and map-terrain association, are taught in this Program. The Advanced Land Navigation Program does not stress either method. Rather, the trainee should learn both methods with sufficient proficiency so that he can make an appropriate judgment on which method, or combination of methods, he should use depending on the environmental condition.

PERIOD FOUR

Section I. Detouring Obstacles

The instructor should stress that no special technique needs to be

used to detour small obstacles, such as trees, bushes, small clumps of dense vegetation, etc., but he must emphasize that a count must be maintained of all paces taken that are on the route azimuth. For large obstacles, such as minefields, swamps, etc., specific instruction is given on how both a forward count and a count of deviation off the route must be maintained. It should be made clear to the trainee that this specific method need only be used to detour large obstacles.

Section II, Distance Determination

In the second part of the period, the trainee establishes one individual pace count which he should use to navigate over most types of terrain and under all conditions of visibility. The pace count is established for 25, 50, 75, and 100 meters.

It is important that trainees learn to routinely tie a knot in the pace cord during this period, so they will have this habit firmly established by Periods Five and Six.

Starting the trainees on the course should offer no problem since one instructor can easily handle three lanes; however, it is important that, as the trainees return, all instructors work as quickly as possible to fill out the Record Card. Our results indicate that 200 men can establish their pace counts in 27 minutes, and this includes making out the Record Cards!

If a trainee has an obviously incorrect count (all counts for 100 meters should be from 95 to 150), he should be required to pace the course over again. Since pacing comprises at least 50 per cent of dead reckoning, it is vitally important that all trainees get an accurate count during this period.

PERIOD FIVE

Conduct of Night Navigational Exercise

The company is split into two equal groups which move to opposite ends of the course. The procedure used is exactly the same for both groups. During this period, the trainees navigate in pairs. After the PI gives the 10 minutes of instruction to the entire group, the group is equally distributed among 12 starting points. Each AI and the PI are responsible for three starting points. An instructor will start one pair (at route 1, for example), move to his next assigned starting point (route 2), and then move again to his last starting point (route 3). He will then retrace his steps (route 2, route 1, etc.) until all pairs assigned to him are started. The experimental program indicates that, if there are 200 men in a company, all men should be started within 12 minutes after the PI completes his instruction. It should be remembered that men are started from both sides of the course at the same time. Thus, half the company is going in one direction (east, for example) and the other half will be going in the opposite direction (west, in this case). This method keeps any one route from having a large number of men on it going in the same direction and thus avoids the problem of bunching up.

Trainees are instructed, in this period, to navigate to their check points and then to move to a map pole to verify their position. It is important that the instructor make sure all trainees understand this concept.

When all men have started, the selected AI's will move immediately to their assigned check points. At the check point, they will patrol up and down the length of the check point and will have three main duties.

1. They will assist any trainees that appear confused. This will be accomplished by taking him to the nearest map pole, telling him where he is, where he is going, and discussing with him any navigational problems he is having.
2. They will break up any large groups of trainees that are traveling together
3. They will enforce light discipline.

Those instructors who do not move to the check points will stay at the ends of the course and receive troops as they finish. The finishing points of the routes are marked with the appropriate route numbers; thus, when a trainee comes to the end of the course, he can compare his route card with the symbol on the sign and tell whether he has navigated correctly. If he is off course, he can go to an instructor, tell him where he finished, and the instructor will tell him how many meters he was off and in which direction. Each instructor should carry a master list of starting and finishing point stakes for this purpose.

Since a trainee carries only a route card and a compass in this exercise, the basic navigational tool used is dead reckoning. However, even on the darkest night, a trainee should remember what terrain he has crossed. By referring to the map near the check points, he should be able to determine his approximate check-point location by map-terrain association.

PERIOD SIX

Conduct of the Day Navigational Exercise

Before the day exercise, the start stakes at one end of the course must be moved back 400 meters from the night exercise position, and the third check point must be set up.

The company splits into the same groups as in Period Five; however, each group goes to the end of the course opposite from where it was in Period Five. Basically, the same instructions and procedures are used in this period as were used in Period Five, with two exceptions. First, each trainee is required to navigate alone. Second, along with the route card, the trainee is supplied a map with his route marked on it. The experimental group used a combination map and route card as described in Chapter 2 and pictured in Period Six Lesson Plan.

When the trainee is navigating and goes to a map pole near a check

point, he should compare his route card map, the map on the pole, and the ground around him. In this way, he will realize how the terrain features on the ground appear on maps with two very different scales. This is important since, with increased patrolling and dispersal, more and more map substitutes will be used.

It is in this period that the trainee receives the majority of instruction in navigation by terrain features. Although the LWI will not always have a map when he is navigating, the purpose of this period is to teach the trainee how to recognize terrain features on the ground, how to move by using these terrain features, and only lastly how to do actual navigation while having a map in his hand.

It is hoped that in this period the trainee, since he navigates alone, will develop a basis for selecting a navigational method for any particular mission. Our research indicates that there are some trainees who cannot count their paces accurately enough for this type of distance estimation to be of any use to them; therefore, dead reckoning, for this group of people, will be of little use.

However, we also have evidence indicating that some trainees are incapable of interpreting a map correctly, regardless of the amount of training they have received. In these cases, dead reckoning is the best solution.

By knowing various methods of navigation, the trainee can develop the capability to navigate accurately on any mission, regardless of the type of terrain and the level of illumination.

Chapter 5

DEFINITION OF SOME COMMON NAVIGATIONAL TERMS

Some of the navigational terms used in the present Program may be unfamiliar to the instructor, Below are listed and defined the more common of the terms used. It is suggested that, for other terms not included here, the Dictionary of United States Army Terms, AR 320-5, January 1961, should be consulted.

Azimuth: A direction expressed as a horizontal angle. This is always given in degrees when used in land navigation and is measured clockwise from north.

Check Point: A predetermined point on the earth's surface used as a means of controlling movement. The end of each leg of a route should always be at a check point. Check points can be either natural or man-made features and should always appear on a map.

Dead Reckoning: A method of navigation that requires the ability to determine an azimuth and to compute distance traveled. In land navigation, this is usually accomplished by using a lensatic compass for direction and by counting paces to estimate distance traveled.

Land Navigation: Movement from point to point across unfamiliar terrain. This may be accomplished by a variety of navigational techniques.

Leg of a Route: This is a section of a route. The specific azimuth, distance, and check point differentiate it from other legs of the same route.

Map Reading: This is made up of the knowledges and skills necessary to correctly and efficiently interpret the information contained on a map.

Map-Terrain Association: This is a method of land navigation by which the navigator pre-selects terrain features that appear both on his map and on the ground and then regulates his movement by these features. This is sometimes called Navigation by Terrain Features or Ground Navigation.

Relief Map: A type of map in which the configuration of the ground is shown by raised sections.

Route: This is the specific navigational plan of movement from a starting point to an objective. It is usually composed of several legs for which an azimuth, the distance, and a check point are required.

Steering Mark: This is a cultural or natural feature that is selected by the navigator as an indicator of direction because it is on or near his route. Steering marks are usually small (trees, bushes, etc.) and thus do not appear on maps.

PART II

Lesson Plans

PERIOD ONE

PREPARATION DATA SECTION

1. TITLE:	Advanced Land Navigation: Review of Dead Reckoning
2. TYPE OF INSTRUCTION:	Conference, demonstration, and practical exercise
3. HOURS OF INSTRUCTION:	One (1) hour: first of ten
4. CLASS PRESENTED TO:	
5. PURPOSE:	To review dead-reckoning procedures and to provide instruction and practice in holding, reading, and sighting the compass in connection with selection and use of steering marks
6. INSTRUCTOR REFERENCES:	Instructor's Guide: RIFLEMAN V
	FM 21-26, Chapter 7
7. INSTRUCTIONAL AIDS:	Twenty-one (21) slides
	One (1) lensatic compass for PI and each student[1]
	One (1) roster of students
	One (1) pencil per student
	One (1) notebook,[2] pocket size, per student
	One (1) worksheet per student (See example attached to Lesson Plan)

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1 Prior to issue, each compass should be checked for accuracy and preset for line-over-arrow use on the azimuth prescribed by the PI. Students will be instructed to leave the compasses set as issued, and not to remove them from the pouches until told to do so. Instruction for checking compasses for accuracy may be found in Chapter 2 of this Guide.

2 The student will keep the notebook, and bring it to each class during the course.

PERIOD ONE

7. INSTRUCTIONAL AIDS: (concluded)	One (1) Back Azimuth and Detouring Training Aid for PI and each student. (See example attached to Lesson Plan)
8. STUDENT UNIFORM AND EQUIPMENT:	Uniform: as required Equipment: none
9. PHYSICAL FACILITIES:	Standard classroom and sound equipment One (1) slide projector One (1) screen for projection of slides Blackout curtains or opaque shades for windows One (1) pointer for instructor
10. PERSONNEL REQUIREMENTS:	One (1) principal instructor Assistant instructors as required
11. TROOP REQUIREMENTS:	None
12. TRANSPORTATION REQUIREMENTS:	As required
13. AMMUNITION REQUIREMENTS:	None
14. SPECIAL SOUND EQUIPMENT:	None
15. EVACUATION PLAN:	The principal instructor will familiarize himself with the evacuation plan for the classroom or building in which the class is presented.
16. PRINCIPAL INSTRUCTOR'S CHECKLIST FOR PROBLEM REHEARSAL AND PRESENTATION:	SOP preclass check of classroom, platform, lights, charts, air conditioning or heating, sound equipment, and after-class clearing of classroom.
17. SAFETY FACTORS:	As required

18. COORDINATION: As required

19. REMARKS: Students are seated at wooden tables equipped with all necessary training aids. Metal tables are not suitable for uses of the compass required in this and other classroom periods.

Prior to class, select three azimuths as instructed on page 46.

OUTLINE OF MATERIAL TO BE PRESENTED

I.	Introduction and Purpose	(3 minutes)
II.	Training Goals	(1 minute)
III.	Description and Practice of the Line-Over-Arrow, Center-Hold Technique	(30 minutes)
IV.	Selection and Use of Steering Marks	(9 minutes)
V.	Use of Land Navigation Skills to Report Information	(2 minutes)
VI.	Summary	(4 minutes)
VII.	Instructions for Worksheet	(1 minute)
VIII.	Questions and Answers	

Break

NOTE: No time is allotted for the questions and answers. These are provided for use when a class has a few minutes of extra time at the end of this period.

LESSON PLAN
PERIOD ONE

REVIEW OF DEAD RECKONING

DIRECTIONS: BEFORE CLASS PERIOD BEGINS, PLACE PENCILS, NOTEBOOK, COMPASS, WORKSHEET, AND TRAINING AID ON STUDENTS' TABLES.

I. INTRODUCTION AND PURPOSE

DIRECTIONS: INSTRUCT STUDENTS NOT TO REMOVE COMPASSES FROM POUCHES. THEN SHOW SLIDE ONE.

A. During basic training, you gained some proficiency in land navigation. Emphasis throughout the basic course was to teach you to dead reckon to the vicinity of a check point (POINT) or an objective, then to correct using terrain recognition based on map study.

1. In dead reckoning, you used a route card (POINT) showing direction, distance, and description of each check point or objective. You used the compass (POINT) to determine and maintain direction from one steering mark to the next on one azimuth between check points.

2. A check point is an easily identified point, such as a road junction, used either to control movement or as a reference point for reporting the location of friendly troops and for the adjustment of artillery and mortar fire. Check points appear on the map and on the ground and are usually selected for you by a leader.

3. Steering marks, such as trees, stumps, boulders, etc., rarely appear on the map. You, as a navigator, must select steering marks on the ground.

4. Distance was determined by counting paces, and converting paces to meters. You used a pace cord (POINT) and tied one knot for each 100 meters traveled. Specific methods of detouring were also learned.

5. During the Advanced Land Navigation Program, you will again use these basic skills. The purpose of the advanced training is to increase your ability to move

accurately and rapidly over many kinds of unfamiliar terrain by night or by day.

DIRECTIONS REMOVE SLIDE ONE.

B. Bring your notebooks and Back Azimuth and Detouring Training Aids to all classes. Use your notebook for taking notes in class and for doing simple arithmetic when detouring and using back azimuths. The Training Aid can be used as a substitute for a compass during study after class (HOLD UP TRAINING AID).

II. TRAINING GOALS

On completion of this training, you will navigate over a 1700-meter rough route at night, crossing small streams and moving through thick brush on three different azimuths to an objective approximately 40-meters wide. At night, you will train in buddy pairs. The day navigation problem requires each man to move alone over a rough, thickly wooded route approximately 2300-meters long on four different azimuths. You must reach your objective within a time limit.

III. DESCRIPTION AND PRACTICE OF THE LINE-OVER-ARROW, CENTER-HOLD TECHNIQUE

DIRECTIONS. SHOW SLIDE TWO.

A. Stand, take out your compass, and perform each step as I explain it. Place the movable parts of the compass in their proper positions.

1. Rotate the thumb loop from the locked position to the holding position underneath the compass.

2. Place your thumb through the thumb loop and your forefinger around the front of the compass case (POINT).

3. Open the cover and extend it flat.

4. Raise the eyepiece (POINT) to the highest position to make the dial fully visible from above (POINT).

5. Use your free hand to steady the compass and shield it from glare.

DIRECTIONS: REMOVE SLIDE TWO; THEN SHOW SLIDE THREE.

6. Position the compass at the vertical center of your body approximately halfway between your chin and the top of your belt (POINT). This position minimizes possibility of compass error from iron in the metal magazines, grenades, or a slung weapon (POINT). Note that the rifles are slung well back, away from the compass (POINT).

7. Vary the height of the compass hold so you can best read the dial directly by day without using the magnifying glass in the eyepiece. Use the magnifying glass by night to read detour azimuths.

8. Hold the compass level so the dial is free to rotate and is parallel to the rim of the cover glass. If you tilt the compass, the dial will stick and cause error. Be careful to avoid this common error.

9. Brace your elbows and forearms against the sides of your chest to ensure a steady hold.

10. Stay directly behind the compass, squarely facing the prescribed azimuth (POINT). If you turn only the compass or merely twist your body to obtain correct compass alignment, your first step will be off-course. Turn on your feet when aligning the compass.

11. Get the feel of the correct hold and use the same hold consistently for all navigation.

DIRECTIONS: AI'S WILL MAKE CORRECTIONS. REMOVE SLIDE THREE; THEN SHOW SLIDE FOUR.

B. Be seated, and leave your compasses open flat on the desk. You must be thoroughly familiar with the markings on the compass used during navigation. By knowing exactly what the pertinent marks look like, you will reduce chances of misreading the compass. This is very important during darkness when you must set the broken luminous line over the arrow

with a prescribed azimuth under the index line. When detouring at night, leave your line over arrow set on the forward azimuth and read the detour azimuth through the magnifying lens. Correct readings are essential to accurate navigation. On your compass dial, note each of the characteristics as I describe them.

NOTE: This instruction was written for the new standard lensatic compass. This compass shows all degree markings in red, as they appear on the slides accompanying the Lesson Plans. In units where the older compass, with all dial markings in black, is still in use, the instructor must modify the Lesson Plans accordingly.

1. The black, outer scale (POINT) is not, repeat not, used in land navigation.

2. The red, inner scale (POINT) used for land navigation is a full circle, 360 degrees.

3. Each mark on the red, 360-degree scale is worth 5 degrees (POINT).

4. The red, inner 360-degree scale is numbered every 20 degrees, clockwise from the luminous north arrow.

DIRECTIONS: POINT TO INDICATE CLOCKWISE DIRECTION.

NOTE: Point out 20, 40, etc., around the dial to the right, clockwise, to 340 degrees. The luminous north arrow (POINT) represents both zero and 360 degrees, but no numerals appear for this marking.

5. The short, unnumbered tick marks on the red, 360-degree inner scale show azimuths ending in 5, such as 5 degrees (POINT), 15 degrees (POINT), 125 degrees (POINT), etc.

6. The long, unnumbered tick marks on the red scale show azimuths ending in zero, such as 10 degrees (POINT),

90 degrees (POINT), 270 degrees (POINT), etc. All these long, unnumbered tick marks are multiples of 10; only multiples of 20 are numbered.

7. In the field, you will most often use magnetic azimuths read directly from the compass dial to the nearest five degrees. In this training, magnetic azimuth is simply a direction measured in degrees, read clockwise (POINT) from the magnetic north arrow. The azimuth toward which the compass is pointed is always under the index line.

8. When the compass dial is free to rotate and not affected by iron or electrical fields, the luminous arrow (POINT) points to magnetic north, an azimuth of 360 degrees. To use the compass with a map, remember that north is toward the top (POINT) of the map.

9. East, the general direction of sunrise, is at a magnetic azimuth of 90 degrees, clockwise (POINT TO INDICATE CLOCKWISE MOVEMENT FROM 360 DEGREES TO 90 DEGREES) from north. A luminous "E," meaning east, appears on the dial and 90 degrees is shown by the long, unnumbered tick mark (POINT) halfway between the numbered azimuths of 80 degrees (POINT) and 100 degrees (POINT). On maps, east is on your right (POINT) as you face the map with north at the top.

10. South is halfway around the compass dial at an azimuth of 180 degrees (POINT). Read the dial numbers, one, eight, zero. Note that south is not marked with a luminous letter. South is toward the bottom of maps (POINT).

11. West, the general direction of sunset, is three-fourths of the way clockwise (POINT TO INDICATE CLOCKWISE MOVEMENT FROM NORTH TO 270 DEGREES) around the dial at 270 degrees. A luminous "W," meaning west, appears on the dial. West, 270 degrees, is shown by the long, unnumbered tick mark (POINT) halfway between the numbered azimuths of 260 degrees and 280 degrees. West is toward the left (POINT) on a map sheet.

12. Your forward route azimuth is always read, to the nearest 5 degrees, directly under the long, black index line (POINT) from the inner, red, 360-degree scale.

DIRECTIONS: REMOVE SLIDE FOUR;
THEN SHOW SLIDE FIVE.

C. Keep the compass away from iron alloys such as weapons, etc. Although the issue flashlight is made of plastic, the metal battery cases may cause error at distances under six inches (POINT). Metal magazines in the ammunition pouches on your belt (POINT) may cause compass error. A stainless steel cigarette lighter or wristwatch case are examples of personal objects that can cause compass error. You can check any item by placing it near the compass and watching for dial movement. Power lines, barbed wire fences, field guns, tanks, and large trucks may demand clearances to 60 meters. Note that nails or other iron in wooden tables such as you are now using may cause compass error.

DIRECTIONS: REMOVE SLIDE FIVE.

D. Now you will learn how to set the broken luminous lines on the cover glass for reference by day or night.

1. Let me explain this procedure first; then you will practice it.

DIRECTIONS: SHOW SLIDE SIX.

a. Hold the compass level at the center-hold position, away from weapons, or other metal, and turn on your feet until the prescribed route azimuth, say 50 degrees (POINT), appears directly under the black index line as in the slide.

DIRECTIONS: REMOVE SLIDE SIX;
THEN SHOW SLIDE SEVEN.

b. Place the index finger of the compass-holding hand up and over the cover hinge and exert pressure backward. This provides a firm hold on the compass so you can turn the cover glass without disturbing the azimuth.

DIRECTIONS: REMOVE SLIDE SEVEN; THEN SHOW SLIDE EIGHT.

c. With the 50-degree tick mark directly under the index line, rotate the cover glass until the luminous north arrow (POINT) is directly under and in alignment with the broken luminous line (POINT) on the cover glass. Once the compass has been preset, you can align the north arrow and the broken luminous line (POINT) and your forward route azimuth will be under the black index line (POINT). By night, the numbers on the dial are difficult to read through the lens. But the correctly aligned luminous markings will permit you to move accurately on your assigned azimuth by day or night without reading the numbers except when detouring obstacles.

DIRECTIONS: REMOVE SLIDE EIGHT.

NOTE: Prior to commencing the class, select a minimum of three, unnumbered tick marks representing azimuths from the direction of the class toward the instructor. This will permit the class to stand, set the compass three times on three different azimuths, and continue throughout to maintain instructor-class contact. Lights must be on during this drill. Azimuths _____, _____, and _____.

2. Now stand, hold the compass at the center-hold position, and turn on your feet until an azimuth of _____ degrees appears directly under the black index line.

a. Without disturbing the compass reading, place the index finger of the compass-holding hand up and over the cover hinge and exert pressure backward. Hold the compass firmly between the index finger and the second finger with the thumb through the thumb loop.

b. With the free hand, grasp and turn the movable cover glass until the broken luminous line is

directly over and aligned with the luminous north arrow.

c. Read the azimuth appearing under the black index line, and make any adjustments essential to a correct setting of the luminous display.

d. Use this hold only for setting the compass. Use the center hold for sighting. If you have difficulty, raise your hand. An AI will assist you.

NOTE: AI's will spot check readings and correct errors, including compass-holding errors, and assist men who fail to grasp the procedure. Repeat the practice indicated by 2(a)--2(d) for the other two azimuths.

e. Be seated, please. The hold and alignment procedure you have just practiced is called the line-over-arrow center hold.

f. During navigation, use this technique habitually except on detours at night. When navigating with a preset compass by day, align the luminous display first; then check your dial reading under the index line and make any necessary correction. Stay directly behind your compass, facing your azimuth squarely.

DIRECTIONS: SHOW SLIDE NINE.

During darkness, the aligned luminous display alone shows when your prescribed route azimuth is under the index line. To read detour azimuths at night, focus the lens and read the detour azimuth under the black index line. Leave your luminous lines set for the route azimuth while detouring. When detouring by day, read detour azimuths directly from the center-hold position.

DIRECTIONS: REMOVE SLIDE NINE.

g. At a check point, it usually is necessary to change the setting of the line over arrow for a different azimuth. During darkness, use a diffused red flashlight under a poncho to avoid detection by the enemy. Hold the flashlight between your knees at least six inches away from the compass. The battery cases in the flashlight may cause error if held closer to the compass. Do not use an unshielded light. That will destroy your night vision. When no light is available, use the lens in the eyepiece to read all azimuths.

DIRECTIONS: SHOW SLIDE TEN.

h. In summary, remember that, with a preset compass with the luminous markings correctly aligned:

(1) Your direction of movement by day is indicated by the black index line and the sight wire (POINT).

(2) By night, the black index line and the imaginary line between the two luminous dots indicate the direction of movement. The sight wire may be seen at night, also.

(3) The prescribed route azimuth is under the black index line. I say again, the azimuth indicating your route direction is under the black index line (POINT).

(4) The luminous arrow on the compass dial points to magnetic north. The only time you would follow the north arrow would be on a prescribed azimuth of 360 degrees. On all other route azimuths, the black index line and the sight wire or luminous dots indicate the direction of movement.

DIRECTIONS: REMOVE SLIDE TEN.

IV. SELECTION AND USE OF STEERING MARKS

A. Definition. A steering mark is any well-defined, easily visible

object on the ground to which a navigator can move or his prescribed azimuth.

B. Purpose. Steering marks permit you to move rapidly and accurately for the longest distance possible over the best walking available from one compass sighting position to a more distant sighting position on the same azimuth. Line over arrow provides one technique for day or night use and no blocking of view of steering marks occurs.

C. Description. The most useful steering mark:

1. Lies directly on the route azimuth.

2. Provides a specific point on the ground to move to as opposed to moving in a general direction.

3. Sticks out like a sore thumb from everything around it.

4. Is distinct in color, shade of color, size or shape, preferably all four, as seen among surrounding objects.

5. May be a boulder, bush, tall tree, log, stump, etc., and infrequently a man-made object, such as a water tank, a fire tower, or a building.

6. Is usually between you and a check point or the objective and usually marks the point of your next sighting.

7. Usually permits fast, accurate movement and reduces the number of sightings with the compass.

DIRECTIONS: SHOW SLIDE ELEVEN.

D. Illustration of a steering mark. This soldier (on the slide) is moving toward one of two pine trees that stand alone in a clearing. The pine tree to his front (POINT) is directly on his azimuth. It has all the characteristics of a useful steering mark. If he were subject to enemy fire in the clearing, he could detour the clearing and, on arriving on the far side (POINT), use his back azimuth to the pine tree to get back on course. Set your Training Aid (DISPLAY) on a route azimuth of 110 degrees. Note the back azimuth is 290 degrees. A back azimuth is simply the direction opposite to your forward route azimuth. To obtain a back azimuth, subtract 180 degrees if the forward route azimuth is more than 180 degrees; if the

forward azimuth is less than 180 degrees, add 180 degrees. For example, a forward route azimuth of 5 degrees would have a back azimuth of 180 plus 5, or 185 degrees.

DIRECTIONS: REMOVE SLIDE ELEVEN.

E. Selection and use of steering marks

1. After setting the prescribed azimuth on your compass, align the broken luminous line over the luminous arrow and sight in the direction indicated by the black index line and the sighting wire or luminous dots.

2. Select the most distinct (color, shade, size, shape), far and high steering mark judged to be most easily seen from all points on the prescribed azimuth between you and the steering mark.

DIRECTIONS: SHOW SLIDE TWELVE.

This soldier has selected a high, far, distinct steering mark. The route to his front indicates that the steering mark can be reached. He will use the best walking available to detour the ditches (POINT), but he will count only the forward paces.

DIRECTIONS: REMOVE SLIDE TWELVE; THEN SHOW SLIDE THIRTEEN.

3. Study the steering mark to obtain a good view of it in relation to surrounding objects; learn what it looks like. This soldier is pointing to a group of pines which are about the same size and color. Even a tree directly on your azimuth is often difficult to recognize as compared to other trees. Look for some difference in each steering mark that will help you recognize it.

DIRECTIONS: REMOVE SLIDE THIRTEEN; THEN SHOW SLIDE FOURTEEN.

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Look at the steering mark toward which this soldier is pointing. It is close, but it is easy to recognize. It has all the characteristics of a good steering mark except distance.

DIRECTIONS: REMOVE SLIDE FOURTEEN; THEN SHOW SLIDE FIFTEEN.

4. After a clear view of the steering mark, look at the route to see if you can pace to the steering mark without losing sight of it.

5. If the far steering mark appears that it may be quickly lost from view because of movement into dense brush, downhill, etc., select the next best steering mark that can be kept in view during movement to it. At this big tree, a steering mark you can see across a valley to the far ridge, the location of your objective (POINT). But if you select a steering mark on the high ground across the valley (POINT), you will lose sight of it quickly as you descend into the brush-choked valley. Select steering marks that you can keep in view during movement to them.

DIRECTIONS: REMOVE SLIDE FIFTEEN; THEN SHOW SLIDE SIXTEEN.

6. When a steering mark is lost to view, resight and select a new steering mark immediately. This soldier (POINT) selected one small pine tree among many similar trees on the far edge of a clearing. He is still moving in the general direction of his route, but he has lost sight of his steering mark. He should halt, resight, and select a new steering mark immediately.

DIRECTIONS: REMOVE SLIDE SIXTEEN.

7. When no steering mark is visible on the prescribed azimuth, select a distinct, distant steering mark that can be reached on either side, just off the route. On reaching the steering mark, correct to the prescribed azimuth before resighting. Correct by estimating the distance or by using a back azimuth on the preceding steering mark. We will cover this in greater detail in Period Four.

DIRECTIONS: SHOW SLIDE SEVENTEEN.

Sighting over the black index line and the sight wire, you see that your route passes between these two pine trees (POINT). No better steering mark appears on the route azimuth. What will you use for a steering mark? Answer: The tree nearest the route azimuth. On reaching the steering mark, correct to the prescribed azimuth by moving the estimated distance from the tree nearest the route to the true route or by adjusting on your last position with a back azimuth.

DIRECTIONS: REMOVE SLIDE SEVENTEEN.

F. Effect of darkness on visibility of steering marks

1. Colors disappear during darkness and objects appear as black or gray silhouettes.

2. Close objects and skylined objects may serve as steering marks at night.

3. Trees, bushes, and similar objects appear to change shape because you see them from slightly different angles as you move up or down hills and when you are detouring obstacles. This applies to a lesser degree by day, too.

4. When no distinct steering marks are visible, maintain direction by frequent reference to the compass. Use the center-hold, line-over-arrow technique. Face your whole body toward the route azimuth as indicated by the black index line and luminous dots. By facing squarely on the route azimuth, you step off on the prescribed route; do this by day as well as by night so it becomes a habit. An effective compass hold lets your compass point the way just as if it were mounted in a boat or an aircraft.

V. USE OF LAND NAVIGATION SKILLS TO REPORT INFORMATION

All soldiers are responsible for reporting military information observed en route. Location of objects or activity is essential in any report. Report a location directly on your route by furnishing the distance, to the nearest 25 meters, from your last check point. Your leader, who plotted

your route on his map, can locate your position.

DIRECTIONS: SHOW SLIDE EIGHTEEN.

This soldier (POINT) has reached a minefield on his route that was not mentioned in the briefing by his leader. As pace man of a patrol, in this situation, you would furnish the patrol leader the distance, to the nearest 25 meters, from the last check point. Navigating alone, you would be responsible for reporting the location and the estimated size of the minefield. This navigator is pointing to a good steering mark on the far side of the minefield (POINT). He can see the right boundary of the minefield (POINT). He will detour this minefield to the right, counting only his forward paces.

DIRECTIONS: REMOVE SLIDE EIGHTEEN; THEN SHOW SLIDE NINETEEN.

This soldier sees an enemy tank (POINT) halted about 600 meters off his route. The soldier first reports his own position, the distance, to the nearest 25 meters, from the last check point. Then he shoots an azimuth from his location to the tank, and estimates the distance in meters from his location to the tank to complete the report.

DIRECTIONS: REMOVE SLIDE NINETEEN; THEN SHOW SLIDE TWENTY.

VI. SUMMARY

A. Briefly review the center-hold technique.

1. Keep the compass level with the dial parallel to the rim of the cover glass at a point midway between the top and bottom of the bowl.

2. Avoid iron alloys and electrical fields that cause compass error. Keep hand-held weapons and objects of similar size at least one meter from the compass. Field tests indicate that a slung rifle, pushed well to the rear (POINT), and a helmet (POINT) worn by the compass user will have no effect on compass accuracy when using the center hold or sighting at eye level.

3. Stay directly behind the compass; consistently use the same hold.

DIRECTIONS: REMOVE SLIDE TWENTY.

B. Briefly review the line-over-arrow technique.

DIRECTIONS: SHOW SLIDE TWENTY-ONE.

1. Correct alignment demands that the prescribed azimuth be under the black index line and the luminous arrow be directly under the broken luminous line.

2. Use the line over arrow as a reference to ensure that the prescribed azimuth is under the black index line by day and night, when moving on the forward route azimuth. By night, use the luminous markings only on the forward route azimuth. Use the hold shown in the slide (POINT) only for setting the compass.

3. Set the broken luminous line directly over the north arrow with the prescribed azimuth directly under the black index line. You must make these settings at each check point. At night, a diffused red light must be used under a poncho to avoid detection by the enemy.

4. After the prescribed azimuth is set correctly on your compass, use the index line and sight wire or luminous dots as indicators of direction of movement.

DIRECTIONS: REMOVE SLIDE TWENTY-ONE.

C. Emphasize the necessity for using steering marks.

1. Few men walk in a straight line for any appreciable distance. Recall the crooked, wandering trails seen in the woods and fields. Accuracy demands that you use good steering marks when they are available so you will move on one azimuth or detour accurately when necessary.

2. Make frequent, but brief, references to the compass when no satisfactory steering marks are visible on or near the prescribed route. Do not waste time with unnecessary

sightings or attempt to walk while watching the compass reading.

D. Ask the men if they have any questions. The PI and all AI's will be available during the break to answer questions or demonstrate techniques.

VII. INSTRUCTIONS FOR WORKSHEET

On each desk, you found a drawing of the red, 360-degree part of the compass dial, showing a north arrow and a series of short tick marks. By increasing the length of some of the tick marks and numbering others, you can reproduce the markings used on the red, 360-degree scale of the compass dial. Use a pencil for this work. Look at your Training Aid as a help in placing the long tick marks and numbers. Return these worksheets at your first Advanced Land Navigation class tomorrow. Check your worksheet against your Training Aid and put your name, rank, and serial number in the spaces provided for them.

Any questions?

Bring your notebooks and Training Aids (DISPLAY) to ALN class tomorrow. Use your Training Aid to become familiar with detour and back azimuths. Turn the route azimuth arrow to any assigned azimuth, and your back azimuth and detour azimuths will appear at the ends of the other arrows. Become familiar with the angles involved. You must know how to determine 90-degree detours, either right or left, and a back azimuth, which is always 180 degrees from your route azimuth.

VIII. QUESTIONS AND ANSWERS

DIRECTIONS: SOME CLASSES PROGRESS MORE RAPIDLY THAN OTHERS. WHEN TIME PERMITS, USE THE FOLLOWING QUESTIONS. ASK THE QUESTION AND PAUSE LONG ENOUGH FOR EACH MAN TO FORMULATE AN ANSWER; THEN CALL ON ONE MAN BY NAME FROM THE CLASS ROSTER TO ANSWER THE QUESTION. AFTER EACH QUESTION IS ANSWERED, INDICATE ACCURACY OF SOLDIER'S ANSWER AND REPEAT THE ANSWER SHOWN IN THE LESSON PLAN TO FIX THE POINT FOR THE CLASS.

I have covered the answers to most of the following questions; others will require thought on your part. Think in terms of what you expect to do

in the field; do not merely recall and repeat words. Look at or hold your compass if this will help you answer a question.

QUESTION 1: If your route azimuth is 45 degrees, would you see a long tick mark, a short tick mark, or a numbered tick mark on the red degree scale under the index line?

ANSWER: A short tick mark. All azimuths ending in 5 degrees are shown by short tick marks.

QUESTION 2: If you were instructed to move northeast for 200 meters to a security position, what azimuth would you use? Explain your answer.

ANSWER: The correct azimuth would be 45 degrees. North is at zero or 360 degrees, east is at 90 degrees. So northeast would be halfway between zero and 90 -- at 45 degrees.

QUESTION 3: What is the magnetic azimuth representing west on the compass dial and how is it shown?

ANSWER: West is at 270 degrees on the red scale. It is shown by a long tick mark halfway between the numbered azimuths of 260 degrees and 280 degrees. A luminous "W" also appears on the dial at 270 degrees.

QUESTION 4: What may happen if the compass is tilted during sighting and how can tilting be prevented?

ANSWER: The dial may stick and cause the wrong azimuth to appear under the index line. Tilting can be prevented by holding the compass level as indicated by a free swinging north arrow. When the line-over-arrow technique is used correctly, you know the compass is not tilted or sticking when the arrow swings freely into position directly under the broken luminous lines.

QUESTION 5: We have just agreed that failure to hold the compass level may cause error; what else may cause an incorrect reading to appear under the index line?

ANSWER: Use of the compass near iron alloys, such as weapons, stainless steel rings or steel watch cases. Always keep six inches of clearance between a flashlight and the compass to prevent the metal battery cases from causing compass error when setting the luminous lines even under a poncho in enemy territory.

QUESTION 6: Why should you consistently grasp and hold the compass in the same position and turn on your feet to align the compass on a specified azimuth?

ANSWER: By using the center-hold, line-over-arrow technique and facing squarely in the direction of movement from a position directly behind the compass, sighting is likely to be more accurate and you are less likely to step off-course then if you turn only the compass or twist your body at the waist to get a correct alignment.

QUESTION 7: What is the advantage of using steering marks when navigating?

ANSWER: Accurately selected steering marks ensure that each successive sighting is made on the correct azimuth. At the same time, the navigator can detour minor obstacles, such as thick briers, etc., and always return to his steering mark prior to resighting on the same azimuth.

QUESTION 8: If a navigator loses sight of a steering mark during movement, what should he do?

ANSWER: Select a new steering mark on the prescribed azimuth immediately. If no steering marks are available on the azimuth, use one slightly to the right or left of the azimuth and correct to the proper azimuth on reaching the steering mark. Correction must be based on an estimate of the distance noted from the steering mark to the right or left of the azimuth. If no steering marks are available, by day or night, the navigator must make frequent reference to the compass until useful steering marks are again visible.

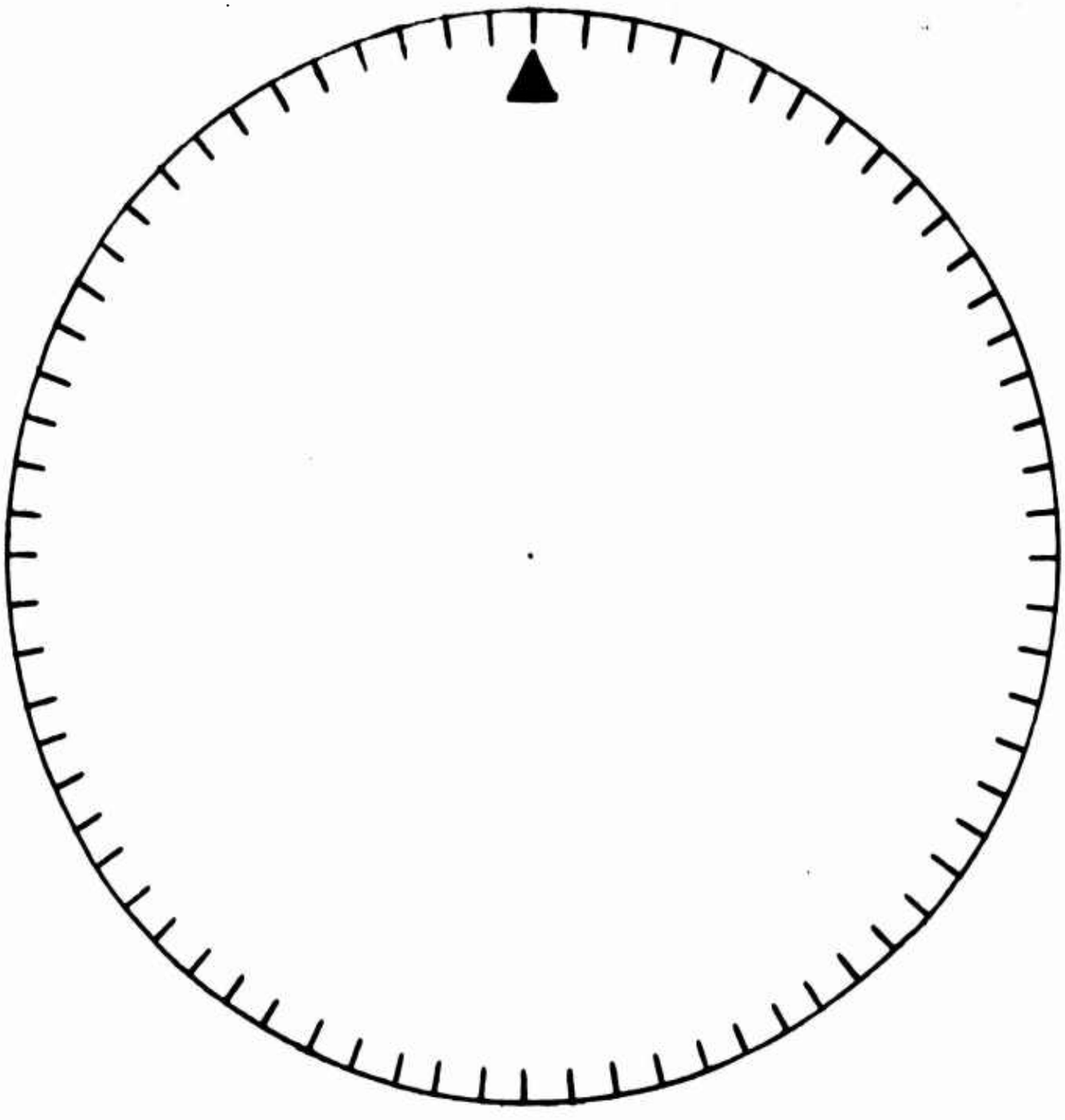
QUESTION 9: What parts of the compass indicate the direction of movement by day? By night?

ANSWER: Once the level compass has the prescribed azimuth under the index line and the broken luminous line directly over the luminous arrow, the index line and the sight wire show the direction of movement by day. At night (when colors disappear), direction of movement is shown by the index line and an imaginary line extending between the two luminous dots located at the end of the sight wire inside the fully extended cover.

LESSON PLAN
PERIOD ONE
WORKSHEET

Name_____ Rank_____ Serial Number_____

Lengthen the tick marks and add numbers to represent the markings on the red, 360-degree dial of the Army compass. Return this paper to the instructor at your first ALN class meeting tomorrow. Be prepared to reproduce the degree marking without reference to your Training Aid or your compass.



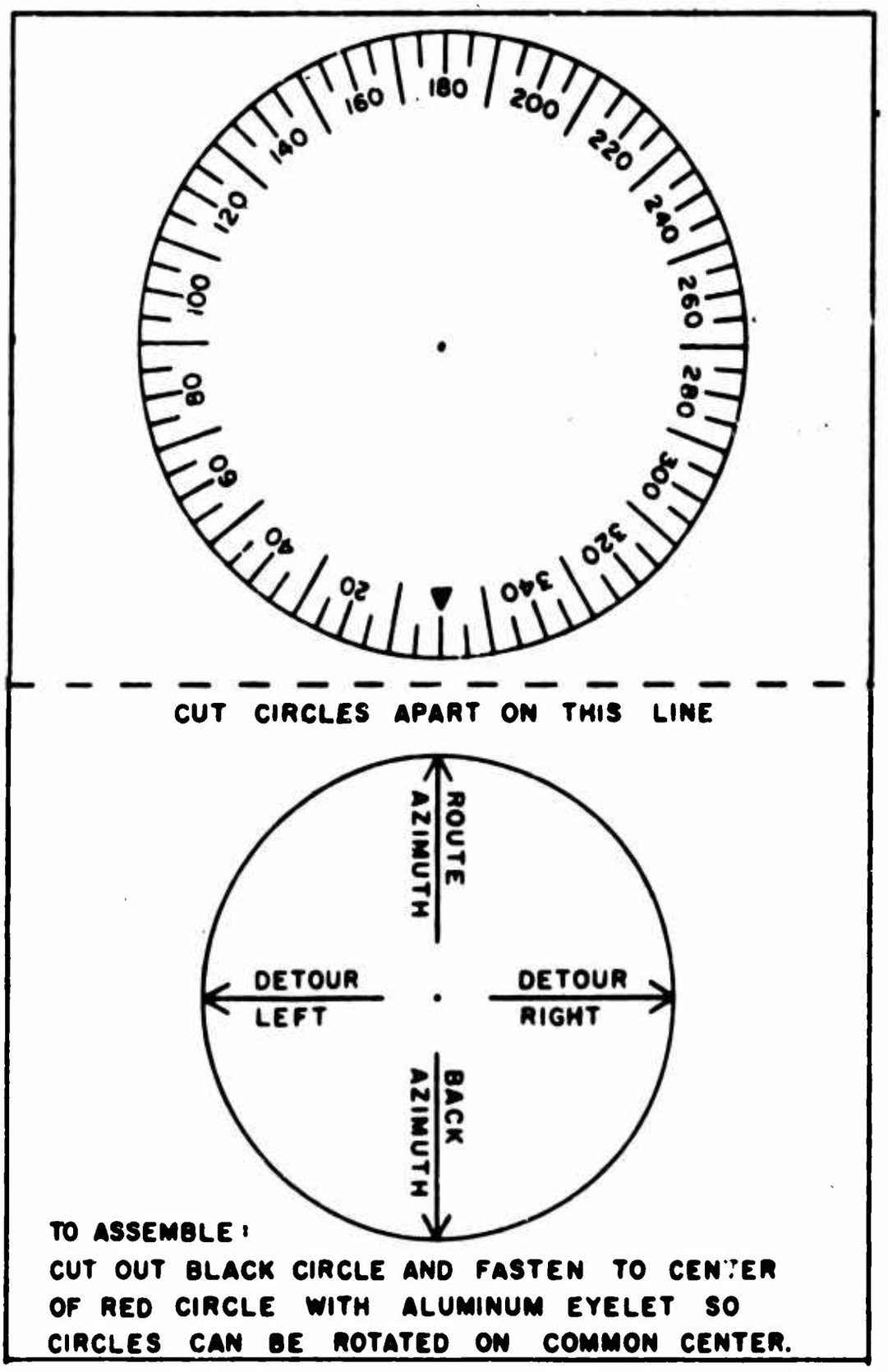


FIGURE 11. BACK AZIMUTH AND DETOURING TRAINING AID

On the Training Aid, the larger circle with its markings is reproduced in red, and the smaller circle is in black. The Training Aid will be reproduced on card stock and assembled for use prior to issue to students.

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PERIOD TWO

PREPARATION DATA SECTION

1. TITLE:	Advanced Land Navigation: Basic Skills in Map Interpretation
2. TYPE OF INSTRUCTION:	Conference, demonstration, and practical exercise
3. HOURS OF INSTRUCTION:	Two (2) hours: second and third of ten
4. CLASS PRESENTED TO:	
5. PURPOSE:	To provide instruction and practice in the basic skills necessary for correct map interpretation
6. INSTRUCTOR REFERENCES:	Instructor's Guide: RIFLEMAN V
	FM 21-26, Chapters 3-8
	FM 21-31
7. INSTRUCTIONAL AIDS:	Nineteen (19) slides
	One (1) plastic training map per student
	One (1) topographic map sheet per two students (Columbus sheet, third edition)*
	One (1) lensatic compass per student
	One (1) pencil per student
	One (1) piece of paper per student
	One (1) handout per student, "Measuring Distance Along a Curved Road"

* The instruction in these Lesson Plans is based on the Columbus map sheet. Instructors may either use this sheet or substitute others, with appropriate changes in the text.

PERIOD TWO

8. STUDENT UNIFORM AND EQUIPMENT:	Uniform: as required Equipment: one (1) notebook one (1) Back Azimuth and Detouring Training Aid one (1) worksheet
9. PHYSICAL FACILITIES:	Standard classroom and sound equipment One (1) slide projector One (1) screen for projection of slides Blackout curtains or opaque shades for windows One (1) pointer for instructor
10. PERSONNEL REQUIREMENTS:	One (1) principal instructor Assistant instructors as required
11. TROOP REQUIREMENTS:	None
12. TRANSPORTATION REQUIREMENTS:	As required
13. AMMUNITION REQUIREMENTS:	None
14. SPECIAL SOUND EQUIPMENT:	None
15. EVACUATION PLAN:	The principal instructor will familiarize himself with the evacuation plan for the classroom or building in which the class is presented.
16. PRINCIPAL INSTRUCTOR'S CHECKLIST FOR PROBLEM REHEARSAL AND PRESENTATION:	SOP preclass check of classroom, platform, lights, charts, air conditioning or heating, sound equipment, and after-class clearing of classroom.
17. SAFETY FACTORS:	As required
18. COORDINATION:	As required

19. REMARKS:

Students are seated at tables equipped with all necessary training aids.

AI's are distributed about classroom as required.

OUTLINE OF MATERIAL TO BE PRESENTED

SECTION I. INTRODUCTION (3 minutes)

I. What Is Map Reading?

II. The Importance of Map Reading

III. The Relationship Between Map and Ground

IV. Map Information

SECTION II. GRID COORDINATES (10 minutes)

I. What Is a Grid System?

II. How Does the Grid System Work?

III. Practical Exercise

SECTION III. TOPOGRAPHIC SYMBOLS (10 minutes)

I. Introduction

II. Explanation of Symbols

III. Practical Exercise

IV. Summary

SECTION IV. CONTOUR INTERPRETATION (27 minutes)

I. Introduction

II. What Is Contour Interpretation?

PERIOD TWO

SECTION IV. CONTOUR INTERPRETATION (Concluded)

III. How Contour Lines Represent Rise and Fall of the Land

IV. Contour Interval

V. What Are Index Lines?

VI. How Can You Tell the Slope of the Land?

VII. How Can Contour Maps Help Us Recognize Five Primary Terrain Features?

VIII. Practical Exercise

IX. Summary

Break (10 minutes)

SECTION V. MAP DISTANCE MEASUREMENT (15 minutes)

I. Introduction

II. Ways To Measure Distance on a Map

III. Practical Exercise

SECTION VI. MAP ORIENTATION (20 minutes)

I. Introduction

II. Orientation of the Map with the Compass

III. Orientation by Inspection

IV. Practical Exercise

V. Summary

SECTION VII. DETERMINING AZIMUTHS (15 minutes)

I. Introduction

II. Determining the Azimuth Between Points on the Map

SECTION VII. DETERMINING AZIMUTHS (Concluded)

III. Practical Exercise

IV. Summary

Break

LESSON PLAN
PERIOD TWO
SECTION I

INTRODUCTION

DIRECTIONS: BEFORE THE CLASS PERIOD BEGINS, PLACE PENCILS, PAPER, COMPASS, HANDOUTS, TOPOGRAPHIC MAP SHEETS, AND PLASTIC RELIEF MAPS ON STUDENTS' TABLES. WHEN STUDENTS ARE SEATED, TAKE UP THEIR COMPASS WORKSHEETS.

I. WHAT IS MAP READING?

Map reading is the art of interpreting or understanding information printed on a map. It is not sufficient merely to understand the symbols printed on a map; a good map reader should be able to form a clear picture of the ground in his mind and use this knowledge of the terrain to solve practical military problems.

II. THE IMPORTANCE OF MAP READING

As an LWI, you may at some time during combat need to know the solution to one of the following problems:

1. What is my exact location?
2. How far is it from my location to some desired objective?
3. What route should I travel to reach a certain destination?
4. What is the highest spot in this area?

Your map has all the answers to these questions if you are able to read it.

In future combat, the LWI will use a map more than ever before. Increased movement and patrolling will make it necessary that all LWI's be able to use a map efficiently.

III. THE RELATIONSHIP BETWEEN MAP AND GROUND

Most of you have seen maps or maybe even used maps, but have you ever considered what the relationship is between a map and the ground area it represents? A map is a pictorial drawing of the earth's surface, or a portion of it, as it would be seen from high up in the air and directly above.

There are several rules of caution to be observed when we are reading a map. Ordinarily, we view our everyday surroundings while we are standing on the ground. Thus, we see a side view of most objects. When we study the surface of the earth using a map, we must first understand that we are seeing a top view of the area. Second, we should understand that no map is an absolutely accurate representation of the earth's surface. Man can change the vegetation on some portion of the earth's surface by clearing out a forest or building a lake. Also, he may put up a new building or build a railroad. These changes would not show up on an older map.

The area of a map is so small, as compared with the area it represents, it would be impossible to make a map where every specific feature could be distinguished. A map reader must be content with recognizing classes or categories of objects. For example, a two-story house will look the same as a one-story house on a map. A forest of pine trees will have the same appearance as a forest of oak trees.

Both man-made and natural features are seen on the map as symbols, lines, and colors. There is a section of each map devoted to the explanation of the meanings of all the signs, symbols, and colors found on the map. This section is called the legend. The legend is usually located in the lower left corner of the map. Look at your Columbus map sheet and notice the legend.

IV. MAP INFORMATION

All information found on a map can be classified under four main headings. These are:

1. Description
2. Details
3. Direction
4. Distance

The description of the map is found on its margin. Look at the top center and the bottom right corner of your topographic map. You will notice the name "Columbus" in both places. This is the name of the main feature on your map. The map name may be a town, lake, mountain, or some other prominent feature.

The bottom margin will also tell you when the map was first made, and when and if it was field checked for accuracy. The older the map is, the more cautious you should be about accepting the map as a true representation of some area of the earth's surface.

LESSON PLAN
PERIOD TWO
SECTION I

The details of a map include all the map signs and symbols. The map maker makes an effort, where possible, to associate the symbols with the things they represent, either by color or by shape.

In finding direction with a map, the general rule of map making and map reading is that north is always at the top of the map (where the name is in large letters).

Distance on the ground is expressed on the map by the scale of the map. The scale of the map is the expression of the relationship between distance on the map and the corresponding distance on the ground. For example, a scale of 1:50,000 would mean that, if you measured the distance between two points on a map as one foot, the actual ground distance between the two points would be 50,000 feet.

A thorough discussion of all these points will be given later in the Program.

LESSON PLAN
PERIOD TWO
SECTION II

GRID COORDINATES

I. WHAT IS A GRID SYSTEM?

DIRECTIONS. HAVE STUDENTS LOOK AT THEIR COLUMBUS MAP SHEET.

A. The grid system is a network of squares on the map.

1. This network of squares is formed by black parallel lines.

a. These lines run from north to south and from east to west.

b. The north-south lines always run from the top of the map to the bottom.

c. The east-west lines run from right to left on the map.

2. On these maps, the distance between each of the grid lines is equal to 1000 meters on the ground; therefore, each grid square represents 1000 meters on each side.

B. The purpose of a grid system is to enable the map reader to locate points on the map quickly and accurately. When using a grid system a map reader can tell another map reader exactly where a specific point is on a map. Here is how this is done.

II. HOW DOES THE GRID SYSTEM WORK?

A. Each grid line is numbered with a different number.

1. To locate a specific point on the map, all that is needed are the numbers of the grid lines.

a. The map reader can merely look at his map, find where the numbered grid lines cross, and determine the specific point.

b. The numbers of a specific point where the grid lines cross are called grid coordinates.

2. There is a special way to read these grid coordinates, so everyone will read them the same way and thus avoid confusion.

   a. The numbers in the largest print on the left margin and on the bottom edge of the map label each grid line.

   b. The grid lines run in two directions, and one, of course, must be read first.

      (1) The north-south grid lines are always read first. These numbers are at the bottom of the map.

      (2) The east-west grid lines are read second. These numbers are on the left-hand side of the map.

      (3) A good way to remember which to read first is to read right along the bottom and then read up along the side.

      (4) A more simple way to remember this is to simply READ RIGHT AND UP.

3. If the grid coordinates are read right and up, the result is a four-digit grid coordinate, such as 9574, which refers to a specific grid square.

   a. A grid square is designated by the intersection of the grid lines of its lower left-hand corner.

   b. These numbers are written as a continuous series of numbers with no gap in between; for example, 9574.

DIRECTIONS: WRITE GRID COORDINATES ON BLACKBOARD.

   c. A four-digit coordinate will give only the 1000-meter block in which the specific point is located.

B. Each grid square can be imagined to be further divided.

1. More precise grid coordinates are needed than the four-digit system.

2. In order to make the coordinates more precise, imagine that the 1000-meter grid square is broken up into smaller squares by ten evenly spaced, imaginary lines running both across and down the square.

   a. Imagine that these lines are numbered from 1 to 10 from left to right along the west-east line.

   b. Imagine that they are also numbered from 1 to 10 from bottom to top along the south-north line.

DIRECTIONS: SHOW SLIDE ONE.

3. This hill is in the center of grid square 0789. Thus, it is on the center of the west-east line and the center of the south-north line.

   a. Since the dotted lines are numbered, it is on line 5 for the west-east line and line 5 for the south-north line.

   b. These new numbers must be added to the grid coordinates.

      (1) The additional number of the north-south line is put at the end of the north-south coordinate, and the additional number of the east-west line is put at the end of the east-west coordinate.

      (2) In this example, the grid coordinate would be 075895.

      (3) Using a six-digit coordinate such as this will tell you where an object is located within 100 meters.

DIRECTIONS: REMOVE SLIDE ONE.

4. A grid square can be broken down into even smaller units by giving more grid coordinates.

   a. For example, an eight-digit coordinate will give

the location of an object within ten meters.

b. When computing an eight-digit coordinate, a new number must be added to each set of digits for both the north-south and east-west coordinates.

c. Grid coordinates always contain an even amount of numbers.

III. PRACTICAL EXERCISE

DIRECTIONS: HAVE STUDENTS LOOK AT COLUMBUS MAP SHEET.

A. These are the steps required to interpret grid coordinates 108825.

1. First, count how many numbers there are in the set.

   a. There are six in this set.

   b. There will always be an even number, so split the six-digit number in half.

2. Use each group of three numbers separately.

   a. The first set of three numbers is the north-south coordinate, 108.

   b. Find 10 along the bottom edge of the map.

   c. The second set of numbers is the east-west coordinate, 825.

   d. Find 82 along the left side of the map.

   e. Move along these respective grid lines until you find grid square 1082. Remember that the grid coordinates cross in the lower left-hand corner of the grid square.

3. Now, imagine that this 1000-meter grid square (1082) is broken up into 100 smaller squares.

   a. Add eight of these smaller squares to the number (10)

you located on the bottom edge of the map; this gives the north-south coordinate 108.

b. In the same way, add five of the smaller squares to the number located on the side of the map; this gives the coordinate 825.

4. Read right and up to locate the specific point on the map.

a. What do you find there?

(Pause 30 seconds.)

b. Answer: You should find some ruins at grid coordinates 108825.

B. Now, using the same procedure, and following the same steps, find grid coordinates 987784.

(Pause 30 seconds.)

1. What is located at that specific point?

2. Answer: Harps Pond is located at grid coordinates 987784.

LESSON PLAN
PERIOD TWO
SECTION III

TOPOGRAPHIC SYMBOLS

I. INTRODUCTION

The standard topographic map has various symbols printed on it. You, as an LWI, need to know the meaning of some of these symbols. We are going to cover in this period several basic principles which will enable you to determine what many of the important topographic symbols mean.

II. EXPLANATION OF SYMBOLS

A. The first symbols we will discuss and look at are those for water.

DIRECTIONS: SHOW SLIDE TWO.

1. On a topographic map, the color blue always means water.

2. If the blue color is solid, the water is always there.

3. If the blue color is not solid, but dashed or broken, the water is there only occasionally. It is usually there during wet weather, but the area is usually dry otherwise.

DIRECTIONS: POINT OUT DIFFERENCES ON SLIDE; THEN REMOVE SLIDE TWO.

B. The next symbols we will discuss and look at are those for railroads.

DIRECTIONS: SHOW SLIDE THREE.

Any single black line or lines with other single black lines crossing or perpendicular to them are railroads.

DIRECTIONS: POINT OUT EXAMPLES; THEN REMOVE SLIDE THREE.

C. The symbols that represent roads will be our next topic.

DIRECTIONS: SHOW SLIDE FOUR.

1. A solid red line represents a heavy duty road.

2. A dashed red line is the symbol for a medium duty road.

3. A white line means the road is classed as a light duty road.

4. Parallel, dashed black lines stand for a dirt road.

5. A single, dashed black line signifies a trail, if not indicated otherwise.

DIRECTIONS: POINT OUT DIFFERENCES ON SLIDE; THEN REMOVE SLIDE FOUR.

D. The last symbols we will look at are those that deal with buildings. Any black square or rectangle represents a building.

DIRECTIONS: SHOW SLIDE FIVE, POINT OUT EXAMPLES; THEN REMOVE SLIDE.

III. PRACTICAL EXERCISE

DIRECTIONS: HAVE STUDENTS LOOK AT COLUMBUS MAP SHEET.

Using the principles we have just discussed, find at least four features that are located in grid square 9789.

(Pause 30 seconds.)

Answer:

1. A pond with water always there.

2. A stream with water sometimes there.

3. Some dirt roads.

4. A medium duty road.

5. Buildings.

IV. SUMMARY

We have discussed several different principles for the interpretation of map symbols. By using these, you should be able to interpret correctly all the symbols you need to know on a map. Remember that you should always check the legend of a map, in the lower left-hand corner, if you see a symbol that you do not understand. This legend will tell you what the symbol means.

LESSON PLAN
PERIOD TWO
SECTION IV

CONTOUR INTERPRETATION

I. INTRODUCTION

DIRECTIONS. HALF STUDENTS LOOK AT THE SMALL PLASTIC MAP.

This plastic map is used for training purposes. It is divided into three sections. All three sections are maps of the same area, but each map represents the area in a different way. The flat section on the left is like any military map, except the green color, which represents vegetation, has been left off. The map to the far right has been raised to show how the land rises and falls to form hills and valleys. It is called a relief map. The raised map in the center, with no markings, is called a contour layer map.

II. WHAT IS CONTOUR INTERPRETATION?

A. Contour interpretation is the art of interpreting the shape and the elevation of the land from a map.

1. The shape of the earth's surface varies from level plains to tall mountain ranges.

2. Contour lines are the means by which the rise and fall of the land is most commonly represented on a map.

B. Locate area "E" (9075) on the flat map to the left.

1. The brown lines that curve around and form a succession of "V's" are called contour lines.

2. When a trained map reader looks at this pattern of lines, he pictures the actual ground as being a ridge with a valley on each side.

3. Look at the map on the far right. Notice the ridge at "E." See how the ground slopes down on each side into the valleys.

C. Each contour line represents a definite height above sea level.

1. Look at the contour line above point "O" in grid square 8375.

2. The number, 1000, means that every point on this line is 1000 feet above sea level.

3. On any contour line, all points along the line are the same height above sea level.

D. Adjacent contour lines differ in height by a certain fixed number of feet.

1. Look at the lines immediately above and below the 1000-foot line at point "O." All points along the line below this line are 100 feet lower, or 900 feet. All points along the line above are 100 feet higher, or 1100 feet.

2. This 100 feet is measured as vertical distance, or distance straight up and down.

III. HOW CONTOUR LINES REPRESENT RISE AND FALL OF THE LAND

We can best illustrate the full meaning of contour lines by showing how a map maker would represent a hill on a map by the use of contour lines.

DIRECTIONS: SHOW SLIDE SIX.

This is the side view of a hill. We will consider the base of the hill to be at sea level (POINT TO BASE). The map maker decides to have a contour line for every 100 feet of vertical rise in elevation. Therefore, the first contour line will be 100 feet above sea level. He will begin by placing stakes at various points along the side of the hill, all of which are 100 feet above sea level. Then, he will go up the hill to the 200-foot level, repeat the same procedure, and so on for every 100-foot rise in elevation until he reaches the top of the hill.

Look at the slide. This is how the hill will look when all the stakes have been placed in position.

DIRECTIONS: REMOVE SLIDE SIX;
THEN SHOW SLIDE SEVEN.

When all the stakes are connected, with a rope, the hill will look like this. The bottom picture is a top view of the hill as we would see

it from the air. When the map maker puts this hill on a map, he takes away the stakes and all we see are the contour lines alone.

DIRECTIONS: REMOVE SLIDE SEVEN.

IV. CONTOUR INTERVAL

A. The fixed vertical distance in height between adjacent contour lines is called the contour interval.

1. Look at the flat map on your left. You will see the words "contour interval 100 feet."

2. Every map will give the contour interval in the margin for that particular map.

3 The contour interval is the same for any one map, but it changes from map to map.

4. Look at the Columbus map sheet. The contour interval for that map is 20 feet.

B. We will now explain contour interval.

DIRECTIONS: SHOW SLIDE EIGHT.

This is the side view of a hill showing the contour lines. Think of this hill as increasing in elevation by successive steps. The top portion of each step is one contour interval higher than the step below it. Each red line represents the vertical distance from one contour line up to the next. If this step is 100 feet in elevation, then this step (POINT TO APPROPRIATE LEVEL) will be 200 feet in elevation.

DIRECTIONS REMOVE SLIDE EIGHT.

C. Let's look at contour interval on the plastic map.

1. Look at the center contour layer map.

a. Each layer is a step.

b. On this map, each new layer as you go up a slope is 100 feet higher in elevation than the one below it.

2. Look at the flat map on the left. Imagine that you are walking up a slope. Try to picture that, each time you come to a new contour line, you are one contour interval higher than the line below it.

V. WHAT ARE INDEX LINES?

A. On the flat map, some contour lines are darker and thicker than others. These lines are called index lines.

1. There are numbers at various places on these lines which give the elevation of the land along them.

2. Every fifth contour line will be an index line.

B. Now, suppose you want to know the elevation of the middle contour line in grid square 8473.

1. First, locate the two index lines above and below this line.

a. The first index line below is 500 feet in elevation.

b. The index line above our point is 1000 feet in elevation.

c. Since the contour interval is 100 feet, you add 100 feet for each contour line above the 500-foot level.

2. Therefore, the middle contour line in grid square 8473 is 800 feet high, because it is the third line above the 500-foot contour line.

C. Let's see how we can use what we know about contour lines to find the elevation of a point on the map that is between two contour lines. This process is called interpolation. Interpolation of elevation is simply estimation of the distance between two contour lines.

If you have two contour lines, with a contour interval of 100 feet, the point halfway between the two lines is one-half of

the contour interval, or 50 feet. If the point is one-fourth of the distance between the contour lines, the distance in elevation is 25 feet above the lower contour line.

DIRECTIONS: SHOW SLIDE NINE.

To compute the elevation of this point, all you do --first, estimate where the point is between the contour li . Then, you take that much of the contour interval. The poi . is three-fourths of the way up the contour interval, so you take three-fourths of 100 feet (75 feet). You then add this to the lower contour line value (500 feet). The total is 575 feet. The point is located at an elevation of 575 feet. You have just interpolated the elevation of this point.

DIRECTIONS. REMOVE SLIDE NINE.

D. What is the approximate elevation of the base of the building at grid coordinates 892736? Answer: 350-370 feet.

VI. HOW CAN YOU TELL THE SLOPE OF THE LAND?

A. The further apart contour lines are spaced, the more level or gentle will be the slope of the ground. The closer together contour lines are, the steeper the slope.

B. Look at area "L" on both your flat map and the relief map.

1. The contour lines to the right of "L" in grid square 8272 are closer together than those to the left in grid square 8172.

2. The slope of the land is more gentle in 8172, then, than in square 8272.

C. Let's illustrate slope further on our maps.

1. Look at the area to the right of "A" on the flat map in grid square 8673. These lines are far apart.

a. Now, look at the same area on the contour layer map in the center.

b. See how gently the land slopes.

2. Look on the flat map at the right side of point "E" in grid square 9075. The lines are very close together.

a. Look at the same area on the contour layer map.

b. Note how sharply the land slopes.

D. Keep in mind that vertical height is determined by the contour lines themselves, and the steepness of the slope is determined by the space between contour lines.

VII. HOW CAN CONTOUR MAPS HELP US RECOGNIZE FIVE PRIMARY TERRAIN FEATURES?

We will now discuss how contour lines help us identify terrain features that are found on topographic maps.

A. On maps, the Army uses five symbols to represent five primary terrain features. A terrain feature is an area of land that is shaped in a certain way. Contour lines tell you the shape of these land features. The five primary terrain features we shall talk about are hilltop, ridge, valley, saddle, and depression.

1. The first one we will discuss and learn is the hilltop.

DIRECTIONS: SHOW SLIDE TEN.

a. The way to identify a hilltop is by remembering that it is the area enclosed by the last closed contour line.

DIRECTIONS: POINT OUT EXAMPLE; THEN REMOVE SLIDE TEN.

b. Look at the flat map on your left.

(1) You will see a hilltop near the letter "G" in grid square 9071. (POINT OUT HOW THE LAST CLOSED CONTOUR ENCLOSES THE TOP OF THE HILL.)

(2) Look at the relief map on the right.

(3) Realize that if you were standing on the top of that hill, you could see how the ground slopes down in all directions. Put your pencil on the top of the hilltop. You could see, if you were standing there, how the ground goes down in all directions.

2. The next symbol is the ridge.

a. A ridge is easily identified by looking for contour lines shaped like "U's," with the tip of the "U" pointing away from high ground. Some ridges may have the shape of a "V," but the characteristic shape is a "U."

DIRECTIONS: SHOW SLIDE ELEVEN, POINT OUT EXAMPLE; THEN REMOVE SLIDE ELEVEN.

b. Look at point "H" on your map. It is in grid square 8676. The "U's" to the southeast of it indicate a ridge.

c. Look at point "H" on your relief map. Put your pencil on "H."

(1) Imagine you are standing there. Notice how the land slopes down in three directions and up in one.

(2) Notice how the contour lines form "U" shapes with the tip pointing away from the high ground.

(3) Compare these lines with the lines on the map on your far left and you will see that they are the same.

DIRECTIONS: SHOW SLIDE TWELVE.

3. Now here is another slide.

a. This slide does not show a ridge. It shows a valley.

b. Notice that the characteristic shape of a valley is a "V." Some valleys may have the shape of a "U," but the characteristic shape is a "V."

(1) The symbols for a ridge and a valley are similar, but it is the way they are sloping that tells us if the land feature is a ridge or a valley.

(2) In a valley symbol, the "V's" are pointing toward high ground.

DIRECTIONS: REMOVE SLIDE TWELVE.

(3) This can be seen in grid square 8975.

(4) Imagine that you are standing in a valley such as this one.

(a) See how the land goes up in three directions and down in one.

(b) Compare the valley on your relief map with the one on your flat map. Notice the pattern of "V's."

4. The fourth terrain feature is the saddle.

DIRECTIONS: SHOW SLIDE THIRTEEN.

A saddle is easily identified and is found between two hilltops.

a. The ground slopes up in two directions and down in two directions.

DIRECTIONS: REMOVE SLIDE THIRTEEN.

b. A good example of a saddle is point "D" at grid square 8570. The arrow points to the saddle.

(1) Notice the two hilltops.

(2) Notice the characteristic sloping of the ground between the two hilltops.

(3) The ground goes up in two directions and down in two directions.

(4) Look at the relief map on your right. You can actually feel the indentation the saddle causes if you run your finger over the saddle.

(5) Compare the saddles of both the relief map and the flat map.

5. A depression is the last type of primary terrain feature we will learn.

DIRECTIONS: SHOW SLIDE FOURTEEN.

a. A depression is most easily identified by the short marks on it. These short marks point toward the low ground.

DIRECTIONS: REMOVE SLIDE FOURTEEN.

b. Look at point "C" on your map. "C" is at grid square 8472.

(1) This is a depression.

(2) Compare the depression on your flat map with the one on your relief map.

(3) Notice that they are the same symbols.

B. There are other features we can identify on our maps.

1. If you look at point "B," you will see an example of a cut. At point "A," there is an example of a fill.

2. The building of roads, bridges, and railroads which cut through hills or cause a section of a valley to be filled

in form these areas. Notice on the relief map how the hard surface road cuts through the hill at "B."

3. These cuts and fills are of tactical value to the soldier.

   a. They offer cover and concealment.

   b. You can use them to hide behind and they can shield you from enemy fire.

VIII. PRACTICAL EXERCISE

Look at your Columbus map sheet. What types of terrain features are found in grid square 0782?

(Pause 30 seconds.)

Answer:

1. Hilltop
2. Valley
3. Saddle
4. Ridge

IX. SUMMARY

We have discussed contour lines and how they help us interpret terrain features. Next, we are going to talk about how you use a map to solve some problems you may encounter as an LWI.

MAP DISTANCE MEASUREMENT

I. INTRODUCTION

Map distance measurement consists of finding the distance between any two points on a map, and using this map distance to estimate the ground distance between these two points.

Research has led to the finding that there is a tendency for most people to be short in their measurements. Watch out that you do not commit this error. Be very careful when you measure because, on a map with a 1:50,000 scale, a measuring error as small as one-fourth of an inch on the map would cause you to have an actual ground distance error of about 325 meters.

II. WAYS TO MEASURE DISTANCE ON A MAP

A. There are several ways to measure distance on a map. All of these ways make use of a graphic scale. A graphic scale is a ruler printed on the map by means of which distances between any two points on a map may be converted to actual ground distance.

1. Most military maps have at least three different graphic scales--yards, miles, and meters.

DIRECTIONS: SHOW SLIDE FIFTEEN. POINT OUT EXAMPLES AS GIVEN BELOW.

a. We will be using only the meter scale, but the other scales are used the same way.

b. One meter is equal to 39.37 inches, so it is slightly longer than a yard.

2. A graphic scale is made up of a combination of two different scales, a primary scale and an extension scale.

a. The primary scale extends from the 0 (zero) mark to the right.

b. The extension scale extends from the 0 (zero) mark to the left.

3. On the primary scale, there are marks only at 1000, 2000, 3000, etc., meters; therefore, on this scale, only whole thousands of meters can be measured.

4. The extension scale represents 1000 meters, but it is subdivided into ten 100-meter parts.

   a. The extension scale enables you to measure distances that are less than 1000 meters.

   b. For example, three marks to the left on this scale would equal 300 meters.

   c. In reading the extension scale, if the distance does not fall exactly on one of the 100-meter lines, estimate the fraction of a hundred to the nearest 25 meters.

   d. For example, if the distance falls three-fourths of the way between 200 and 300 meters, your answer would be 275 meters.

DIRECTIONS: REMOVE SLIDE FIFTEEN.

B. I will now give you a practical illustration of how to use the primary and extension scales together to solve a map distance measurement problem.

DIRECTIONS: SHOW SLIDE SIXTEEN.

Suppose you want to know the ground distance as represented by points "A" and "B" on the slide. We will calculate the ground distance by using the strip-of-paper method.

First, take a piece of paper with a straight edge and place it on the map in such position that the straight edge just barely touches points "A" and "B." Make pencil marks (tick marks) opposite the center of points "A" and "B."

Now place the paper along the meter scale so that the straight edge lies below, but just touching, the meter scale. Next, line up your straight edge on the scale so that point "A" is at zero, and point "B" is extended along the primary scale.

As you can see, point "B" lies somewhere between 3000 and 4000 meters. Move the piece of paper to the left so that point "B" now touches the nearest whole thousand mark, which would be 3000 meters. The fraction of a thousand that previously extended to the right of the 3000-meter mark will now be on the extension scale.

Add the number of meters found on the extension scale to the number of meters on the primary scale to get the total actual ground distance. If point "A" falls two marks to the left, you will have 200 meters plus 3000, or 3200 meters.

C. How does one find the distance between "A" and "Z" along a curved road? In order to find the distance of a curved road, the road is changed into several straight sections that are connected to each other. The length of all the straight sections added together is equal to the distance along the curved road. The actual ground distance is measured on the graphic scale.

Line up your straight edge along the edge of the road so that it touches point "A" near one end of the piece of paper. Turn your straight edge so that it extends along the edge of the road, as far as possible, without going off the road. At the point where the edge of the paper leaves the road, make a mark and label it point "B." Make tick marks on the edge of the paper where points "A" and "B" touch the straight edge. Label the tick marks "A" and "B" to correspond to points "A" and "B" on the map.

Making sure that the mark on your paper for "B" is exactly on top of point "B" on the map, turn your paper so that it extends as far as possible along the road. Where the edge goes off the road, label this point "C." Now, make a tick mark on your paper where point "C" touches the straight edge. Continue this procedure until you reach "Z." The distance between "A" and "Z" on the straight edge will represent the curved road distance between "A" and "Z" on a map. Line up your straight edge on the graphic scale in the usual way to find the actual ground distance between "A" and "Z."

DIRECTIONS: REMOVE SLIDE SIXTEEN.

D. The strip-of-paper method is the best method to use if you seldom make map measurements. However, measurements can be made directly with a scale.

If you wish to make your own scale, just line up a paper straight edge along the desired graphic scale and copy the graphic scale onto the straight edge. You can then put your straight edge between any two points on a map and read your answer directly.

III. PRACTICAL EXERCISE

A. You should have learned enough about the theory of map distance measurement to be able to apply this knowledge to a practical situation.

B. Statement of problem to student

1. Look in the upper right-hand corner of your Columbus map sheet.
2. You will see two dots labeled "A" and "B."
3. Find the actual ground distance between the center of these two dots.
4. Answer: 4400 meters.

C. Statement of problem to student

1. This problem will be to measure the distance between two points along a curved road.
2. You have been given a mimeographed sheet with a sketch map on it.
3. You will notice that there is a curved road on the map with two points on the road labeled "A" and "Z."
4. You are to find the actual ground distance between "A" and "Z."
5. You will notice that the road has already been divided into straight sections, and each connecting point is labeled "A," "B," "C," etc.
6. All you have to do is to find the total length of all the sections, and then use the graphic scale on your real map to get the actual ground distance.
7. Answer: 4550 meters.

D. Statement of problem to student

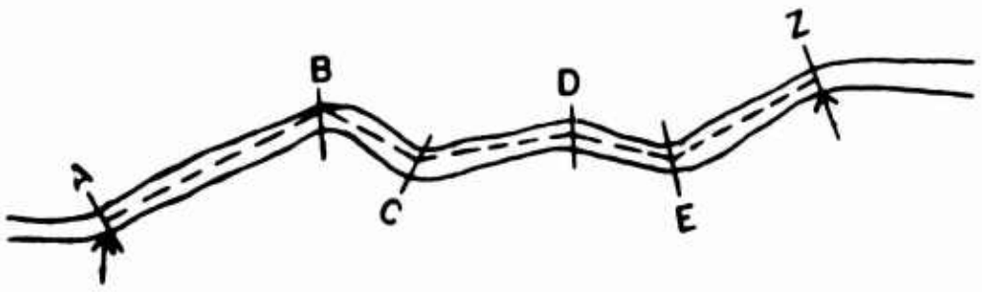
1. In this problem, you will be asked to find the ground distance between two points along a curved road.

2. Unlike the previous problem, however, this road is not divided into sections. You must do the entire procedure by yourself.

3. On your Columbus map sheet, find the ground distance between the two arrows on Buena Vista Road.

4. Answer: 2825 meters.

LESSON PLAN
PERIOD TWO
SECTION V
HANDOUT



SCALE

1:50,000

MEASURING DISTANCE ALONG A CURVED ROAD

MAP ORIENTATION

I. INTRODUCTION

When you work with a map in the field, the first step is to hold the map in a way that puts all features on the map in the same position as they are on the ground. This is really nothing more than turning the map and lining it up with the ground, so that every direction on the map is the same as it is on the ground. That is, north on the map is north on the ground, and south on the map is south on the ground. This is called orienting the map.

There are two ways to orient a map. One is by using the compass, which is the fastest and most accurate way. The other is by what we call "inspection"; that is, if the ground features are very clear and can be identified easily both on the ground and on the map, the map can be placed so that the terrain features depicted on it are lined up in the same position as they are on the ground. We will now discuss both of these methods.

II. ORIENTATION OF THE MAP WITH THE COMPASS

A. The compass is the best indicator of direction we have in the field.

1. The compass needle always points in only one direction, which is called "magnetic north."

   a. Magnetic north is really a huge ore deposit located near the Hudson Bay region of northern Canada. This ore deposit attracts all compass needles toward it.

   b. The easiest way to line up the map with the ground is to line up the magnetic north direction of the map with the needle of the compass which points to magnetic north.

   c. To do this, we use grid lines to help us determine direction and orient the map.

2. You remember that the lines that run from top to bottom on the map are called north-south grid lines, with north always at the top of the map.

   a. We call the north direction indicated by these north-south grid lines grid north.

b. Grid north, as indicated by these north-south grid lines, and magnetic north may be the same but usually are not.

c. Magnetic north is usually at an angle either to the right or left (east or west) of grid north on the map.

B. To locate magnetic north, you use the declination diagram.

1. Declination means the angle magnetic north deviates from grid north.

a. The declination diagram tells you how many degrees magnetic north deviates from grid north.

b. This amount of difference between grid north and magnetic north varies from map to map and depends on the relationship of the map area to the ore deposit in Canada.

2. To determine whether magnetic north angles off grid north either right or left, you use the declination diagram.

a. The declination diagram is the three-pronged diagram printed at the bottom of the map.

b. The prong with the half-arrow, or barb, represents magnetic north. The prong with the star is true north, and the plain prong is grid north.

c. If the magnetic north prong is to the left of the grid north prong, then magnetic north deviates from grid north to the left, or west.

d. If the magnetic north prong is to the right of the grid north prong, then magnetic north would be to the right of grid north, or east.

C. To line up, or orient, your map, the compass is placed on the map so that the compass needle varies from a north-south grid line in the same direction and number of degrees as shown in the declination diagram.

DIRECTIONS: SHOW SLIDE SEVENTEEN; THEN REMOVE SLIDE. INSTRUCT STUDENTS TO PLACE COMPASS ON LEFT SECTION OF PLASTIC MAP.

1. The compass is used on the map with the cover opened, and laid flat.

2. The eyepiece is opened as far as it will go. This will put it out of the way so the compass can be easily read from directly overhead.

3. Place the compass on the map with the sighting wire directly over and along any north-south grid line.

4. The compass cover should be pointing toward the top of the map.

5. Read the declination from the declination diagram.

6. Keeping this alignment, rotate the compass and the map together until the correct number of declination degrees appears under the black index line, and the compass needle is to the left as shown in the declination diagram.

DIRECTIONS: HAVE AI'S CHECK FOR ACCURACY.

7. The map is now oriented.

D. Now look at your Columbus map sheet. The declination we will use here is one degree west. Using the same procedure we have just discussed, take your compass and orient the Columbus map sheet.

DIRECTIONS: HAVE AI'S CHECK FOR ACCURACY.

1. Once the map is oriented, you may take the compass away and use the map.

2. You must not move the map if you are going to determine azimuths, however, since any change in its position will move it out of line with magnetic north.

III. ORIENTATION BY INSPECTION

A. We have said that the most accurate way to orient a map is with a compass. There is another method of orienting the map

called orientation by inspection. This method is used in two situations.

1. You have a map, but you don't have a compass.

2. You wish to make frequent and quick reference to your map as you move cross country.

B. Prominent features can be used as guide features.

1. In order to orient your map correctly by inspection, you should pick out two or three prominent features on the ground which also appear on your map. Your job is to line up the features on the map with the same features on the ground.

2. Man-made features, such as roads or railroads, are very useful. Natural terrain features, such as rivers or prominent hilltops, are also helpful.

   a. You should be sure, however, that you do not confuse the features you are using as guide objects with nearby features of the same type. For example, many hilltops look alike.

   b. You must study the surrounding area on your map carefully to eliminate the possibility you are lining up features shown on the map with the wrong features on the ground.

3. When you begin to orient a map by inspection, you must know your approximate location. This will usually be given you by your leader.

4. There may be situations where you can't find any prominent features on the ground with which to line up your map.

   a. This may occur in the desert or in certain thickly wooded areas where you can't see very far in any direction.

   b. Don't try to orient the map by inspection under these circumstances. If the map needs to be oriented, use your compass.

IV. PRACTICAL EXERCISE

Now that I have discussed how to orient by inspection I will give you an illustration of this method.

DIRECTIONS SHOW SLIDE EIGHTEEN.

This slide represents a map as pictured in the lower left-hand corner, and also the actual ground area covered by the map. Note that all terrain features on the map also can be easily seen on the ground.

DIRECTIONS POINT OUT SEVERAL TERRAIN FEATURES THAT APPEAR BOTH ON THE MAP AND ON THE GROUND.

You are standing at point "X". To orient the map by inspection, you must line up the terrain features on the map with the same features on the ground. To do this, you should first position the hill on the map in line with the hill on the ground. Now rotate the map so that the roads on the map are parallel to the roads on the ground. Your map is now oriented, but, to make sure, check the position of the building on the map with the building on the ground. Since everything on the map is in the same relative position with everything on the ground, the map is now oriented by inspection.

DIRECTIONS REMOVE SLIDE EIGHTEEN.

V. SUMMARY

We have talked about two ways to orient the map. (1) by using the compass, and (2) by inspection. Since, on many kinds of terrain, it is difficult to orient the map by inspection, we recommend that in your training you always use your compass to orient the map.

LESSON PLAN
PERIOD TWO
SECTION VII

DETERMINING AZIMUTHS

I. INTRODUCTION

Suppose you were given a map and compass and were told to go from point "A" to point "B," as shown on a map. If you could see point "B," all you would have to do is sight your compass on point "B," read your azimuth, and follow this azimuth to point "B." If you cannot see point "B," however, you must determine the route azimuth from your map.

If you can locate your position and the destination point on the map, you can easily determine the compass azimuth from point "A" to point "B." When you are determining an azimuth from the map, never trace your route with a pencil. If you should be captured, you would not want the enemy to know your starting point or your destination.

II. DETERMINING THE AZIMUTH BETWEEN POINTS ON THE MAP

One method of determining the azimuth between points on a map is by orienting your map using the compass.

1. Place your map on a level surface.

2. Orient your map with the compass as you have previously been taught.

3. After your map is oriented, <u>without moving the map</u>, position your compass so that the compass straight edge is directly over the starting point and the objective, and your compass cover <u>is pointing in the direction of travel</u>.

4. Read the number of degrees indicated under the black index line.

5. This reading will be the magnetic azimuth you will follow to reach your objective.

<u>DIRECTIONS:</u> <u>SHOW SLIDE NINETEEN. EXPLAIN THE PROCEDURE; THEN REMOVE SLIDE.</u>

III. PRACTICAL EXERCISE

A. On your Columbus map sheet, find the magnetic azimuth you

would follow, to the nearest 5 degrees, to go from the junction of Oswichee Creek and the Chattahoochee River in grid square 9475 to the only building in grid square 9379. (Answer: 350 degrees)

B. Find the magnetic azimuth you would follow, to the nearest 5 degrees, to go from BM 293 in grid square 9975 to the center of the mock village in grid square 9873. (Answer: 210 degrees)

1. What would be the back azimuth of this route? You may use your Training Aid for this. (Answer: 30 degrees)

2. What would be the azimuth if the navigator had to detour to the right? (Answer: 300 degrees)

3. If he had to detour to the left? (Answer: 120 degrees)

IV. SUMMARY

Notice that, once you know your route azimuth, you can compute your detour and back azimuths from this. By utilizing your Training Aid, you should learn how to compute these changes in azimuths, since you will have no Training Aid in the field.

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PERIOD THREE

PREPARATION DATA SECTION

1. TITLE:	Advanced Land Navigation: Basic Skills in Map Interpretation (Concluded)
2. TYPE OF INSTRUCTION:	Conference, demonstration, and practical exercise
3. HOURS OF INSTRUCTION:	One (1) hour fourth of ten
4. CLASS PRESENTED TO:	
5. PURPOSE:	To provide the student instruction in the basic concepts of check-point recognition, geographical orientation, and a review of methods of land navigation
6. INSTRUCTOR REFERENCES:	Instructor's Guide: RIFLEMAN V FM 21-26, Chapter 7
7. INSTRUCTIONAL AIDS:	Eight (8) slides One (1) pencil per student One (1) topographic map sheet per two students (Columbus sheet, third edition)
8. STUDENT UNIFORM AND EQUIPMENT	Uniform: as required Equipment: one (1) notebook one (1) Back Azimuth and Detouring Training Aid
9. PHYSICAL FACILITIES:	Standard classroom and sound equipment One (1) slide projector One (1) screen for projection of slides Blackout curtains or opaque shades for windows

PERIOD THREE

9.	PHYSICAL FACILITIES: (Concluded)	One (1) pointer for instructor
10.	PERSONNEL REQUIREMENTS:	One (1) principal instructor Assistant instructors as required
11.	TROOP REQUIREMENTS:	None
12.	TRANSPORTATION REQUIREMENTS:	As required
13.	AMMUNITION REQUIREMENTS:	None
14.	SPECIAL SOUND EQUIPMENT:	None
15.	EVACUATION PLAN:	The principal instructor will familiarize himself with the evacuation plan for the classroom or building in which the class is presented.
16.	PRINCIPAL INSTRUCTOR'S CHECKLIST FOR PROBLEM REHEARSAL AND PRESENTATION:	SOP preclass check of classroom, platform, lights, charts, air conditioning or heating, sound equipment, and after-class clearing of classroom.
17.	SAFETY FACTORS:	As required
18.	COORDINATION:	As required
19.	REMARKS:	Students are seated at tables equipped with all necessary training aids. AI's are distributed about classroom as required.

OUTLINE OF MATERIAL TO BE PRESENTED

SECTION I. CHECK-POINT RECOGNITION (20 minutes)

I. Introduction

II. Check Points

III. General Discussion

PERIOD THREE

SECTION I. CHECK-POINT RECOGNITION (Concluded)

IV. Use of Check Points

V. Practical Exercise

SECTION II. GEOGRAPHICAL ORIENTATION (15 minutes)

I. Introduction

II. Geographical Orientation

III. Summary

SECTION III. SUN-STICK-SHADOW METHOD OF DETERMINING DIRECTION (5 minutes)

I. Introduction

II. Method

SECTION IV. A REVIEW OF METHODS OF LAND NAVIGATION (10 minutes)

I. Introduction

II. Route Planning

III. Dead Reckoning

IV. Map-Terrain Association

V. Summary

Break

LESSON PLAN
PERIOD THREE
SECTION I

CHECK-POINT RECOGNITION

I. INTRODUCTION

When navigating over most types of terrain, the basic navigational tool you should use is dead reckoning. You already know how to do this by using your compass for direction and counting your paces to measure distance. But as most of you have already realized, dead reckoning may not be absolutely accurate if you must use it exclusively for long periods of time without referring to some known points as you travel along. These known points are called check points.

II. CHECK POINTS

There are two basic kinds of check points. These are called line check points and point check points. There are also combinations of these kinds of check points. Let us first discuss line check points.

DIRECTIONS: SHOW SLIDE ONE.

As you can see, line check points are just that. There is a road that forms a line, a stream that forms a line, or any other natural or man-made feature that forms a line across your route.

There are several advantages and disadvantages of line check points. The advantages are:

1. Line check points are usually easy to see.
2. If a line check point stretches across your route, you will almost always hit it.
3. Mistakes in distance measurement can usually be corrected at line check points.

DIRECTIONS: REMOVE SLIDE ONE.

The major disadvantage is that most line check points do not tell you if you are on the correct azimuth, because you can usually not tell your exact location on them. Therefore, they offer you few cues as to direction.

DIRECTIONS: SHOW SLIDE TWO. DISCUSS PRECEDING POINT; THEN REMOVE SLIDE.

Let us now discuss point check points.

DIRECTIONS: SHOW SLIDE THREE.

Point check points, depending on how big they are, can vary in their usefulness to the navigator. For example, if you have a small hilltop, you can pinpoint yourself exactly, but, if you have a broad, flat hilltop, you can only approximate your exact position on the hilltop. However, most point check points, such as buildings, water towers, and hilltops, are easy to see and you can determine your exact position from them.

DIRECTIONS: REMOVE SLIDE THREE.

The advantages of this latter group of point check points are that they indicate exactly where you are on the ground, and you can correct any mistakes in both distance and direction. The disadvantages are:

1. Because they cover just a small area on the ground, point check points may be missed when you are navigating.

2. There may be many points in the area that look alike, for example, many similar hilltops, and you may select the wrong one as your check point.

Now let's look at another slide.

DIRECTIONS: SHOW SLIDE FOUR.

This shows that there are combinations of check points. The first of these combinations we will discuss is the intersection of lines. As you can see, this can be any terrain feature where two or more lines come together. The intersection of streams, valleys, roads, or any combination of these offers an intersection-of-lines check point.

The advantages of this type of check point are:

1. If this type check point stretches across your route, it is hard to miss.

2. Because the intersection is a specific point, this kind of check point offers you knowledge about both your distance and direction.

The fact that check points of this type may be hard to find is the major disadvantage of the intersection-of-lines check point.

DIRECTIONS: REMOVE SLIDE FOUR.

The last kind of check point we will discuss is a combination of lines and points.

DIRECTIONS: SHOW SLIDE FIVE.

As you can see, this type check point occurs when a line, such as a road, lies near a point, such as a building. Now you can ask, "If the building is there, why is it not used for a point check point?" The answer is that there may be many buildings in the area and having the road near it will help you to pick out the correct building.

The advantages of this type of check point are:

1. If it stretches across your route, it is hard to miss.

2. Because you can accurately determine an exact point on the ground from this type check point, it offers you knowledge about both distance and direction.

The principal disadvantage is that check points of this type may be hard to find.

DIRECTIONS: REMOVE SLIDE FIVE.

III. GENERAL DISCUSSION

You can see from the previous discussion that the best check points are those that offer you cues as to both your distance and direction. A point check point does this, but, since it is rather small, it may be missed

as you navigate. Obviously, the best check points are the combination of lines, or lines and points. They are easy to hit when navigating, offer cues to both distance and direction, and are usually easy to see on the ground.

DIRECTIONS: SHOW SLIDE SIX.

Look at this slide. Here is a typical intersection-of-lines check point (POINT). A check point like this can be easily seen both on the map and on the ground.

DIRECTIONS: REMOVE SLIDE SIX.

IV. USE OF CHECK POINTS

How do you use check points? Well, usually, you will have your route plotted for you. However, you will probably have access to a map or map substitute. By looking at this map, you can determine whether you will have good check points or whether your check points will be difficult to see. If you do not have access to a map, you will probably be given your check points. For example, you will be told, "Travel on an azimuth of 210 degrees for 600 meters and you will come to a hilltop. This will be your first check point."

If you ever have occasion to plot your own routes, remember to select check points that are combinations of lines and points, if possible. This type check point offers you knowledge about both your distance and direction and thus will offer you the most help as you navigate.

V. PRACTICAL EXERCISE

DIRECTIONS: HAVE STUDENTS LOOK AT COLUMBUS MAP SHEET.

A. What type check point is located in grid square 0390? There are several of the same type.

(Pause 30 seconds.)

Answer: Intersection of lines.

B. What are the advantages of this type check point?

(Pause 5 seconds.)

Answer: First, they are hard to miss if they stretch across your route, and, second, because the intersection forms an exact point on the ground, they give cues to both distance and direction.

GEOGRAPHICAL ORIENTATION

I. INTRODUCTION

You may have noticed that some people always seem to know where they are. Some years ago, it was thought that these people had a "sixth sense" of direction and that they were born with this. We now know that there is no instinctual sense of direction and that people who always know where they are have learned how to do this. You can learn this skill which is called geographical orientation, and, if you do, you will find that it makes navigation in the field much easier.

II. GEOGRAPHICAL ORIENTATION

A. What is geographical orientation?

Well, geographical essentially means land and orientation means knowing where you are. So, geographical orientation means knowing where you are on the land.

What does this mean to the Infantryman? It means that he knows at all times which direction a selected reference point is, where he is in respect to his CP for example, and what the pattern is (which way do they run) of the hills, roads, streams, etc., that are all around him.

B. How geographical orientation works

1. Visual orientation

How can you learn to do this? First, you must start from a known point. Then, as you move about, you always keep yourself informed exactly where that known point is in relation to you. This point you will select yourself, and we will call it the reference point.

Geographical orientation can be done on a large or small scale. Practicing on a large scale will help you understand orientation on a small scale. For example, you know that as you face north in the United States the Atlantic Ocean is on your right and the Pacific Ocean is on your left. Thus, you are oriented, but having these reference points (Atlantic and Pacific Oceans) so far away from you does not help you to navigate. You should select points that are close to your route. If

possible, they should be points that you can easily see as you navigate. However, in some kinds of terrain, selecting such a terrain feature is extremely difficult because of the dense vegetation. But, as we will explain later, this should not stop you from using reference points.

How does this help you when navigating a route? Well, you should select as your reference point some prominent geographical or cultural feature that lies near or on your route. For example, you could select a stream that is to the right of your route. You would look over the route and you would say, "Well, this stream always lies to the right of my route." Then, as you navigate, you can keep checking that the stream really is always on the right. You do not have to keep the stream in sight all the time. In fact you do not ever have to see it. Just remember that you should not cross it. If you do find yourself crossing it, you should re-orient (get back on the correct route) by moving so that the stream is again on your right. A reference point can be a stream, road, hill or line of hills, or any other feature that <u>can be easily seen on the ground</u>.

You can use anything that is prominent for a reference point, even the sun, moon, or certain stars. But, if you do this, remember that these celestial bodies are constantly moving across the sky so you should not use them if you are going to be walking in the same direction for more than one hour at a time. You can best use the celestial bodies if you are in an area where it is hard to pick up prominent features. You should use them only until you are able to get a good reference point on the ground.

If one reference point is good, are two even better? The answer is "yes." If you are in an area that offers many good prominent terrain features, you should select at least two of them. Let us say that there is a line of hills on the right of your route and a stream on the left. You look at your map and you find that your route lies between these two terrain features. So now you can say to yourself, "As I navigate I should always keep the hills on my right and the stream on my left." By doing this, you have <u>boxed yourself in</u>, and you will be able to keep on your route much easier.

2. Muscle sense

Visual orientation is not the whole of geographical orientation. You can also orient yourself using your muscle sense. How do you use these muscle cues?

Here is one example. You all know that when you walk uphill there is a pull on your body. You can feel this pull through your muscles so that even if you are blindfolded you can tell whether you are walking uphill or downhill. You can use this pull to help keep you oriented. Suppose, for example, that your route goes up a hill to the first check point, down the hill to the second check point, and along the right side of a hill to the objective. Here is what you can say to yourself. "I know by the pull of my muscles that I should be walking uphill until I reach my first check point. If I find that I am not going uphill (but going downhill or along the side of the hill), then I am off course and should re-orient uphill. On the next leg of my route, after I pass check point 1, I should be going constantly downhill, and, on my last leg, I will be going along the right side of the hill." Let us look at this last leg. Since we are going along the right side of a hill (the top of the hill is to our left), how does our muscle sense help us? Remember that, if the top of a hill is to your left, your left leg should be on slightly higher ground than is your right. Thus, if you find yourself in any other situation than having your left leg higher than your right leg, you are probably off course and should re-orient to the correct route.

This, then, is the second part of geographical orientation. You should find out the differences in elevation on your route; you can get this from a map or perhaps talk to someone who has been in the general area, and should recognize and remember what kind of muscle pull you should be experiencing as you travel over your route.

3. Verbal orientation

There is still a third part to geographical orientation. This is called verbal orientation. What does this mean? You know that when you ask directions in a city the person often says, "Go down one block and turn right." This is verbal orientation. You can look at your route

and say to yourself, "At the first check point, my azimuth takes me to the east which is to my right; at the second check point, the azimuth takes me to the west which means I turn left." In this way you will talk about the route to yourself and thus get fixed in your mind the various turning motions that you will do as you navigate over your course. We should stress once again that doing this verbalization will not enable you to navigate exactly, but it will help you to keep from making large errors, such as reversing your course 180 degrees or turning in the wrong direction.

III. SUMMARY

Let us review what we have said. First, we pointed out that when navigating you should try and keep yourself oriented. We have listed three ways of doing this. One way is to select a reference point--two points are better--which is roughly parallel to your route, if possible. Keeping yourself constantly oriented to this point may prevent you from getting lost.

Do not think that you cannot use the reference point system in darkness. Most nights have some light that will enable you to pick up points along the skyline. Remember that you can use the moon and certain stars as points also, but do not use them too long as they are constantly changing position in the sky.

The second way to help you remain oriented is to use your muscle sense. Look at the map and notice how the ground runs. If the route shows you are constantly going uphill, make a mental note that you should always feel the pull of your muscles while walking this particular route.

The third part of geographical orientation is to talk about the route. Say to yourself things like, "Let's see, as I leave the starting point, the azimuth takes me to the right, then at that hill the new azimuth takes me to the left." Doing this may keep you from making a wrong turn.

You realize that, if possible, you should use all three ways of orientation at the same time. For any route, you should get a reference point, notice which way the hills run and what your muscle sense should tell you, and talk about the turns (changes in azimuth) of the route.

We will stress again that by being oriented at all times you may prevent yourself from becoming lost or from straying very far off your route. Geographical orientation gives you an idea of the general direction

in which to go. However, you should still rely mainly on your compass, pacing, and map, if you have one, as these are precise instruments which will enable you to navigate exactly to your objective.

LESSON PLAN
PERIOD THREE
SECTION III

SUN-STICK-SHADOW [1] METHOD OF DETERMINING DIRECTION

I. INTRODUCTION

We have talked about geographical orientation and how you should keep track of where you are at all times. But what should you do if you somehow become separated from your squad and you are confused and without map or compass? I am going to tell you a way by which you can determine direction from things gathered in nature.

II. METHOD

This method is called the sun-stick-shadow method. You can use it on any day that is bright enough for a stick placed in the ground to cast a shadow. Here is how you use it.

DIRECTIONS: SHOW SLIDE SEVEN. REVIEW PROCEDURE, USING A POINTER TO COVER THE FOLLOWING POINTS.

First, you find a stick two or three feet long that is as straight as possible. Push this stick in the ground so that it is straight up and down. You will notice that the stick casts a shadow. Mark the tip of the shadow with a rock or marker of some kind. Now wait at least 15 minutes and you will notice that the shadow has moved. Mark the tip of this second shadow with another rock. Now if you draw a straight line between the two rocks, marking the tips of the shadow, you will have a line that runs generally east-west with east being in the direction of the second shadow.

DIRECTIONS: REMOVE SLIDE SEVEN.

This method will be most useful in a survival situation where you are lost and without map or compass. It will give you a general heading on which to travel, thus helping you regain your orientation.

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1 Instructors desiring more information on this method should consult the following article: "New Way To Find Direction," by Robert Owendoff, in Field and Stream, January 1962.

A REVIEW OF METHODS OF LAND NAVIGATION

I. INTRODUCTION

We have talked about the ways to use a compass and the methods of using a map. Let us now review just how a navigator uses these various techniques to move from point to point across unfamiliar terrain.

II. ROUTE PLANNING

As an LWI, your route will be planned for you by your leader. Here is how it will be laid out. Let us say that we are going to move from a starting point to an objective.

DIRECTIONS: SHOW SLIDE EIGHT.

On this slide, an "X" marks the starting point and the number 4 is at the objective. Notice that the route is not plotted in a straight line. There are several straight sections that are coupled together for the route. Each of these sections is called a leg of the route. Notice the route card on the slide. For each leg, the magnetic azimuth, the distance in meters, and the check point are given. You can determine these same things from your map, but having it plotted for you makes it easier for you to navigate. Notice that at the end of each leg there is a terrain feature. This is called a check point, and we have previously discussed what kind of terrain features make the best check points.

DIRECTIONS: REMOVE SLIDE EIGHT.

III. DEAD RECKONING

In the first period of this course, we discussed a method of land navigation called dead reckoning. Most of you also learned how to do this in Basic Combat Training. Always remember the following points when you are using the dead-reckoning process.

1. Always begin from a known location.

2. Always use your compass to maintain direction by using the center-hold technique.

3. Make frequent reference to your compass as you travel.

4. Stay on your azimuth until you reach your check point.

5. When you get to the check point, look at the ground around you and make sure you are at the correct check point.

6. Always reset the line over arrow of your compass whenever you change azimuths.

7. Use your own standard of pacing to measure distance traveled. If you do not remember what your pace count is, you will get a chance to establish it again when we go to the field.

8. Most people tend to be short in their distance measurement. If you find that you have run out of paces for the individual leg, keep going on your azimuth as your check point will probably be up ahead of you.

9. Always remember that, to use dead reckoning correctly, you must use your compass for direction and count your paces to estimate distance at the same time.

IV. MAP-TERRAIN ASSOCIATION

Dead reckoning is just one method of navigation. Another method that is very popular is called map-terrain association. Let us review some of the important points.

1. Always begin from a known location.

2. First orient the map to the ground by using your compass, and keep it oriented throughout your movement.

3. Before you start your route, look over your map and find the major terrain features that are on or near your route.

4. These features should be ones that can be easily seen both on the map and on the ground.

5. As you start moving on your route, you should see the terrain features on the ground just as they appear on your map. That is, a hill which is on the right on your map should also appear on the right on the ground. Thus, as you move along, you should always know where you are both on the map and on the ground.

6. As you travel along, always consider that the ground distance you cover should match the map distance.

7. Upon arrival at a check point or objective, conduct a detailed comparison between the ground position and the map position to make sure you are at the correct point.

This type of navigation is most effective when there are distinct terrain features both on the map and on the ground. It is difficult to use under conditions of limited visibility and in featureless terrain. When these conditions occur, you should use a combination of dead reckoning and map-terrain association or dead reckoning exclusively.

V. SUMMARY

We have discussed two methods of land navigation. When you go into the field for the practical exercises, you will be supplied with all necessary navigational equipment so that you can use either type of navigation you wish. However, we recommend that an efficient method of navigation utilizes both techniques. You can start on your route by using dead reckoning and also, at the same time, keep track of your position on your map. In this way, if you become confused as to direction or distance, you should be able to determine where you are and to take corrective measures to get back on your route.

This ends the classroom part of the Advanced Land Navigation Program. For our next three periods, we will move into the field and you will get to practice land navigation. If you are confused during any of these exercises, do not hesitate to ask questions of your AI's. They will give you any help you need as you navigate, as the purpose of this Program is to make you better land navigators.

PERIOD FOUR

PREPARATION DATA SECTION

1. TITLE:	Advanced Land Navigation: Detouring Obstacles and Distance Determination
2. TYPE OF INSTRUCTION:	Conference, demonstration, and practical exercise
3. HOURS OF INSTRUCTION:	One (1) hour: fifth of ten
4. CLASS PRESENTED TO:	
5. PURPOSE:	To provide instruction and practice in maintaining direction and distance in the field, including use of the compass as an aid in detouring large obstacles of unknown dimensions, and establishment of a standard, individual pace count peculiar to local terrain
6. INSTRUCTOR REFERENCES:	Instructor's Guide: RIFLEMAN V FM 21-26, Chapter 7
7. INSTRUCTIONAL AIDS:	One (1) lensatic compass per student One (1) pencil per student One (1) pace cord per student. Pace cord should be approximately 5 mm in diameter and 70-cm long. One (1) handout per student, "Detouring Major Obstacles of Unknown Dimensions" (See example attached to Section I of this Lésson Plan) One (1) Pace Count Conversion Card for the PI and each AI (6 Cards) (See example attached to Lesson Plan)

PERIOD FOUR

7. **INSTRUCTIONAL AIDS:** (Concluded)	One (1) Record Card, Distance Determination Course, per student (See example attached to Lesson Plan) Three (3) black lead pencils for the PI and each AI (18 pencils) One (1) clipboard for the PI and each AI (6 boards) One (1) center pole with all markers and Record Card for demonstration (See Figure 5 in Chapter 3 of this Guide)
8. **STUDENT UNIFORM AND EQUIPMENT:**	Uniform: fatigue Equipment: pistol belt, canteen, first aid packet, and poncho
9. **PHYSICAL FACILITIES:**	Distance Determination Course (See Construction Notes in Chapter 3 of this Guide)
10. **PERSONNEL REQUIREMENTS:**	One (1) principal instructor Five (5) assistant instructors One (1) medical corpsman and one (1) driver for emergency vehicle
11. **TROOP REQUIREMENTS:**	None
12. **TRANSPORTATION REQUIREMENTS:**	As required
13. **AMMUNITION REQUIREMENTS:**	None
14. **SPECIAL SOUND EQUIPMENT:**	None
15. **EVACUATION PLAN:**	The senior PI will familiarize himself with any evacuation plan required for the particular area of the reservation.
16. **PRINCIPAL INSTRUCTOR'S CHECKLIST FOR PROBLEM REHEARSAL AND PRESENTATION:**	SOP preclass check to see all necessary equipment is on hand.

17. **SAFETY FACTORS:** As required

18. **COORDINATION:** As required

19. **REMARKS:** A 200-man training company is divided among 18 start stakes. On arrival at the training area, each soldier is given a Route Card with his starting point number. The company forms with an 18-man front within the center circle of the Distance Determination Course. Men are seated on the ground initially during detouring instruction. They move in files to assigned start stakes (1-18, incl) on order from PI, after briefing for Section II. PI and each AI will be responsible for three start stakes each. They will dispatch men from assigned start stakes with 50-meter intervals between men on the same leg.

OUTLINE OF MATERIAL TO BE PRESENTED

SECTION I. DETOURING OBSTACLES (30 minutes)

I. How To Detour Obstacles

II. Detours with More Than Two Lateral Legs

III. Summary

IV. Practical Exercise in Facing and Determining Azimuths for Detouring

SECTION II. DISTANCE DETERMINATION (30 minutes)

I. Introduction

II. Determining the Individual Pace Count

NOTE: Students are afforded rest break before or after completion of the course, according to order of performance.

LESSON PLAN
PERIOD FOUR
SECTION I

DETOURING OBSTACLES

I. HOW TO DETOUR OBSTACLES

A. Travel cross-country in a straight line is often impossible because briers, exposed terrain, swamps, heavy underbrush, minefields, and contaminated areas must be detoured. Detouring any obstacle takes you off your assigned azimuth.

B. Detouring, therefore, must be done systematically. Detouring can be divided roughly into three classes: minor obstacles and visual obstructions; large obstacles with the far side clearly visible; and major obstacles of unknown dimensions.

1. Minor obstacles and visual obstructions

a. A tree, a large bush, a boulder, and sometimes ditches, streams, and road cuts fall into this class.

b. In all of these cases, you are moving toward a clearly visible steering mark.

c. You simply step around small obstacles, estimate the number of forward steps involved, and add them to the forward pace count.

(1) You may take five steps around a bush that is directly on your azimuth, but you estimate that only two paces were forward; therefore, you count two paces.

(2) In crossing a ditch or a road cut, estimate the paces from your position on the near bank to a point straight ahead on the far bank. You may take 30 paces to go down into, cross, and climb out of a road cut or a stream, but only ten of the paces carried you forward on the prescribed azimuth. So you add ten paces to the forward count.

(3) You may jump across a small stream two or three paces wide. Add the two or three paces to your forward pace count.

d. For convenience, we will put shortened steps into

this same category. You know from experience the "feel" of a normal, free-swinging pace. When tall grass, vines, and similar obstructions cause you to take short, half-steps, compensate by counting one forward pace for each two half-steps.

e. Use these techniques to give you the best possible walking without wandering off course. Do not permit paths or easy walking to lure you off your course.

f. In all the cases mentioned, you have been using a steering mark and adjusting your pace count to maintain a count of your forward paces only.

2. Large obstacles with the far side clearly visible

a. These obstacles are easy to compensate for. Remember the navigator who reported the location of, and then detoured, the minefield in Period One?

(1) Select a steering mark on the far side and move to it.

(2) Count only the forward steps.

b. When there is no clearly visible steering mark on the far side, use a steering mark on the near side which will be visible from the far side.

(1) A large open field with the far edge grown up in brush is a good example.

(2) You may have to detour the field to reduce chances of being seen or fired on en route.

(3) Select a steering mark on the near side and detour the field, using the edge of the woods for concealment.

(4) Look back at intervals to "hold" the steering mark that is now behind you.

(5) On arrival at what you judge to be the right spot on the far side, take a back azimuth on the steering mark to your rear.

(6) At night, or in close terrain, another man may serve as a steering mark.

c. A back azimuth is the azimuth directly opposite to the route azimuth.

(1) To get a back azimuth, subtract 180 degrees from your route azimuth if the route azimuth is 180 degrees or more.

(2) If your route azimuth is less than 180 degrees, add 180 degrees to get a back azimuth.

(3) For example, suppose your route azimuth is 10 degrees. You can't subtract 180 degrees from 10 degrees, so you add to get a back azimuth of 190 degrees.

d. Several sightings on the back azimuth may be necessary to get back on course. When you are on course on the far side of the open field and sight to the rear on your correct back azimuth, the steering mark to the rear is exactly on the back azimuth. At this point, you face about and move out on your route azimuth.

3. Major obstacles of unknown dimensions

a. Swamps, areas of thorny brush, and contaminated areas may fall into this category.

b. Navigation around these obstacles demands accurate use of the compass on three different azimuths and maintenance of two pace counts.

c. This is what you must do. Watch the demonstrator.

NOTE: An AI acts as demonstrator. His feet should be clearly visible to the class.

(1) Face squarely on your route azimuth with the compass aligned and held in the center-hold position.

(2) Place your feet together (soles and heels),

and, when visibility permits, look down between your body and the compass and ensure that the soles of your shoes are aligned with the index line and sight wire of the compass.

(3) Keep one foot in place, pivot on the heel of the foot in which direction you wish to go so that it forms an angle of 90 degrees with the foot left in place. Look at the AI's feet; they form a square corner.

(4) Move the foot that is left in place so the feet (heels and soles) are together again and you are facing squarely in the direction indicated by the index line, sight wire, and luminous dots at the ends of the sight wire. Do not permit the compass to move from the center-hold position.

(5) By day, look down and read your detour azimuth from the dial directly under the index line. The new azimuth should be 90 degrees to the right (or left) of the route azimuth. Check it with mental arithmetic and correct the detour azimuth, if necessary.

NOTE: AI may be seated.

(6) During darkness, follow exactly the same facing procedure used by day.

(a) Ensure that you are facing squarely on the new azimuth and select a close steering mark directly to your front.

(b) Raise the compass to eye level, focus the lens, and read the new detour azimuth directly under the index line with the compass aligned on the steering mark.

(c) Again check the new azimuth by mental arithmetic and correct the detour azimuth, if necessary.

(d) For example, the route azimuth is 270 degrees (west) and you wish to detour to the right. The detour azimuth would be 360 degrees, due north.

(7) Move on the detour azimuth, counting each pace, until you clear the obstacle laterally. Remember the lateral pace count.

(8) Face your route azimuth and continue your forward pace count until you clear the obstacle in the forward direction. You are moving forward on a line that is parallel to your true course.

(9) Repeat the facing procedure to return to your original route by moving the same number of paces as you first moved away from the original route. On completion of the return lateral pace count, resume your route azimuth and continue your forward pace count.

II. DETOURS WITH MORE THAN TWO LATERAL LEGS

DIRECTIONS: GIVE EACH TRAINEE A COPY OF THE HANDOUT.

Now look at the drawing on your handout.[1] Often it is impossible to tell when you have cleared a large obstacle in any direction.

For example, the navigator in the Drawing in the handout thought he had cleared the swamp laterally after detouring 20 paces left, from "A" to "B." But only 15 paces on his original azimuth found him on the edge of the swamp, and he detoured left again for 10 more paces from "C" to "D." After 30 paces on his route azimuth, he executed a right face to move 12 paces on his back azimuth, from "E" to "F," before he ran into the swamp for the third time. This was his cue to resume his original route azimuth and pick up his forward pace count. On all forward moves since he began the detour, he was moving parallel to his true course.

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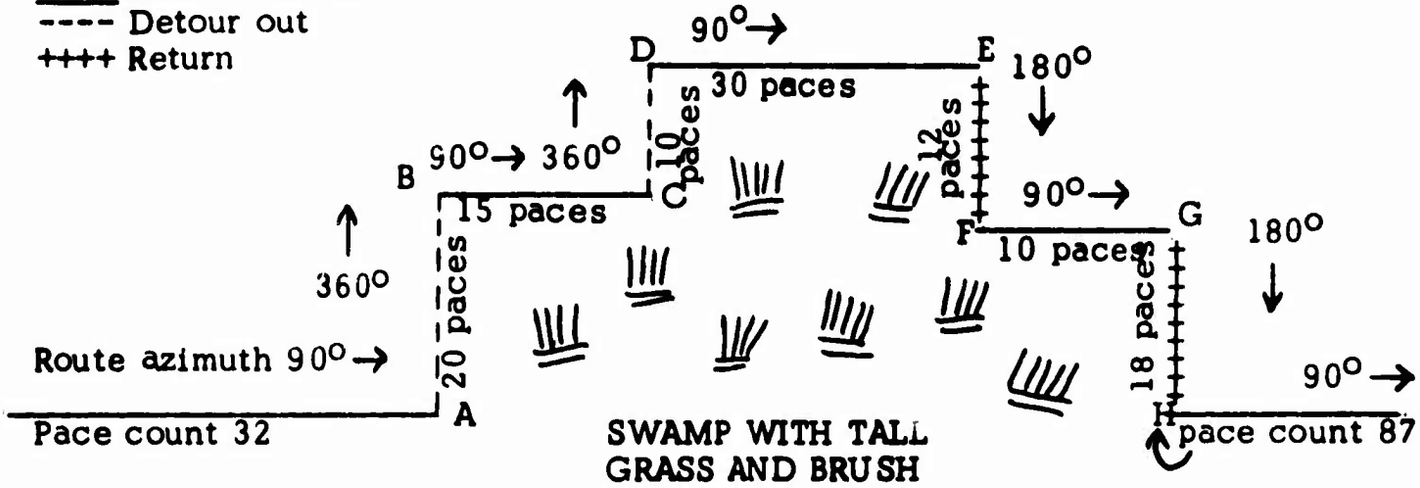
1 A copy of this handout is attached to this Section of the Lesson Plan.

In such a situation, you must remember the pace count applying to the lateral legs, too, because it is incomplete. You are still off your original course by any distance you have not traveled on your back azimuth. In this case, the navigator was still 18 paces from his location at "G" back to the original course.

On clearing the obstacle forward, the navigator repeated the facing procedure and checked his azimuth mentally against the one used on the first part of the return leg. He then moved back to his original route by applying the pace count that was left over when he ran into the obstacle the last time, 18 paces in this case. At the end of this lateral pace count, he resumed his original route azimuth and continued his forward pace count. Study your handouts off duty and practice the facing movements. Do you have any questions?

LEGEND:

_____ Route azimuth
---- Detour out
++++ Return



(HANDOUT DRAWING. DETOURING MAJOR OBSTACLES OF UNKNOWN DIMENSIONS)

III. SUMMARY

Apply these points when detouring:

1. A forward pace count is always maintained.

2. When a steering mark is visible on the far side of an obstacle, only the forward pace count is maintained.

3. A steering mark on the near side of an obstacle may be used if you determine the back azimuth and adjust to your original route by sighting on the steering mark to the rear after clearing the obstacle forward. Obtain a back azimuth by subtracting 180 degrees if you can; if the forward azimuth is less than 180 degrees, add 180 degrees.

4. On detours requiring more than two lateral moves, simply maintain the forward pace count and the lateral pace count according to your direction of movement. The lateral distance back to the forward route must always be equal to the lateral distance out. The azimuth on return to the original route is the back azimuth of the direction you move out from the route when you started the detour. Do you have any questions?

IV. PRACTICAL EXERCISE IN FACING AND DETERMINING AZIMUTHS FOR DETOURING

DIRECTIONS: ISSUE EACH STUDENT A COMPASS.

A. Put away your handouts, stand up, and take out your compasses. Use the center hold and face 270 degrees. Align your feet and body directly on the 270-degree azimuth. Now pivot on your right heel until your right foot forms a 90-degree angle with your left foot. A 90-degree angle is a square corner; look down and check your feet. This position will probably feel a little strained to you. Move your left foot into line with your right foot and read the azimuth under the index line. What is the correct detour azimuth?

(Pause 30 seconds.)

The correct detour azimuth is 360 degrees. If your compass does not read 360 degrees, adjust by moving on your feet until you are facing the correct azimuth.

B. What azimuth would you use to move back to the original route after clearing the obstacle forward?

(Pause 30 seconds.)

The return azimuth after clearing the obstacle forward is 180

degrees, the back azimuth of 360 degrees. We subtracted 180 degrees from 360 degrees to get the correct back azimuth.

C. Now your route azimuth is 135 degrees. Execute the procedure to detour a major obstacle to the left of the route azimuth and determine the correct detour azimuth.

(Pause 30 seconds.)

The correct detour azimuth is 45 degrees. The back azimuth used to return to the route after clearing the obstacle forward is 180 degrees plus 45 degrees, or 225 degrees. In this case we added 180 to 45 because we could not subtract 180 from 45.

D. Your route azimuth is 10 degrees. A swamp of undetermined size lies directly to your front. Face the 10-degree route azimuth, execute the facing procedure to detour left, and read the detour azimuth directly under the index line. What is the correct azimuth for detouring to the left?

(Pause 30 seconds.)

Recall that, from west, 270 degrees clockwise to north at 360 degrees is 90 degrees. The route azimuth is 10 degrees clockwise past north. So you simply add this 10 degrees to 270 degrees to get 280 degrees; therefore, the correct answer is 280 degrees. If you do not have the 280-degree azimuth reading under the index line, turn on your feet until 280 is directly under the index line on your compass. On your original facing, did you turn too little, less than 90 degrees, or too much, more than 90 degrees? Try to get the feel of a facing that is as near 90 degrees as you can possibly make it.

E. Your detour azimuth was at 280 degrees from the 10-degree forward route. Assume that you have cleared the obstacle laterally (to the left) and forward. What azimuth would you follow to return to your original course?

(Pause 30 seconds.)

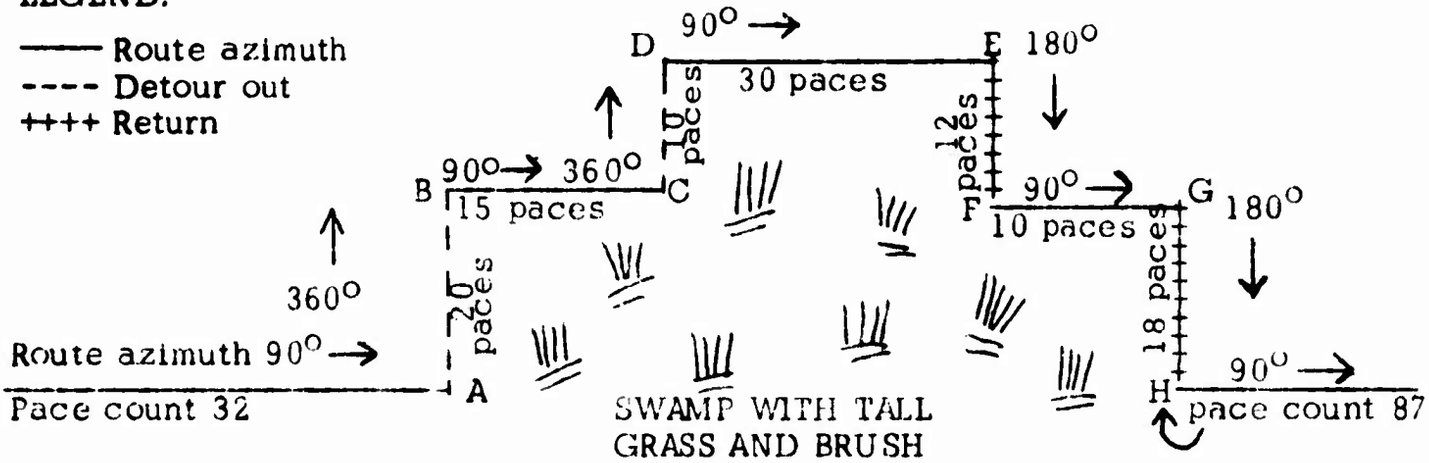
The correct azimuth is 100 degrees. Your detour azimuth, 280 degrees, minus 180 degrees gives you the back azimuth of the detour route out. Do you have any questions? Further study of your Back Azimuth and Detouring Training Aid, issued during Period One, will increase your understanding of detouring and use of the back azimuth.

LESSON PLAN
PERIOD FOUR
SECTION I
HANDOUT

DETOURING MAJOR OBSTACLES OF UNKNOWN DIMENSIONS

LEGEND:

—— Route azimuth
---- Detour out
++++ Return



Suppose you run into the edge of a swamp at "A," above. This is what you must do:

1. Remember your forward pace count, in this case, 32 paces. Say it aloud (to your buddy or to yourself, if alone) to aid recall.

2. Face squarely forward on your 90-degree route azimuth with the compass aligned and held firmly in the center-hold position. Place your feet together and look down between your body and the compass to ensure that your shoes are aligned with the index line. Keep one foot in place, pivot on the heel of the foot in the direction you wish to go so that it forms a 90-degree angle with the foot that was left in place. Move the foot left in place so the feet (heels and soles) are together again and you are facing squarely in the direction indicated by the index line, sight wire, and luminous dots--in this case, 360 degrees.

3. Look at the diagram. You are now at "A," facing 360 degrees. You move 20 paces on this detour azimuth and you feel that you have cleared the swamp. Your forward pace count is 32.

4. At "B," you need not execute a facing; you know your route azimuth is 90 degrees, pace count 32, so you pick up the forward pace count and move, using a steering mark, for 15 paces forward parallel to your original route; then, you hit the swamp again. Now, your forward pace count is 47 and you are off-course 20 paces on a detour azimuth of 360 degrees at "C."

5. At "C," you remember your detour azimuth was 360 degrees so you align your compass and move 10 paces for a total of 30 paces off-course. Your forward pace count is 47.

6. From "D" to "E," 90 degrees forward is 30 paces, raising your forward pace count to 77. Again, you are moving parallel to your true route.

7. At "E," you hope you have cleared the swamp. 360 degrees minus 180 degrees gives you a 180-degree back azimuth to return to your original course. You move 12 paces on the back azimuth, 180 degrees, and hit the swamp at "F." Your forward pace count is 77. You were 30 paces off-course on 360 degrees, you moved 12 paces on the back azimuth of 180 degrees, so you are still off-course 18 paces to the north.

8. At "F," you move forward 10 paces on your original route azimuth, parallel to, but not on, your true route. Your forward pace count is 87 at "G."

9. From "G," you turn right on your 180-degree back azimuth and walk 18 paces. This puts you back on course. So you face squarely on the prescribed azimuth of 90 degrees and pick up your forward pace count from 87.

10. At night, you cannot read your dial directly to obtain detour azimuths. So you must execute your 90-degree facing as precisely as possible, select a steering mark directly to your front, raise the compass to eye-level, focus the lens, and read your detour azimuth from the dial after the compass is aligned on the steering mark. Check your answer with mental arithmetic. If you turned too little or too much on facing, correct according to the compass reading. When no steering marks are available, make frequent reference to your compass.

LESSON PLAN
PERIOD FOUR
SECTION II

DISTANCE DETERMINATION

I. INTRODUCTION

During basic training, you established pace counts for three different types of terrain. By now, some of you have forgotten these pace counts; others will not have the same pace length because of growth or lengthening of stride from marching. A pace count is peculiar to the local terrain. Bad weather, heavy loads of equipment, head winds, and poor footing may shorten your paces. A tail wind or a downhill slope may lengthen your pace. Develop your feeling for your normal pace so you can compensate for shortened or lengthened steps any time they occur when you are acting as pace man. When you leave this course, you should have one standard pace count for 100 meters for use on this terrain and any terrain like it.

During our discussion of detouring, we covered compensation for short steps in heavy brush and when crossing ditches and streams. In the course you will follow today, few, if any, major detours should be involved. Stick to the course so you will finish with a useful average of your pace count.

II. DETERMINING THE INDIVIDUAL PACE COUNT

DIRECTIONS: AI'S PASS OUT THE RECORD CARDS, PENCILS, AND PACE CORDS. HAVE TRAINEES LINE UP ACCORDING TO START STAKE NUMBERS AND HAVE THEM WRITE THEIR NAMES ON THE RECORD CARD.

NOTE: Prior to class, each Record Card has a start stake number entered on it.

Look at the front of your Card, the side with your name and your start stake number on it. You have already noted the white start stakes on the circle around you. Each stake is numbered on both sides. When your start stake number is called, move to your numbered start stake as directed by your AI. He will point out your first steering mark, a white sign (POINT) with the letter "A" and your start stake number on it. The course you will pace runs in a straight line from the start stake to "A," then to "B," then to "C." At "C," you will face about and pace back to "D" over the same course, then to "E." From "E," return to your original start stake using this marker (POINT) in the center of the circle as a

steering mark. Be sure that you are moving to your steering mark, a white sign, to your direct front. Do not stray off to similar markers on your right or left flanks. In addition to the letter on your white sign, your start stake number will appear in black or red (POINT) on each sign so you can be sure you are on your assigned course. Odd numbered lanes are marked with red letters and numbers (POINT). Even numbered lanes are marked with black letters and numbers (POINT). If you cannot see a large lettered panel to your front on the route, move toward the intermediate markers (POINT) until you sight the larger panel.

At each lettered steering mark, halt and tie a knot in your pace cord. Then record the total number of paces taken up to that point in the appropriate space on your Card. Do not start a new pace count at each steering mark; record your total number of paces up to that point as shown here (POINT). If you forget your pace count at any time, return to the last steering mark and start over. Remember, a pace is one normal step, like this.

DIRECTIONS: PI TAKES SEVERAL NORMAL STEPS, COUNTING EACH ONE ALOUD.

On your last return leg, use this center marker (POINT) as a steering mark, but halt at your start stake and make your last entry. Your last entry in the blank space "E to SS" will show the total number of paces taken over the whole course. Wait for an instructor to take your Card. The instructor will complete the bottom part of your card. Do you have any questions? Do all of you have pace cords, pencils, and Record Cards?

AI's, take charge of your men and move them to the appropriate start stakes. Dispatch men with 50-meter intervals.

DIRECTIONS: THE PI AND EACH AI WILL TAKE CHARGE OF THREE FILES EACH AND MOVE THEM TO APPROPRIATELY NUMBERED START STAKES. EACH SOLDIER MUST HAVE A RECORD CARD, A PACE CORD, AND A PENCIL. ON RETURN, AI'S GIVE EACH MAN THE FOLLOWING INSTRUCTIONS AFTER COMPLETING HIS CARD.

Keep the card in your wallet for reference on this or similar terrain. Move over there (POINT) and wait quietly until the others have completed the course. You may practice 90-degree facings or study your pace

count breakdown. Move out.

NOTE: Prior to departure from the area, the PI will call the roll to ensure that all men have cleared the course.

RECORD CARD
DISTANCE DETERMINATION COURSE

NAME_____

START STAKE NO._____

RECORD YOUR TOTAL PACE COUNT AT EACH STEERING MARK; DO NOT START A NEW COUNT AT EACH STEERING MARK.

SS to A	_____	Paces
A to B	_____	Paces
B to C	_____	Paces
(Face about at C)		
C to D	_____	Paces
D to E	_____	Paces
E to SS	_____	Paces

NUMBER OF KNOTS IN PACE CORD_____

GIVE CARD TO INSTRUCTOR

TO BE COMPLETED BY INSTRUCTOR.
PACE CARD FOR WALLET. FOLD AND TEAR OFF.

NAME_____

USE THE FOLLOWING PACE COUNTS IN ALL LOCAL ALN TRAINING. KNOT YOUR PACE CORD FOR EACH 100 METERS.

100 Meters	_____	Paces
75 Meters	_____	Paces
50 Meters	_____	Paces
25 Meters	_____	Paces

AT EACH CHECK POINT, REMOVE ALL KNOTS FROM YOUR PACE CORD AND START A NEW PACE COUNT.

FIGURE 12. RECORD CARD FOR DISTANCE DETERMINATION COURSE

(Front of Card used for recording and determining standard pace count for local terrain. Instructor will fold the Card on the dotted line and tear off bottom section for each subject after using the Pace Count Conversion Card to fill in the pace count.)

LESSON PLAN
PERIOD FOUR
RECORD CARD

ADVANCED LAND NAVIGATION
DISTANCE DETERMINATION COURSE

THE COURSE YOU WILL PACE RUNS IN A STRAIGHT LINE FROM YOUR START STAKE TO STEERING MARK A, FROM A TO B, THEN TO C. AT C, YOU WILL FACE ABOUT AND PACE BACK, OVER THE SAME COURSE, TO D, THEN TO E. FROM E, PACE BACK TO YOUR START STAKE BY GUIDING ON THE TALL MARKER IN THE CENTER OF THE CIRCLE.

BE SURE THAT YOU ARE MOVING TO YOUR ASSIGNED STEERING MARK, A WHITE SIGN BEARING A LETTER AND THE SAME NUMBER AS YOUR START STAKE NUMBER. DO NOT STRAY OFF TO THE FLANK AND PACE A LANE ASSIGNED TO SOMEONE ELSE. ODD NUMBERED LANES HAVE RED LETTERS AND NUMBERS; EVEN NUMBERED LANES ARE MARKED WITH BLACK LETTERS AND NUMBERS. IF YOU CANNOT SEE A LARGE LETTERED PANEL, LOOK FOR AN INTERMEDIATE MARKER BEARING YOUR LANE NUMBER AND COLORS.

AT EACH STEERING MARK (MARKER WITH LETTER AND NUMBER), HALT AND TIE A KNOT IN YOUR PACE CORD, THEN ENTER THE TOTAL NUMBER OF PACES COUNTED UP TO THAT POINT. DO NOT START A NEW COUNT AT EACH STEERING MARK.

FIGURE 13. RECORD CARD FOR DISTANCE DETERMINATION COURSE

(Reverse side of Record Card used to record pace counts on the 600-meter Distance Determination Course. Use standard 5 x 8-inch card stock for reproduction.)

PACE COUNT CONVERSION CARD

600M Range	Paces Per 100M	75M	50M	25M
510-531	88	66	44	22
532-555	92	69	46	23
556-579	96	72	48	24
580-603	100	75	50	25
604-627	104	78	52	26
628-651	108	81	54	27
652-675	112	84	56	28
676-699	116	87	58	29

(Front)

PACE COUNT CONVERSION CARD

600M Range	Paces Per 100M	75M	50M	25M
700-723	120	90	60	30
724-747	124	93	62	31
748-771	128	96	64	32
772-795	132	99	66	33
796-819	136	102	68	34
820-843	140	105	70	35
844-867	144	108	72	36

(Reverse)

FIGURE 14. PACE COUNT CONVERSION CARD

NOTE: The AI's will read the total number of paces entered on the soldier's Record Card in the space marked "E to SS," find the 600-meter range into which the total falls, and use the data on the Conversion Card to fill in the wallet-sized card to be retained by the soldier. The conversion data can be typed on a 2 1/2 x 3-inch card and laminated in clear plastic for protection against wear and weather. It will be necessary to use both sides of the card.

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PERIOD FIVE

PREPARATION DATA SECTION

1. TITLE:	Advanced Land Navigation: Night Navigational Exercise
2. TYPE OF INSTRUCTION:	Conference and practical exercise
3. HOURS OF INSTRUCTION:	Two (2) hours: sixth and seventh of ten
4. CLASS PRESENTED TO:	
5. PURPOSE.	To provide instruction and practice in night land navigation
6. INSTRUCTOR REFERENCES:	Instructor's Guide: RIFLEMAN V
	FM 21-26, Chapter 7
7. INSTRUCTIONAL AIDS:	One (1) lensatic compass per student
	One (1) pace cord per student
	One (1) route card per student (See example attached to Lesson Plan)
	One (1) flashlight with red filter per pair of students
	One (1) master list of start and finish stakes
8. STUDENT UNIFORM AND EQUIPMENT:	Uniform: fatigue
	Equipment: pistol belt, canteen, first aid packet, and poncho
9. PHYSICAL FACILITIES:	Field facilities as described in Chapter 3 of this Guide
10. PERSONNEL REQUIREMENTS:	Two (2) principal instructors
	Six (6) assistant instructors
	One (1) medical corpsman and one (1) driver for emergency vehicle

PERIOD FIVE

11.	TROOP REQUIREMENTS:	None
12.	TRANSPORTATION REQUIREMENTS:	As required
13.	AMMUNITION REQUIREMENTS:	None
14.	SPECIAL SOUND EQUIPMENT:	None
15.	EVACUATION PLAN:	The senior PI will familiarize himself with any evacuation plan required for the particular area of the reservation.
16.	PRINCIPAL INSTRUCTOR'S CHECKLIST FOR PROBLEM REHEARSAL AND PRESENTATION:	SOP preclass check to see all necessary equipment is on hand.
17.	SAFETY FACTORS:	As required
18.	COORDINATION:	As required
19.	REMARKS:	The trainees will be issued compasses and pace cords before coming to the field. Each PI and AI will have with him a sufficient number of route cards and flashlights for issuing to trainees at the specific lanes to which he is assigned.

OUTLINE OF MATERIAL TO BE PRESENTED

I.	Review of Navigational Procedures	(5 minutes)
II.	Rules for the Navigational Exercise	(5 minutes)
III.	Practical Exercise	(110 minutes)

NOTE: PI and AI's who are responsible for lanes will give a one-minute briefing on that lane before starting the individual pairs. Trainees will be started 3-5 minutes apart depending upon the size of the class.

NIGHT NAVIGATIONAL EXERCISE

DIRECTIONS: AFTER ARRIVAL AT FIELD TRAINING AREA, THE COMPANY WILL BE DIVIDED INTO TWO EQUAL GROUPS. ONE GROUP, ACCOMPANIED BY ONE PI AND THREE AI'S, WILL MOVE TO ONE END OF THE LANES, AND THE OTHER GROUP, WITH THE SAME NUMBER OF CADRE, WILL MOVE TO THE OPPOSITE END OF THE LANES. AFTER ARRIVAL AT THESE AREAS, THE GROUPS WILL ASSEMBLE AROUND THE SAMPLE CHECK POINT POLES, AND THE PI FOR EACH GROUP WILL DELIVER THE NECESSARY INSTRUCTIONS. BOTH GROUPS WILL START TRAINEES AT THE SAME TIME. THE PROCEDURE WHICH FOLLOWS WILL BE USED BY BOTH GROUPS. CONTACT BETWEEN THE GROUPS SHOULD BE MAINTAINED BY RADIO.

I. REVIEW OF NAVIGATIONAL PROCEDURES

Gentlemen, this is the night navigational exercise of the Advanced Land Navigation course. Tonight you will run this course in buddy pairs. I am briefly going to review some of the major points you should remember and use as you navigate over these routes.

DIRECTIONS: COVER THE FOLLOWING POINTS.

1. Use your compass for direction. Always use the center-hold position. Reset the line over arrow for a new azimuth at every check point by using your flashlight. If the luminous parts of your compass become dim, recharge them with your flashlight.

2. Count your paces to measure distance. Tie a knot in your pace cord for every 100 meters traveled and start a new pace count. At each check point, untie all knots in your pace cord.

3. Most navigators tend to be short in their distance measurement. If you reach the end of your pace count, and you are still not at the check point, search ahead of you for it but always stay on your azimuth.

4. Since you do not have a map tonight, you will have to depend on dead reckoning to get you in the vicinity of a check point. Consult your route card to determine the azimuth and distance of each leg. When you get to what you think is your check point, establish its location; then go to the nearest striped pole to determine your exact position.

II. RULES FOR THE NAVIGATIONAL EXERCISE

Your instructors will assign each buddy pair to a starting point. There will be several buddy pairs at each starting point and you will be told when to start on the route by an AI. Do not start until he tells you to do so.

You will navigate over this route in buddy pairs. If you have someone with whom you would like to navigate, tell your AI. Otherwise he will assign each of you a partner. As you navigate over this course, you should share the navigational duties. One of you should be the compass man and the other one should act as pace man. Change your duties for each leg of the route. Your AI will give you a briefing on the route before you start.

On these routes, check points are always terrain features. When you get in the area of a check point, you will see a striped yellow and black pole marked with a red light. It is just like the one here (POINT). Go on until you reach what you think is a check point, notice where that is on the ground, and then go to the nearest pole. You will find a map attached to the pole showing the area around the check point. Use your flashlight to look at the map. By interpreting the information on the map, you should be able to determine whether you have arrived at the correct check point or not. If you have arrived correctly, return to your check point and start on your next azimuth. If you have not arrived correctly, from the map determine exactly where your check point is on the ground and move to that point. Then start your new azimuth. Remember to reset the line over arrow for the new azimuth at each check point. You can use your flashlight to help you do this. When you get to the end of the route, you will see a red stake and a white sign. If you have navigated correctly, the letter or number on the sign will match the letter or number at the top of your route card.

You will have about one and one-half hours to reach the objective after you leave the starting point. Move along on your azimuth and if you find another pair close ahead of you, and you are traveling faster than they are, simply move on past them and continue on your route.

Use your flashlight as little as possible. Remember, if you were in combat, a point of light would probably draw fire from enemy forces. If possible, always shield your flashlight when you use it. Your

Instructors will now assign you to a start stake.

III. PRACTICAL EXERCISE (PROCEDURES FOR THE INSTRUCTORS)

A. Procedure at the start stakes

1. The PI will assign pairs equally among the 12 start stakes. The PI and each AI will be responsible for three stakes. One buddy pair should be put by each stake and the other pairs will be seated on the ground about 25 meters behind their respective start stakes.

2. The instructor will give the buddy pair at the starting point a flashlight and the route card, will check to see that each man has a compass and a pace cord, will have the compass man set his compass for the first azimuth and will check to see that the setting is correct, and will deliver the route briefing as detailed below. The instructor will then start the pair.

3. Give the buddy pair the route briefing (one minute), covering the following points. Refer to trainees' route card.

   a. Changes in azimuth

   b. Distance of each leg

   c. Check points

   d. Any hazards

4. When a pair has started, the instructor will move to his next assigned stake and repeat this same procedure for another pair. The instructor will continue this process, moving back and forth among his assigned stakes, until all pairs have been started.

B. Procedure after all trainees have started on the routes

The senior PI will assign three AI's (two from the west side and one from the east side) to serve as check-point monitors. Once all the trainees have departed the starting point, each check-point monitor will move to his check-point area. While at the check point, he will offer assistance where needed, watch and regulate light discipline, and break up any large groups that are moving together on the course.

C. Procedure to end the exercise

The instructors (the PI's and the remaining AI's) that do not move to the check points will stay in the area near the end of the course. As each buddy pair finishes, they will take the compasses, pace cords, route cards, and flashlight from them. These will be collected in a central place.

When all trainees have completed the course, or are otherwise accounted for, all groups will move to the central assembly area.

ROUTE 7

	Degrees	Meters	Check Point
LEG 1	265	475	DRY STREAM
LEG 2	300	600	ROAD
LEG 3	255	400	OBJECTIVE

FIGURE 15. SAMPLE ROUTE CARD FOR NIGHT NAVIGATIONAL EXERCISE

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PERIOD SIX

PREPARATION DATA SECTION

1. TITLE:	Advanced Land Navigation: Day Navigational Exercise
2. TYPE OF INSTRUCTION:	Conference and practical exercise
3. HOURS OF INSTRUCTION:	Three (3) hours: eighth, ninth, and tenth of ten
4. CLASS PRESENTED TO:	
5. PURPOSE:	To provide instruction and practice in day land navigation
6. INSTRUCTOR REFERENCES:	Instructor's Guide: RIFLEMAN V
	FM 21-26, Chapter 7
7. INSTRUCTIONAL AIDS:	One (1) lensatic compass per student
	One (1) pace cord per student
	One (1) combination map and route card per student (See sample attached to Lesson Plan)
	One (1) master list of start and finish stakes
8. STUDENT UNIFORM AND EQUIPMENT:	Uniform: fatigue
	Equipment: pistol belt, canteen, first aid packet, and poncho
9. PHYSICAL FACILITIES:	Field facilities as described in Chapter 3 of this Guide
10. PERSONNEL REQUIREMENTS:	Two (2) principal instructors
	Six (6) assistant instructors
	One (1) medical corpsman and one (1) driver for emergency vehicle

PERIOD SIX

11.	TROOP REQUIREMENTS:	None
12.	TRANSPORTATION REQUIREMENTS:	As required
13.	AMMUNITION REQUIREMENTS:	None
14.	SPECIAL SOUND EQUIPMENT:	None
15.	EVACUATION PLAN:	The senior PI will familiarize himself with any evacuation plan required for the particular area of the reservation.
16.	PRINCIPAL INSTRUCTOR'S CHECKLIST FOR PROBLEM REHEARSAL AND PRESENTATION:	SOP preclass check to see all necessary equipment is on hand.
17.	SAFETY FACTORS:	As required
18.	COORDINATION:	As required
19.	REMARKS:	The trainees will be issued compasses and pace cords before coming to the field. Each PI and AI will have with him a sufficient number of the combination map and route cards for issuing to trainees at the specific lanes to which he is assigned.

OUTLINE OF MATERIAL TO BE PRESENTED

I.	Review of Navigational Procedures	(5 minutes)
II.	Rules for the Navigational Exercise	(5 minutes)
III.	Practical Exercise	(170 minutes)

NOTE: PI and AI's who are responsible for specific lanes will give a one-minute briefing on that lane before starting the individual trainee. Trainees will be started 3-5 minutes apart depending upon the size of the class.

LESSON PLAN
PERIOD SIX

DAY NAVIGATIONAL EXERCISE

DIRECTIONS: BETWEEN PERIODS FIVE AND SIX, THE COURSE WILL BE EXPANDED BY MOVING ONE STARTING POINT INTO THE POSITION AS SHOWN IN THE COURSE CONSTRUCTION IN CHAPTER 3. THUS, THE STARTING POINT FROM ONE SIDE FOR PERIOD FIVE WILL BE THE FIRST CHECK POINT ON THAT SIDE IN PERIOD SIX. THE COMPANY WILL DIVIDE INTO THE SAME GROUPS AS FOR PERIOD FIVE. HOWEVER, EACH GROUP WILL MOVE TO THE OPPOSITE END OF THE COURSE FROM THE ONE IT OCCUPIED IN PERIOD FIVE. THERE, THE PROCEDURE WILL BE THE SAME AS IT WAS FOR PERIOD FIVE.

I. REVIEW OF NAVIGATIONAL PROCEDURES

Gentlemen, this is the day navigational exercise of the Advanced Land Navigation Program. Each of you will run this course separately. I am going to briefly review some of the things you should remember and use as you navigate over these routes.

DIRECTIONS: COVER THE FOLLOWING POINTS.

1. Use your compass for direction. Always use the center-hold compass position. Reset the line over arrow for a new azimuth at every check point.

2. Count your paces to measure distance. Tie a knot in your pace cord for every 100 meters traveled. At each check point, untie all knots in your pace cord and start a new count.

3. Most navigators tend to be short in their distance measurement. If you reach the end of your pace count, and you are still not at the check point, search ahead of you for it, but always stay on your azimuth.

4. Before you leave the starting point, look on your map and notice features on or near your route that will be easily recognized on the ground. Frequently refer to your map as you navigate to see that you are on the correct route. Always orient your map when you use it.

5. Use what you have learned about geographical orientation when you navigate on your route.

II. RULES FOR THE NAVIGATIONAL EXERCISE

Your instructors will assign each of you to a starting point. There will be several of you at each starting point and you will be told when to start on the route by an AI. Do not start until he tells you to do so.

Each of you will navigate over the route alone. There are many different routes in this area so do not think that, just because someone started from the same starting point as you, he has the same route. Your AI will give you a briefing on the route before you start.

On these routes, check points are always terrain features. When you get in the area of your check point, you will see a striped yellow and black pole just like the one you see here (POINT). Go on until you reach what you think is your check point, notice where that is on the ground, and then go to the nearest pole. You will find a map attached to the pole showing the area around the check point. By interpreting the information on the map, you should be able to determine whether you have arrived at the correct check point or not. If you have arrived correctly, return to your check point and start on your next azimuth. If you have not arrived correctly, from the map determine exactly where your check point is on the ground and go to that point. Then start your next azimuth. When you get to the end of your route, you will see a red stake and a white sign. If you have navigated correctly, the letter or number on the sign will match the letter or number at the top of your route card.

You will have about 2 1/2 hours to reach the objective after you leave the starting point. Move along on your azimuth as there will be people behind you on different routes. Do not bunch up on the routes. If you find someone is close ahead of you, and you are traveling faster than he is, simply move on past him and continue on your route. Your instructors will now assign you to a starting stake.

III. PRACTICAL EXERCISE (PROCEDURES FOR THE INSTRUCTORS)

A. Procedure at the start stakes

1. The PI will assign trainees equally among the 12 start stakes. The PI and each AI will be responsible for three stakes. One trainee should be put by each stake and the other trainees will be seated on the ground about 25 meters behind their respective start stakes.

2. The instructor will give the trainee at the starting point the combination map and route card, will check to see that he has a pace cord and a compass, will have the trainee set his compass for the first azimuth and will check to see that the setting is correct, and will deliver the route briefing as detailed below. The instructor will then start the trainee.

3. Give the trainee the route briefing by indicating the following features on his map (one minute).

   a. Changes in azimuth

   b. Streams to be crossed

   c. Check points

   d. Any hazards

4. When a trainee has started, the instructor will move to his next assigned stake and repeat this procedure for another man. The instructor will continue this process, moving back and forth among his assigned stakes, until all men have been started.

B. Procedure after all trainees have started on the routes

The same AI's that served as check-point monitors in the night exercise will again move to their respective check-point areas as soon as all the trainees have departed the starting points. There they will patrol up and down the length of the check point and will give assistance to any trainee that appears to be confused.

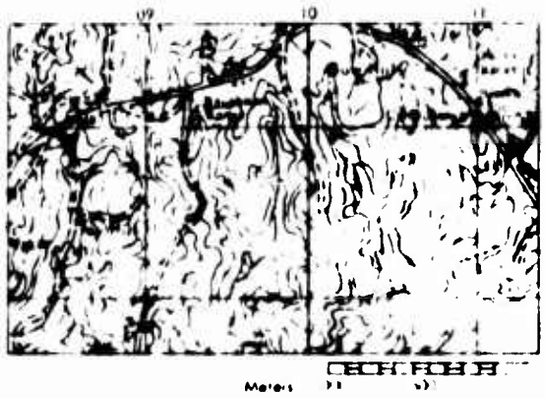
C. Procedure to end the exercise

The instructors (the PI's and the remaining AI's) that do not move to the check points will stay in the area near the end of the course. As each trainee finishes, they will take the compass, pace cord, and combination route card and map from him and collect these in a central place.

When all trainees have completed the course, or are otherwise accounted for, all groups will move to the central assembly area.

PERIOD SIX
COMBINATION MAP
AND ROUTE CARD

ROUTE _____



SCALE
1 : 50,000

MAGNETIC
NORTH

CONTOUR INTERVAL -- 20 FEET

	Degrees	Meters	Check Point
LEG 1	_____	_____	_____
LEG 2	_____	_____	_____
LEG 3	_____	_____	_____
LEG 4	_____	_____	_____

FIGURE 16. COMBINATION ROUTE AND MAP CARD

APPENDIX

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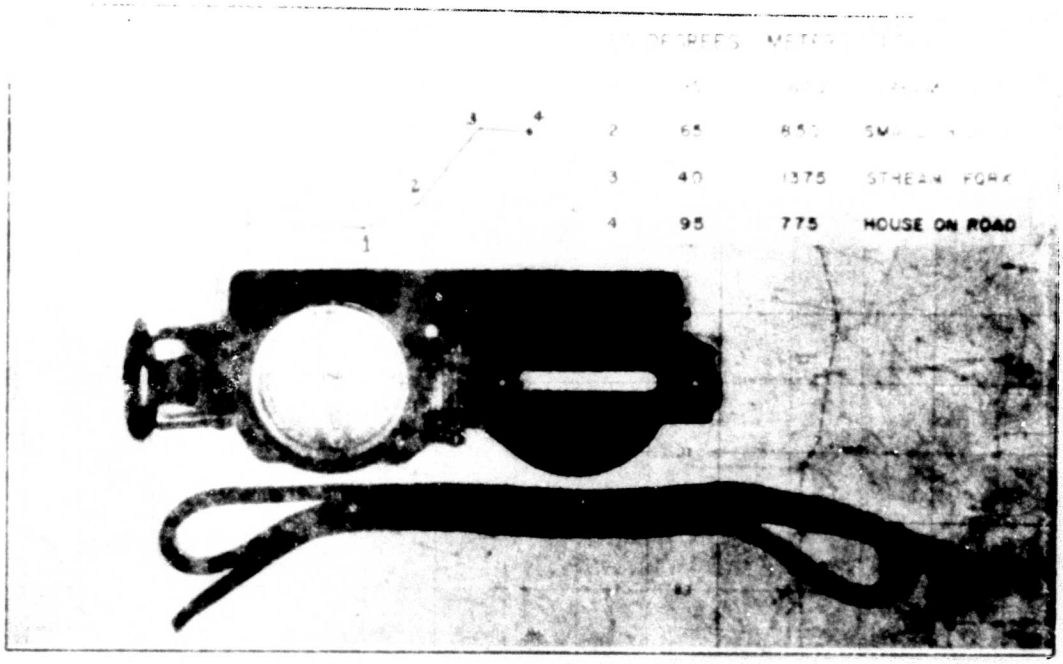
APPENDIX

SLIDES



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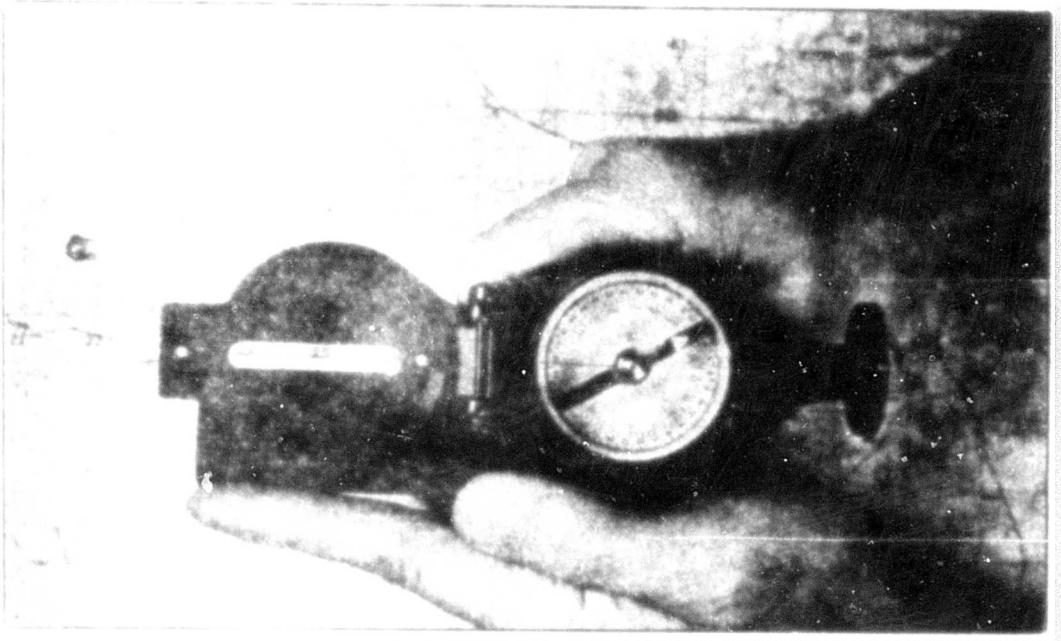

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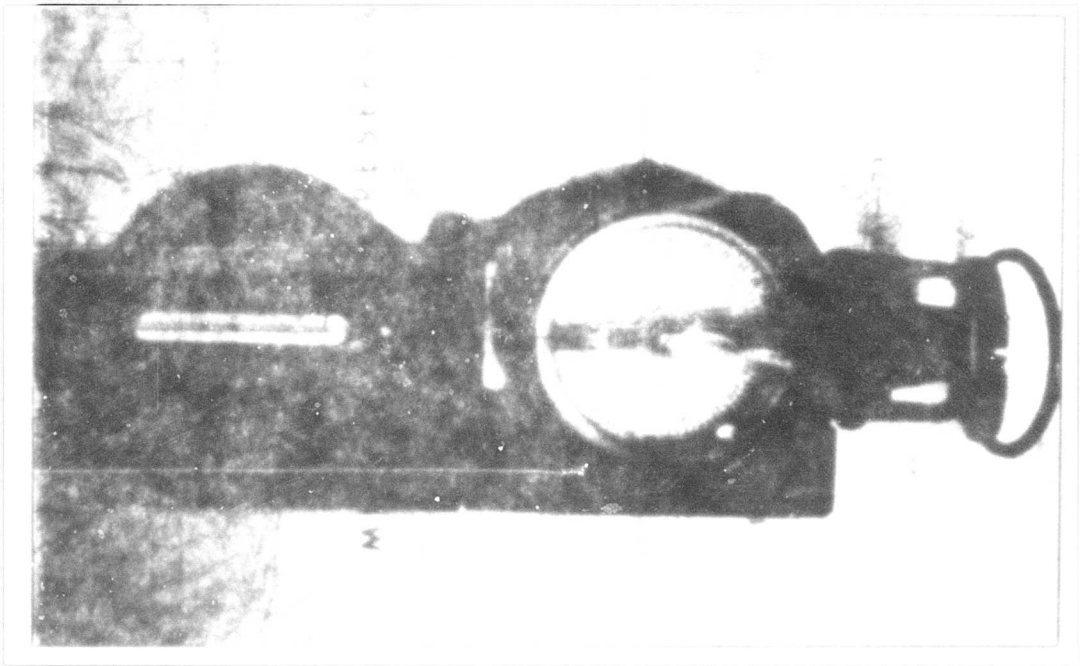

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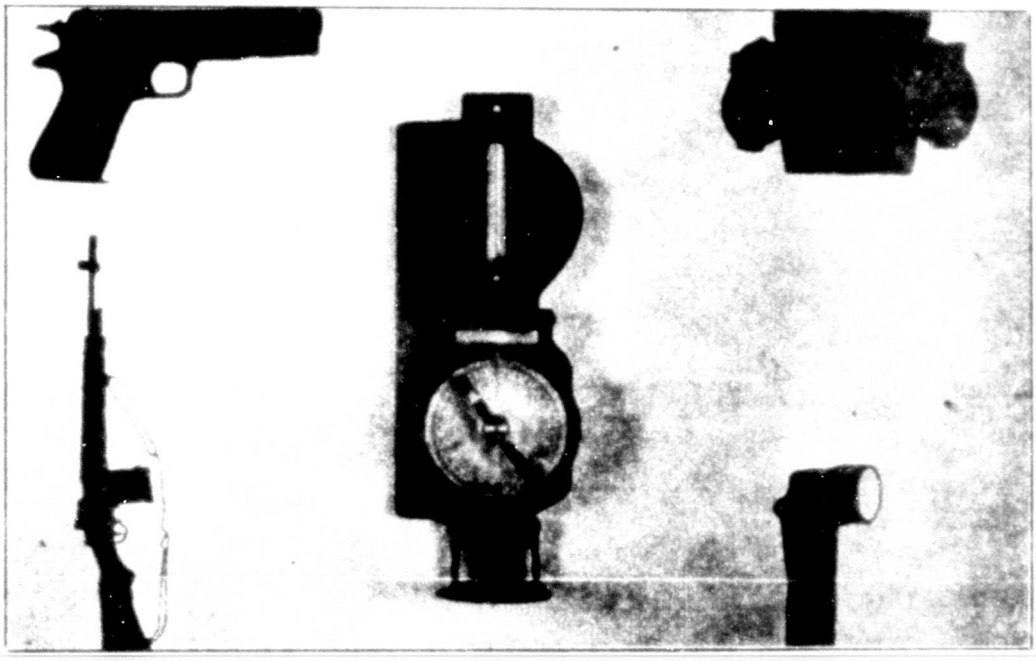

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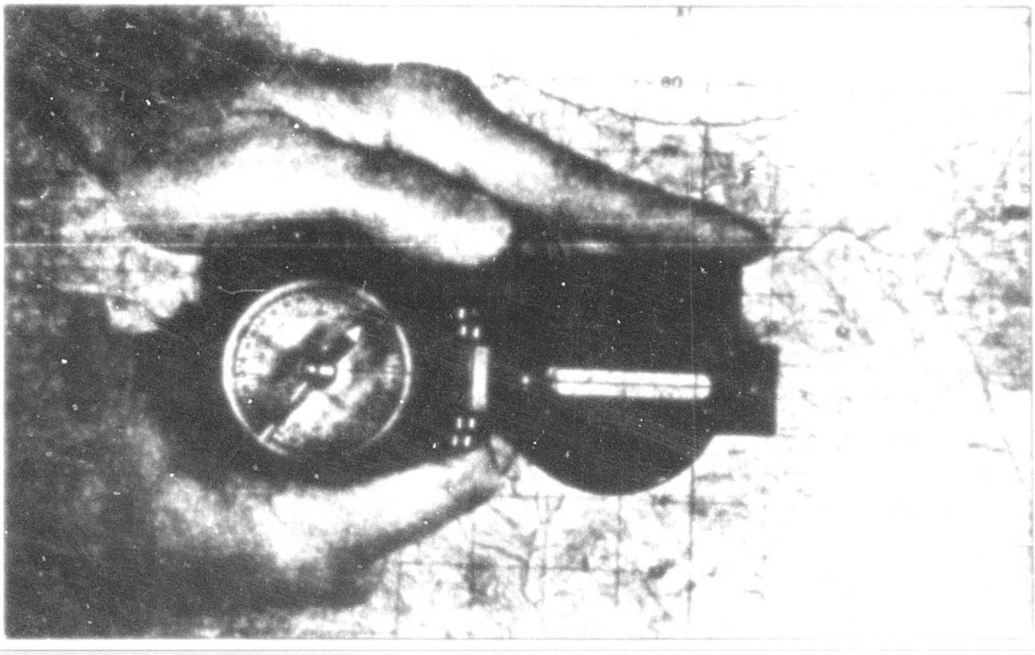

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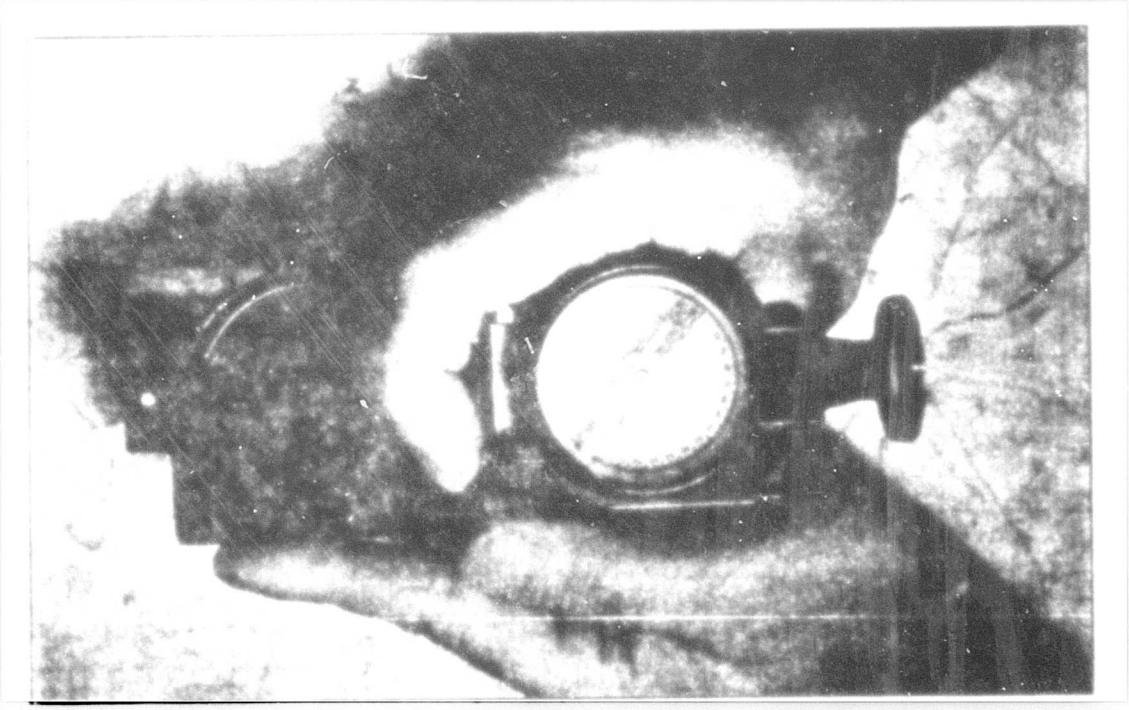

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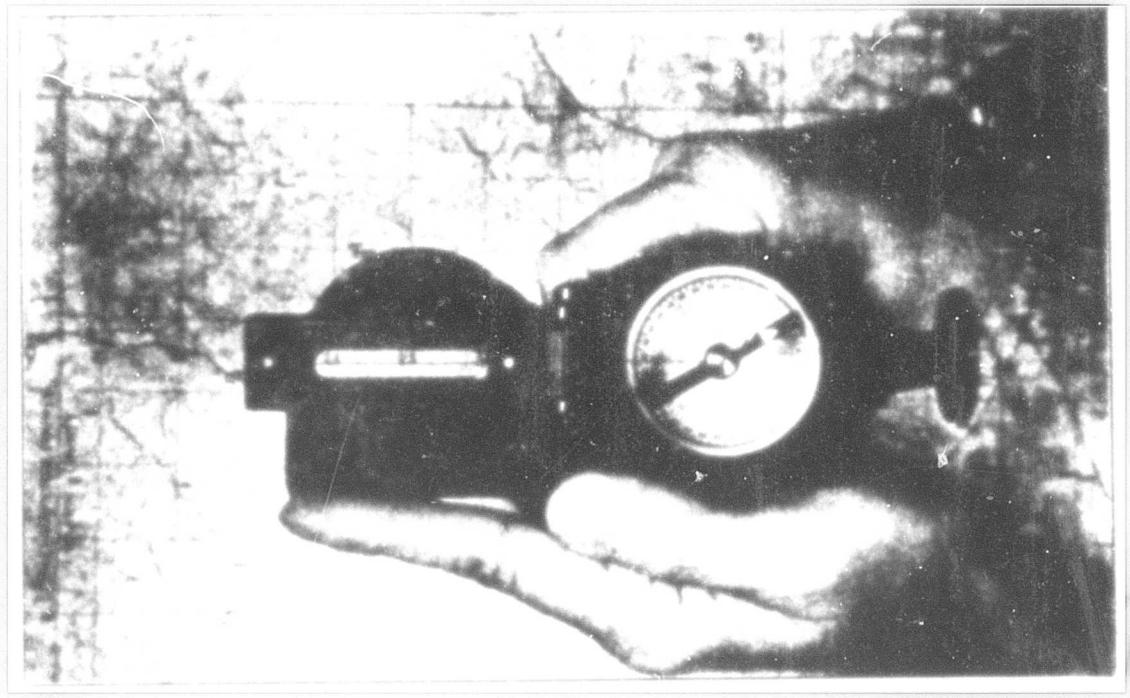

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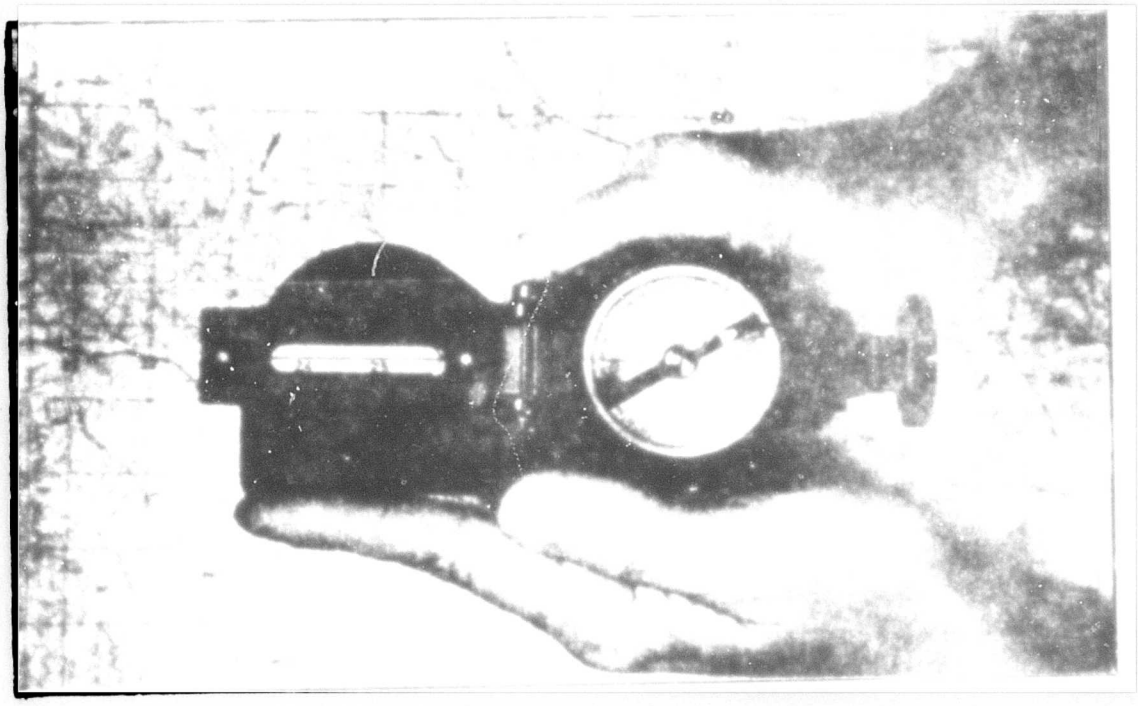

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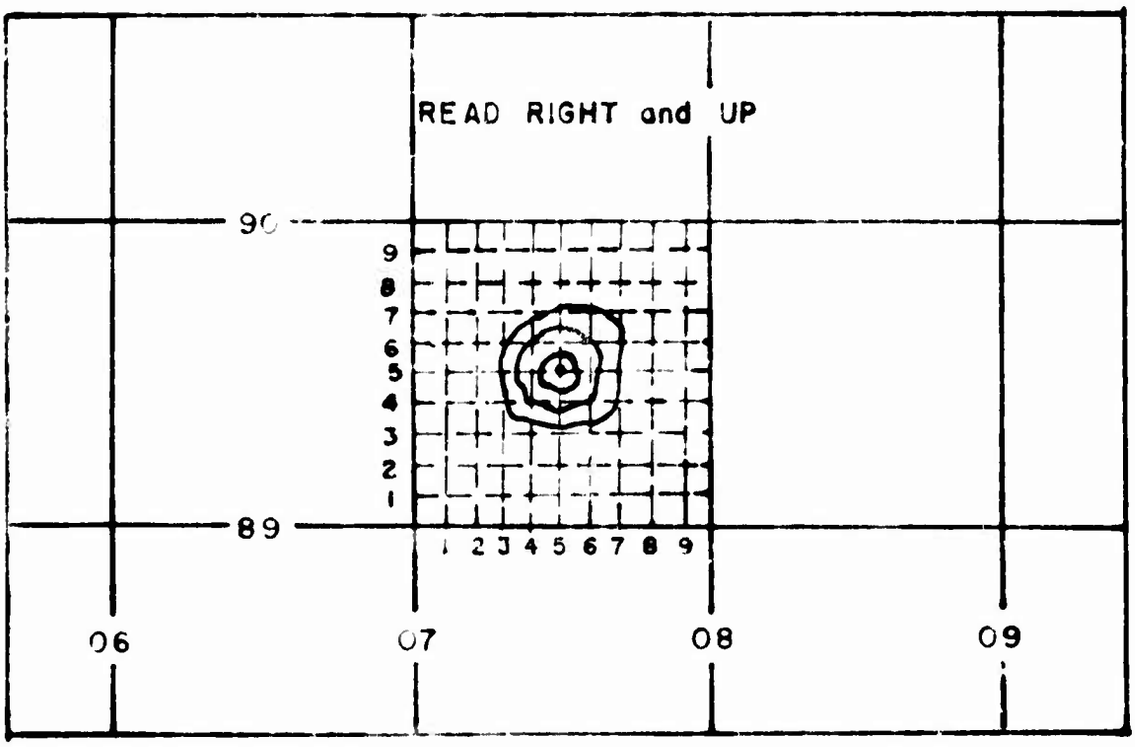

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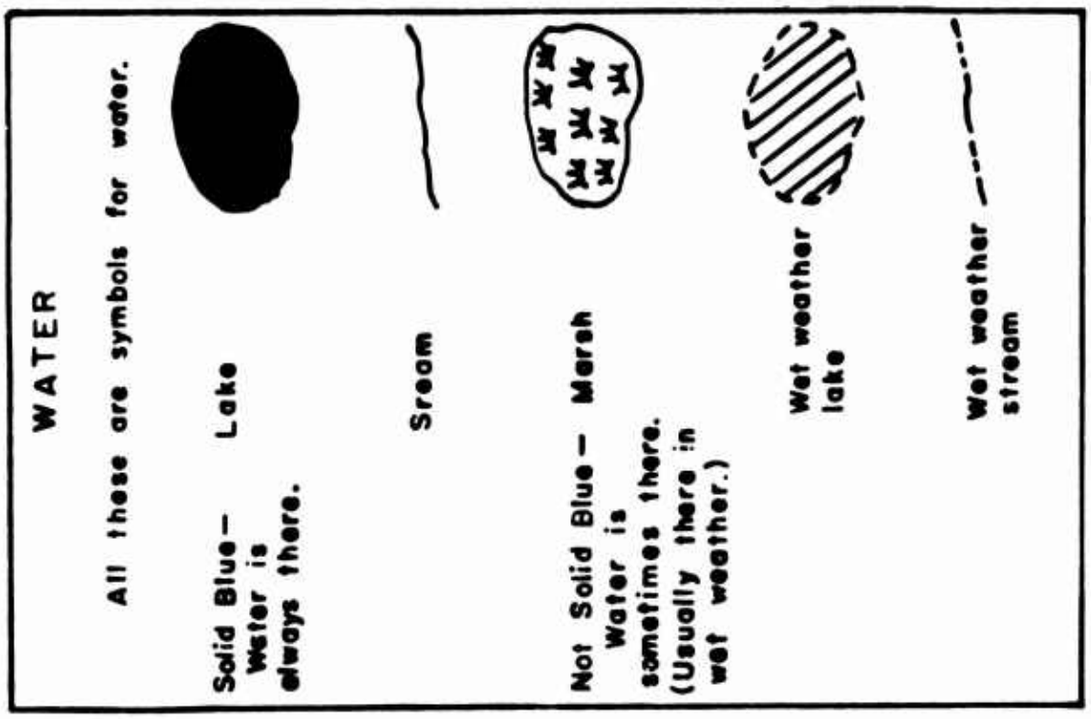

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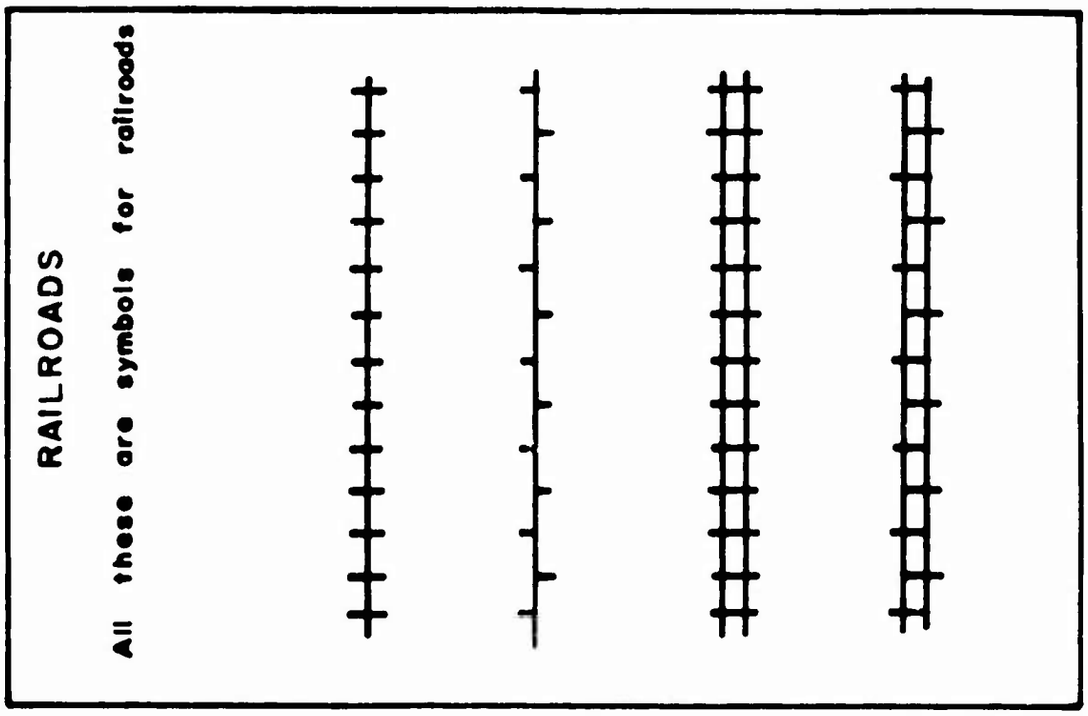

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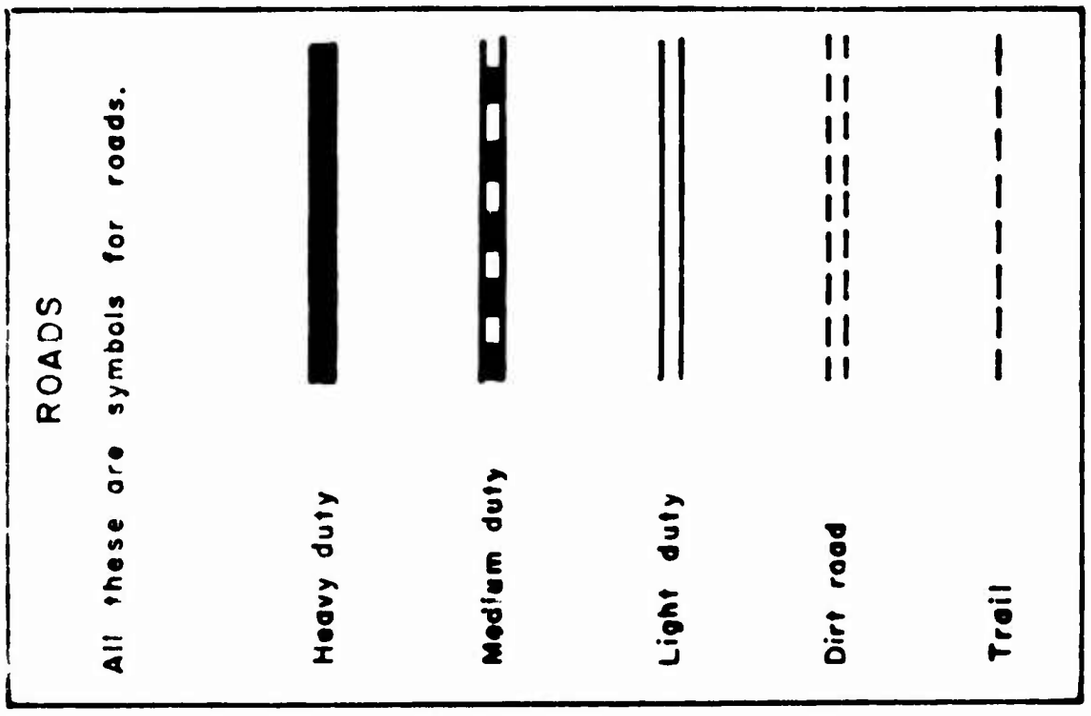

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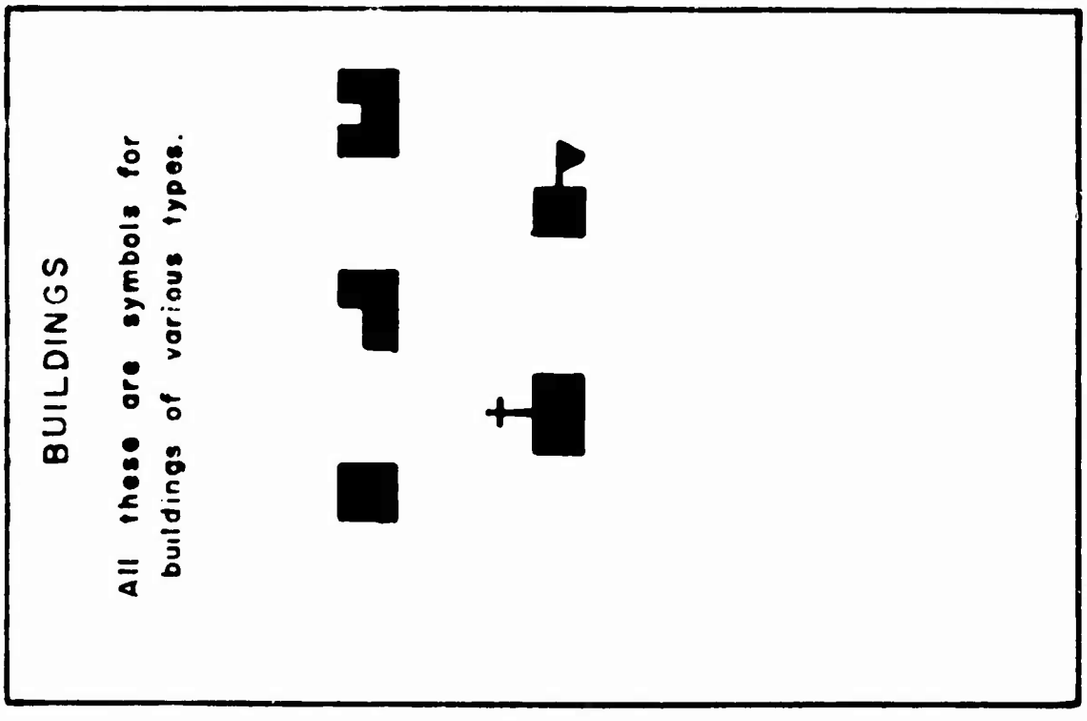

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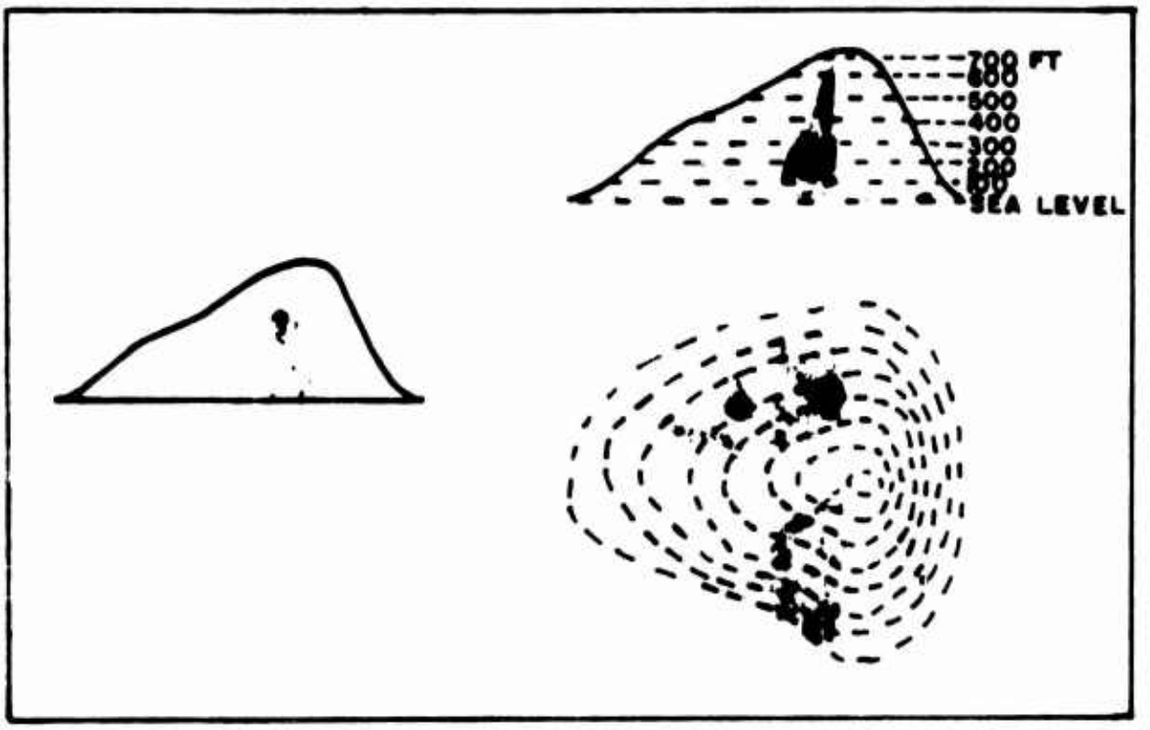
APPENDIX



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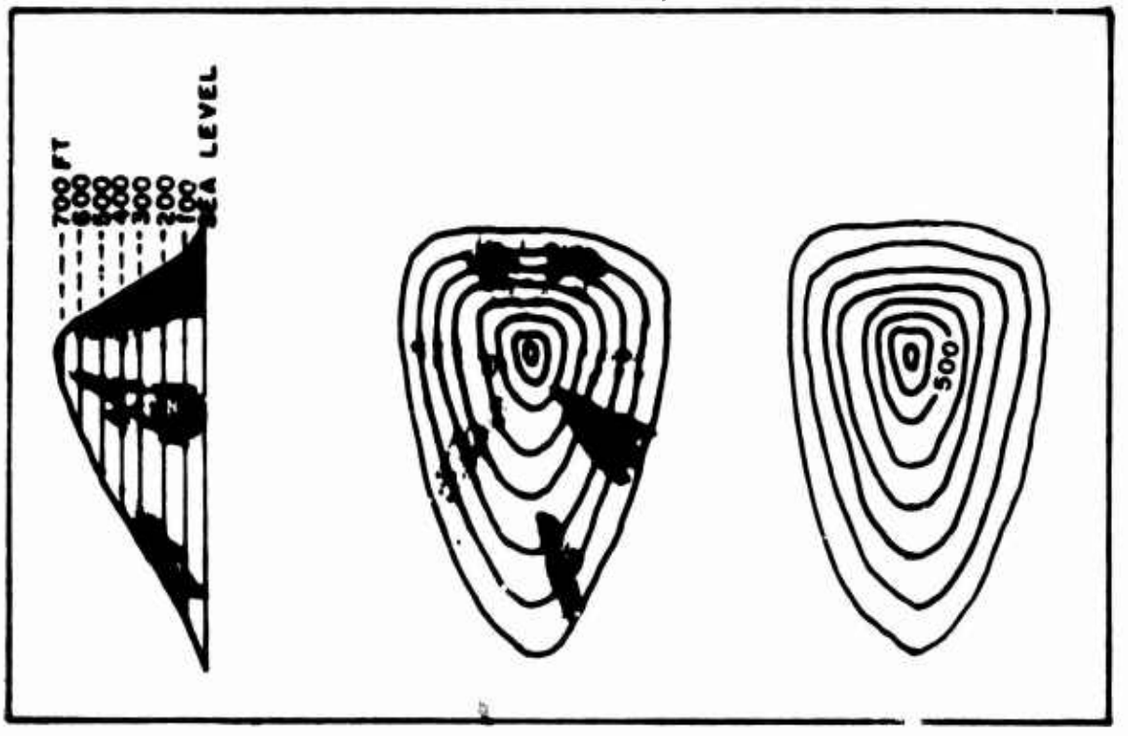

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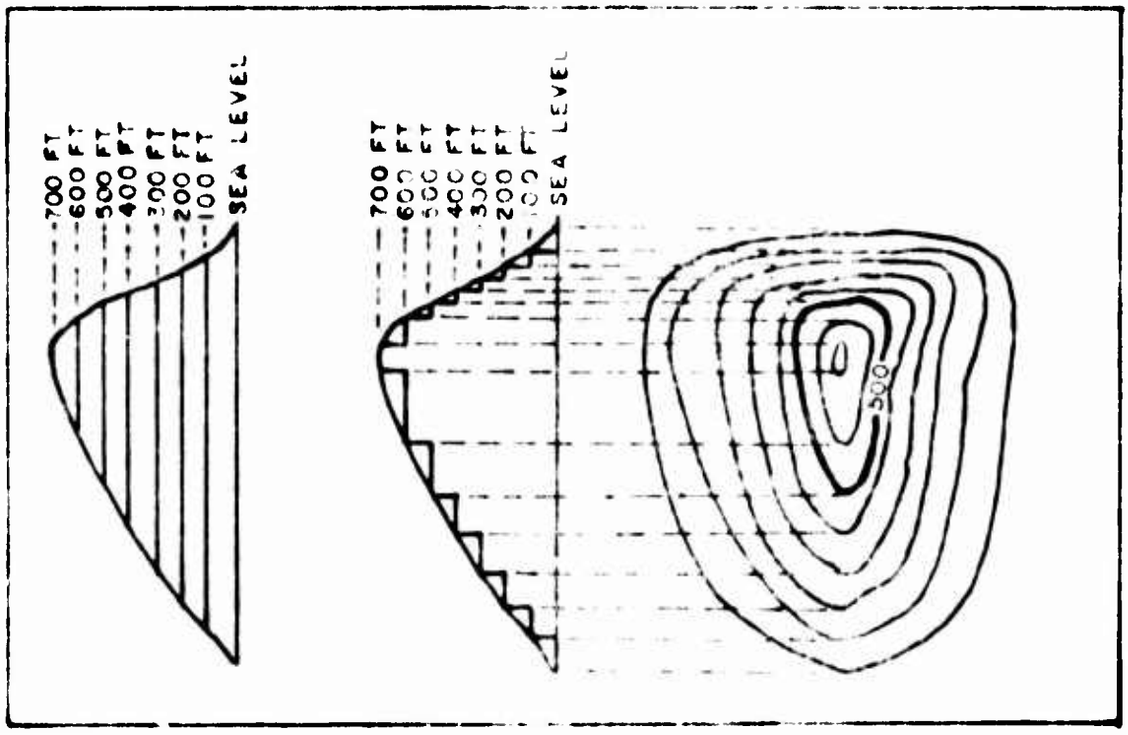

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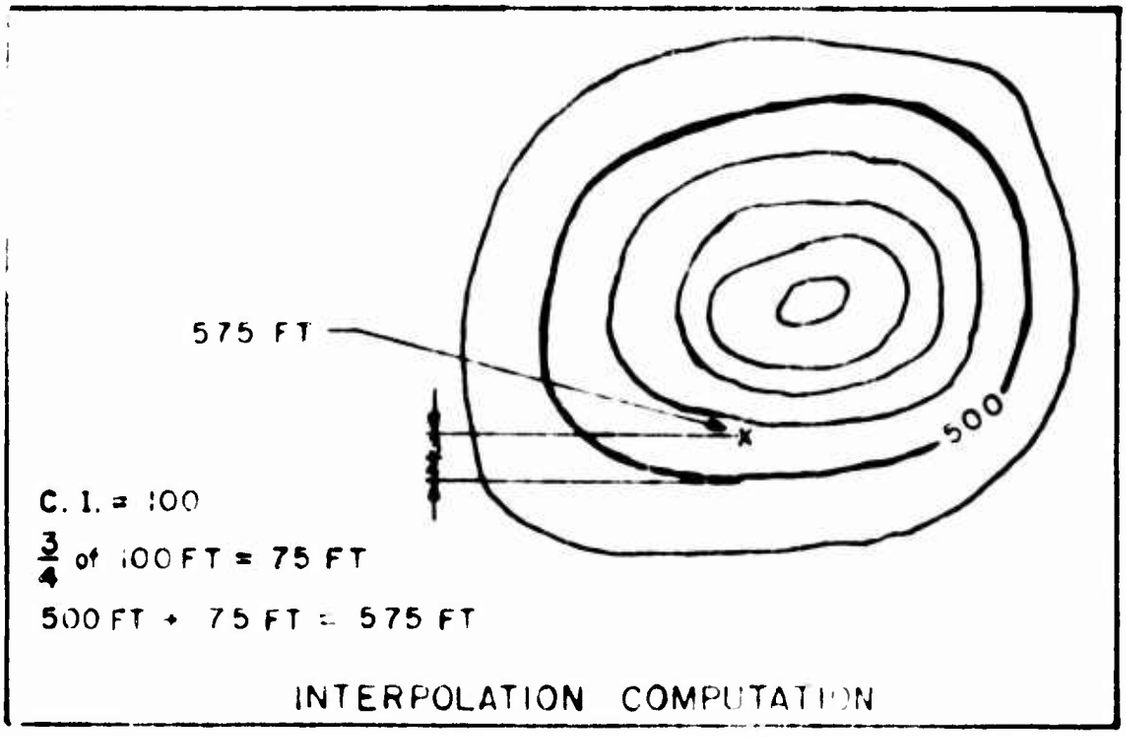

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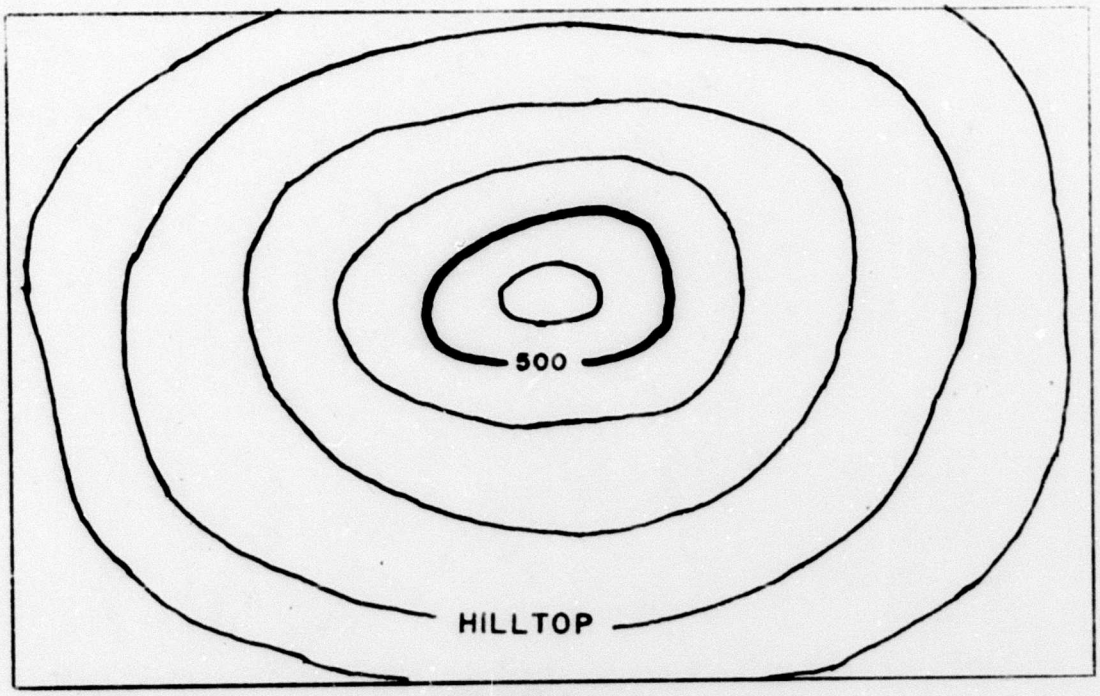

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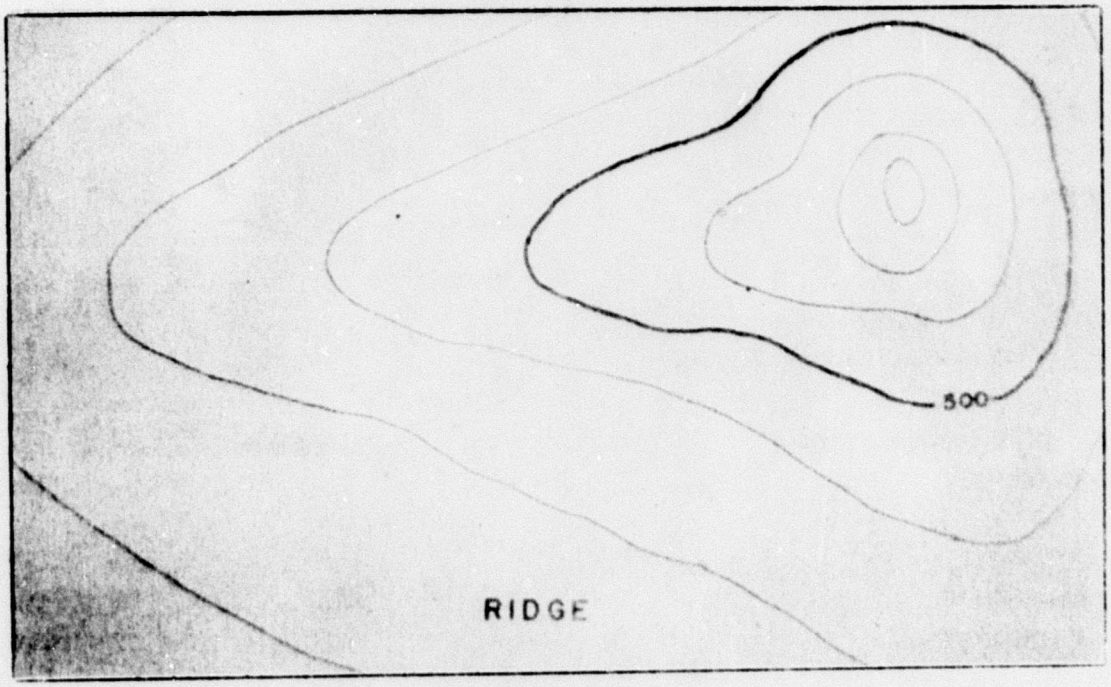

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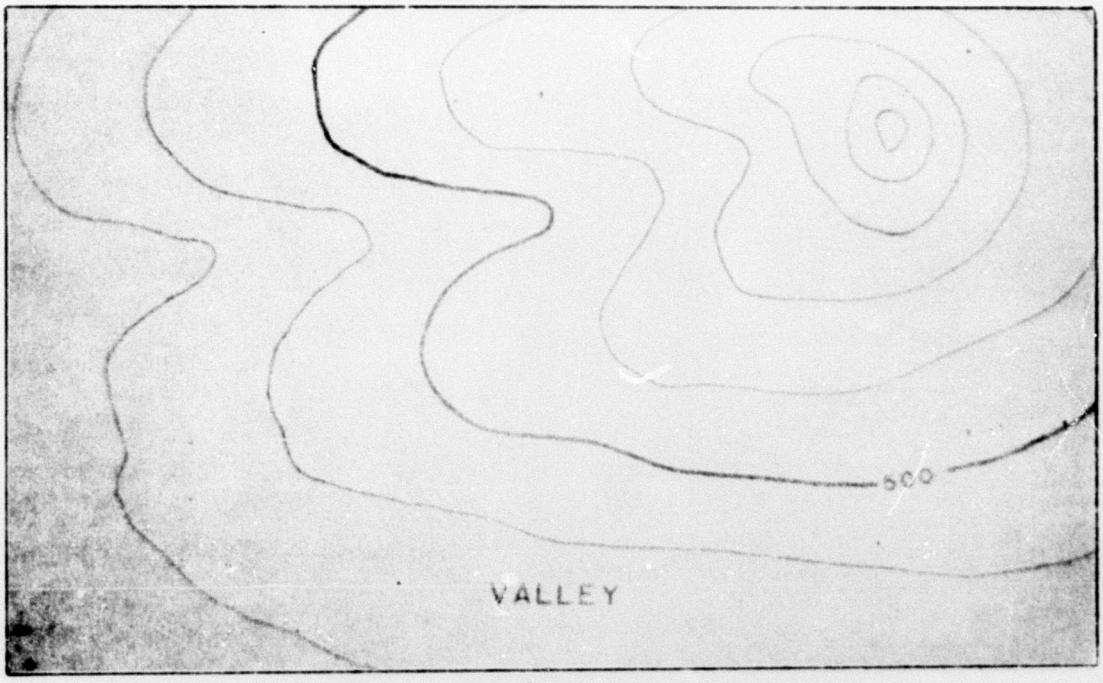

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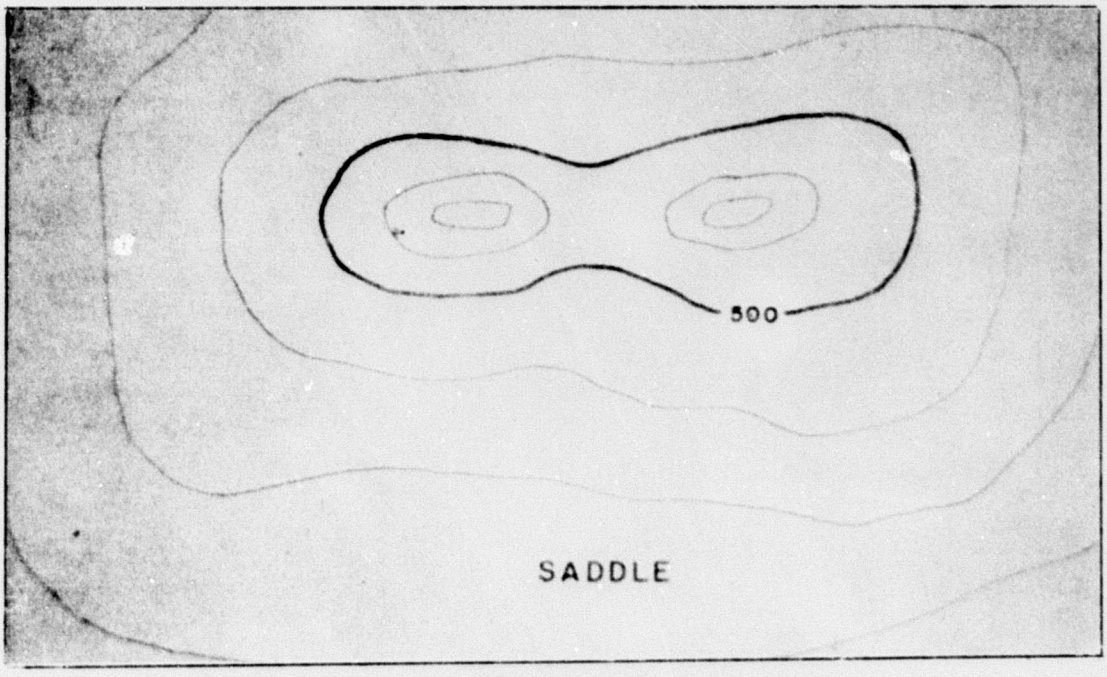

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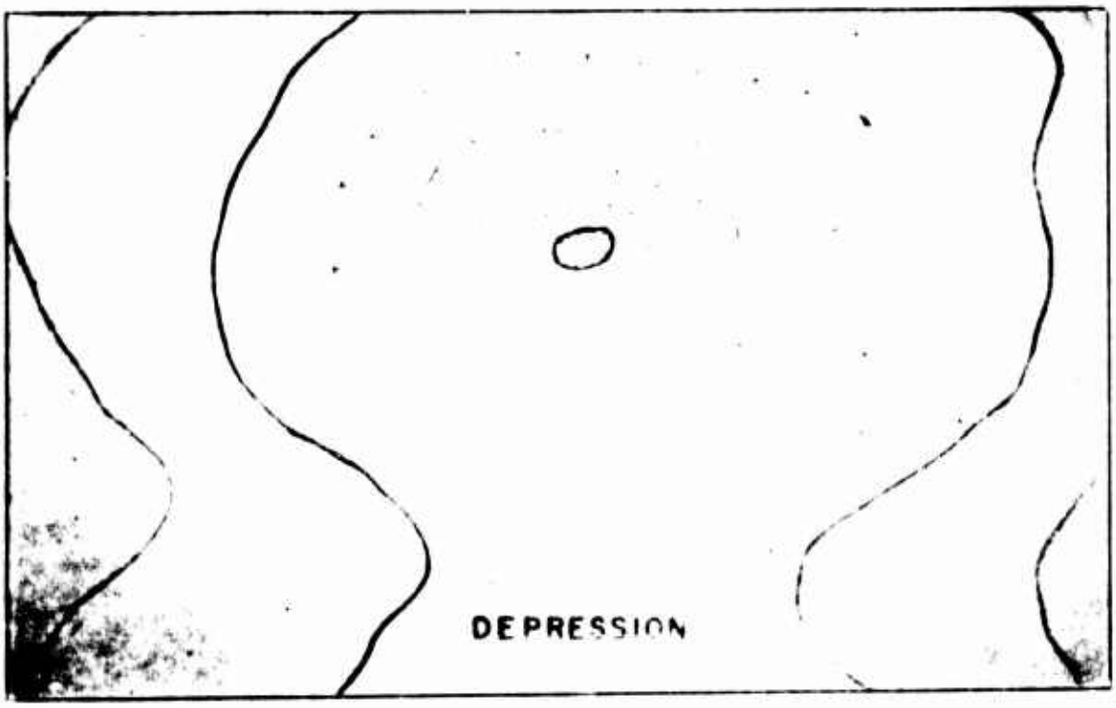

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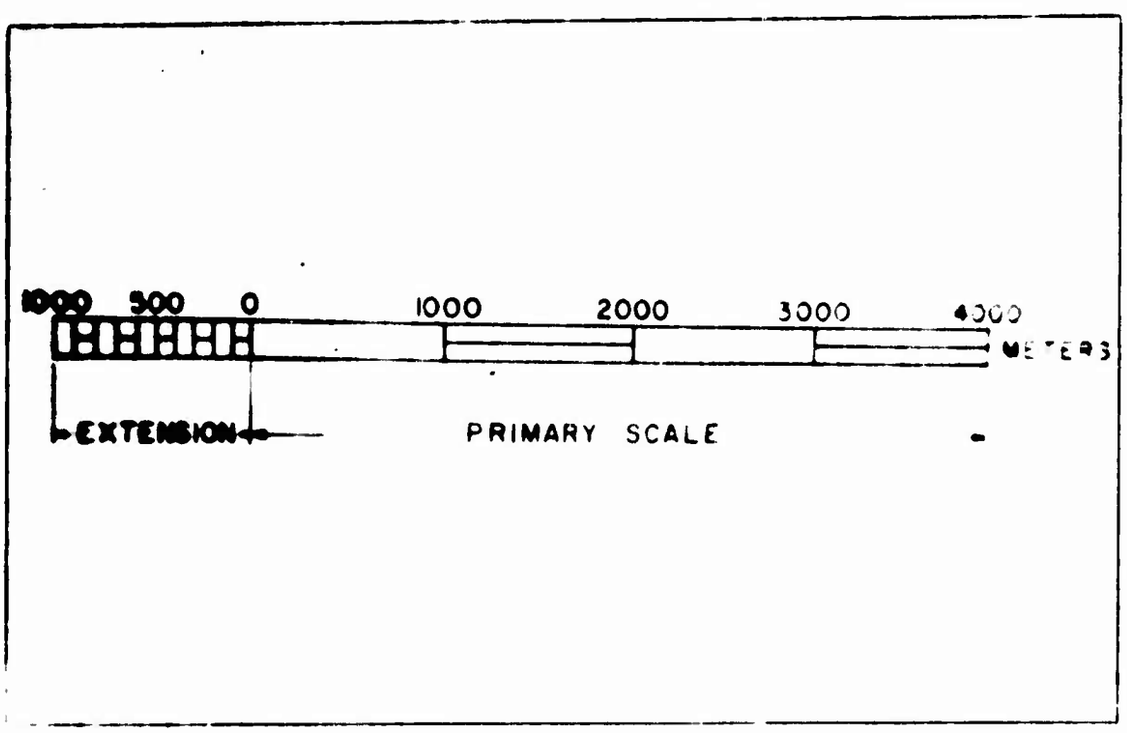

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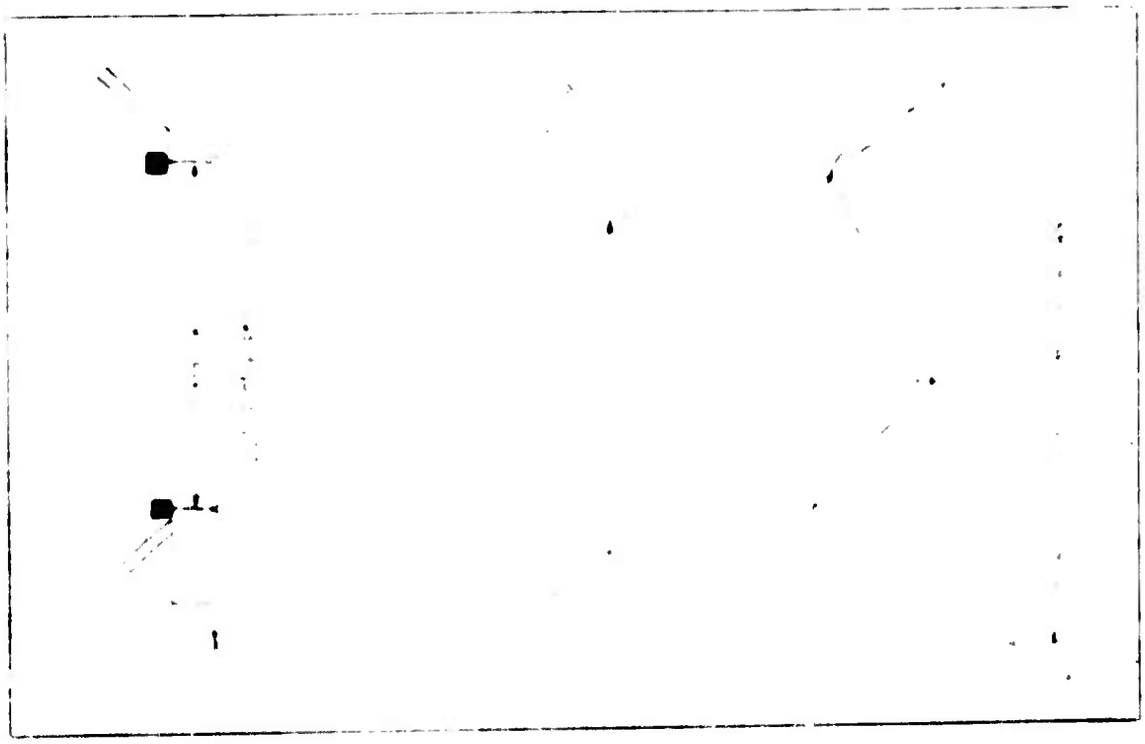

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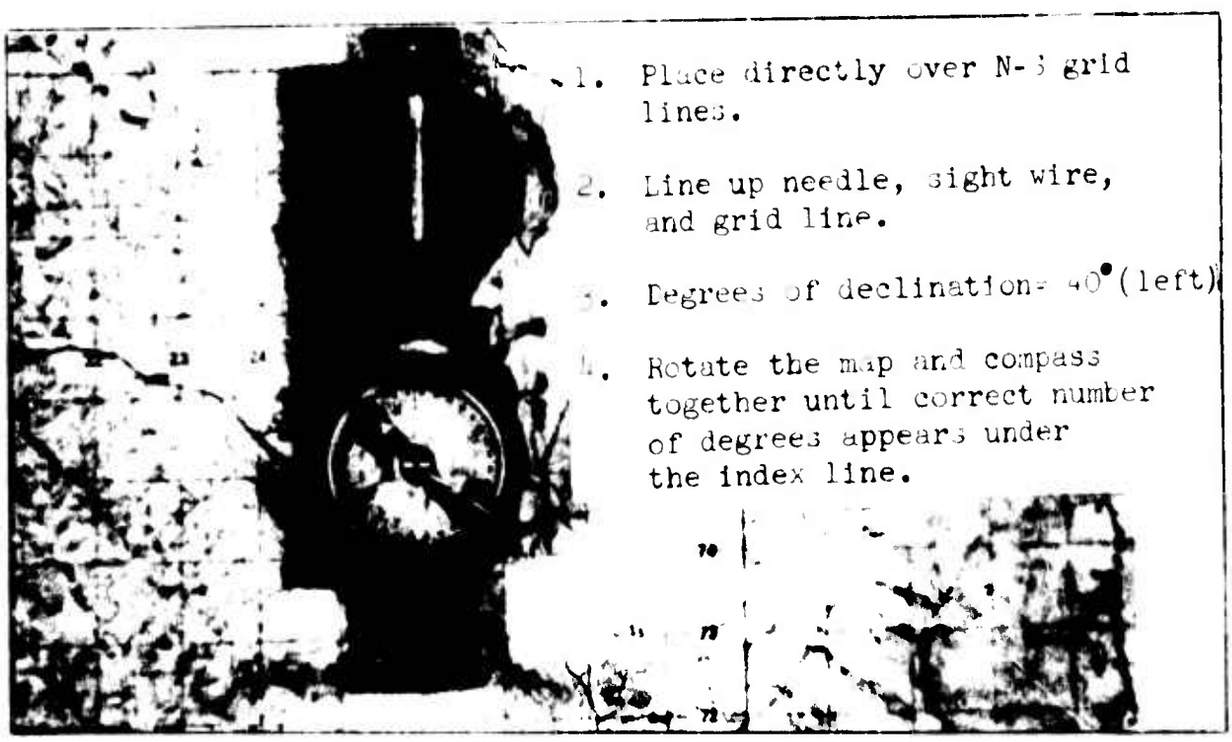

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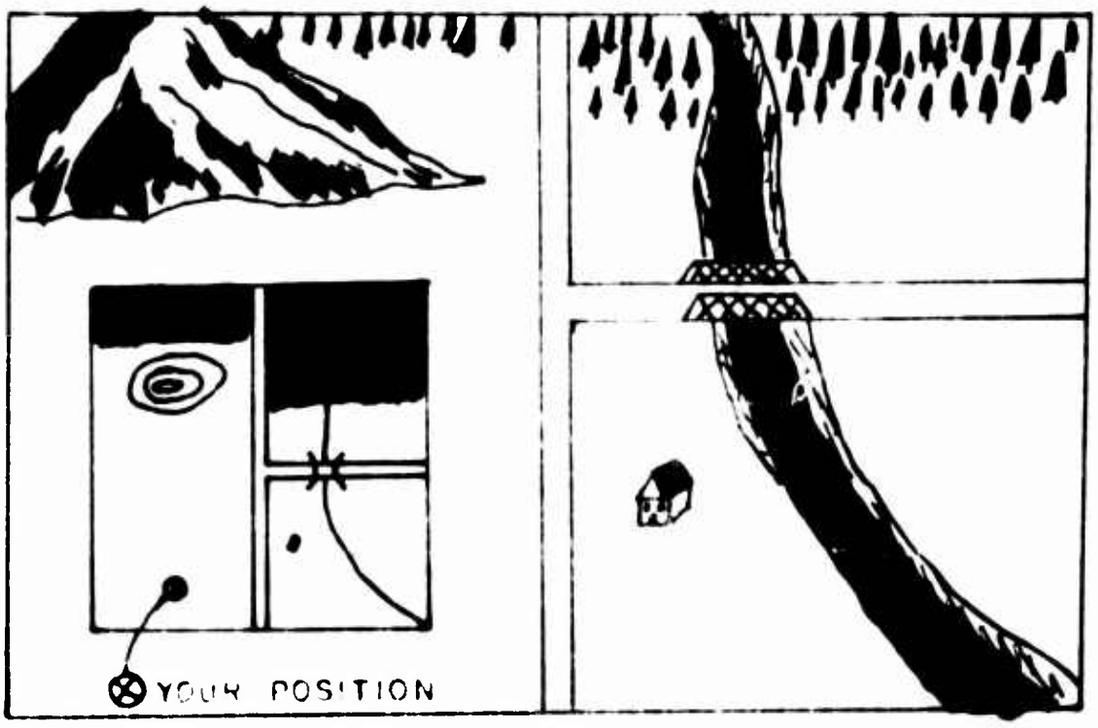

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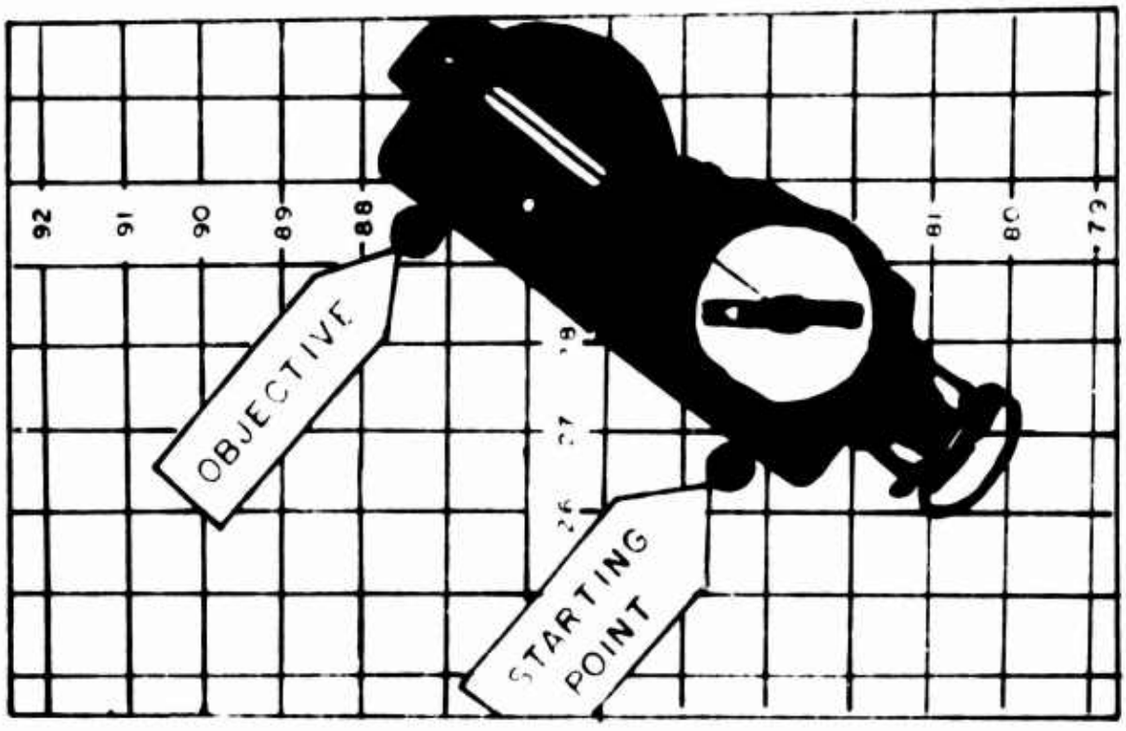

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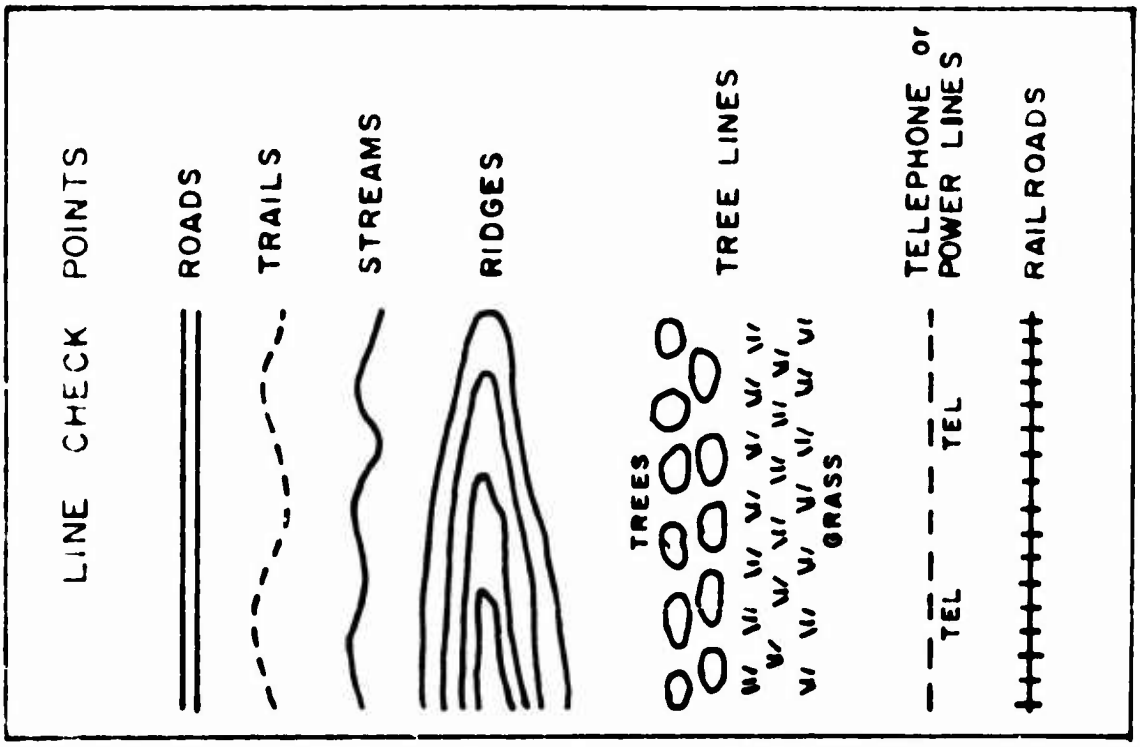

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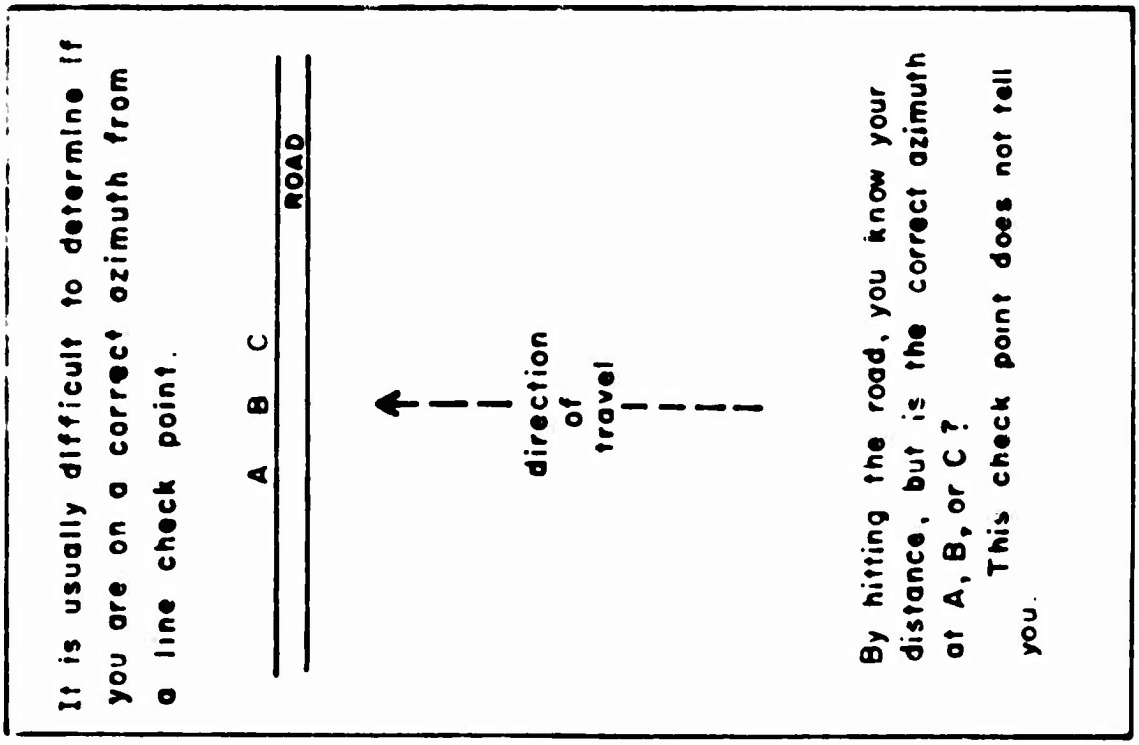

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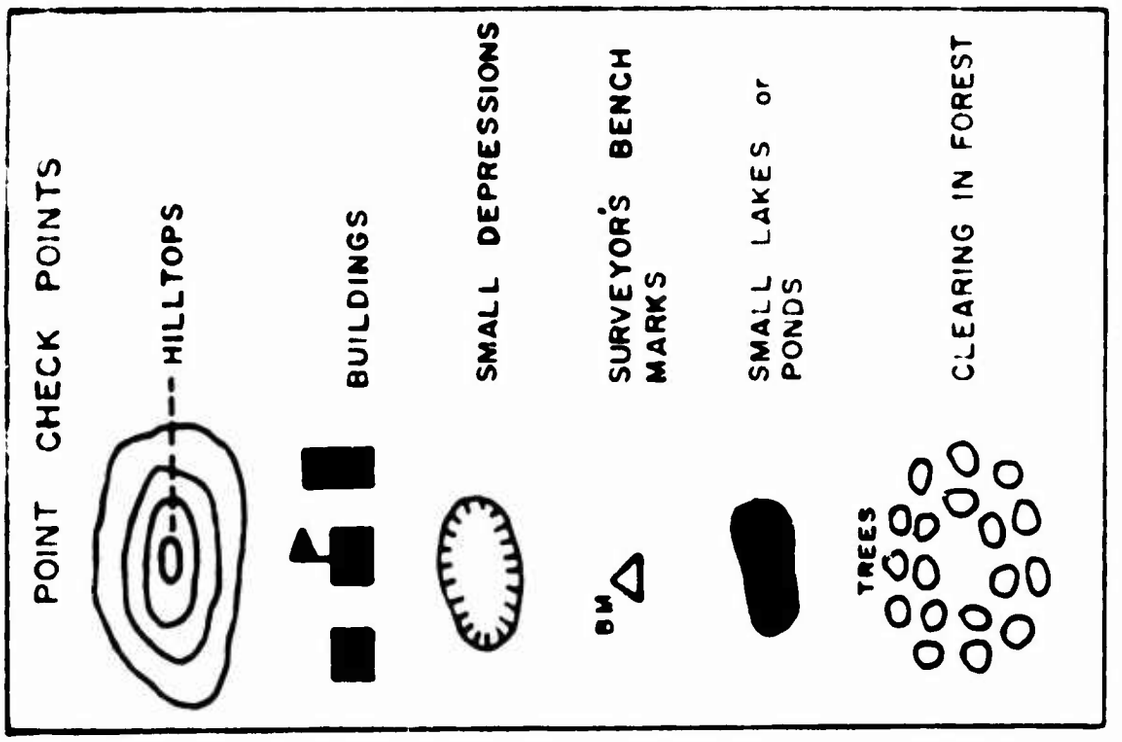

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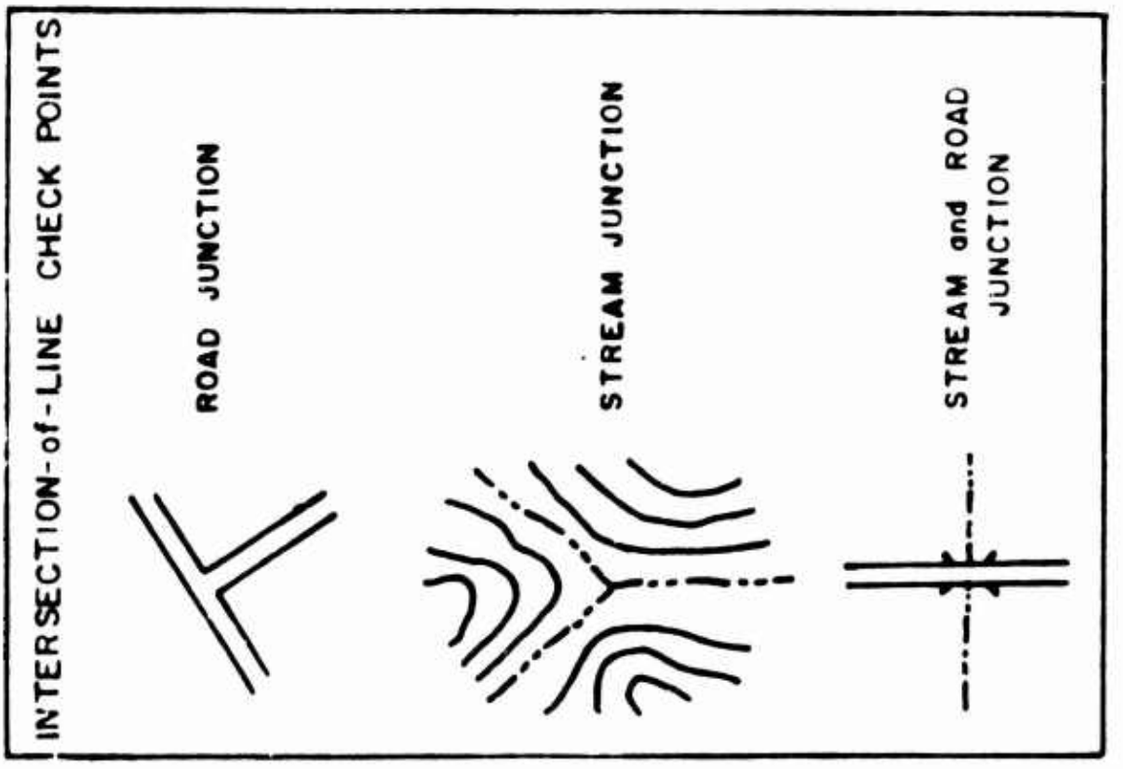

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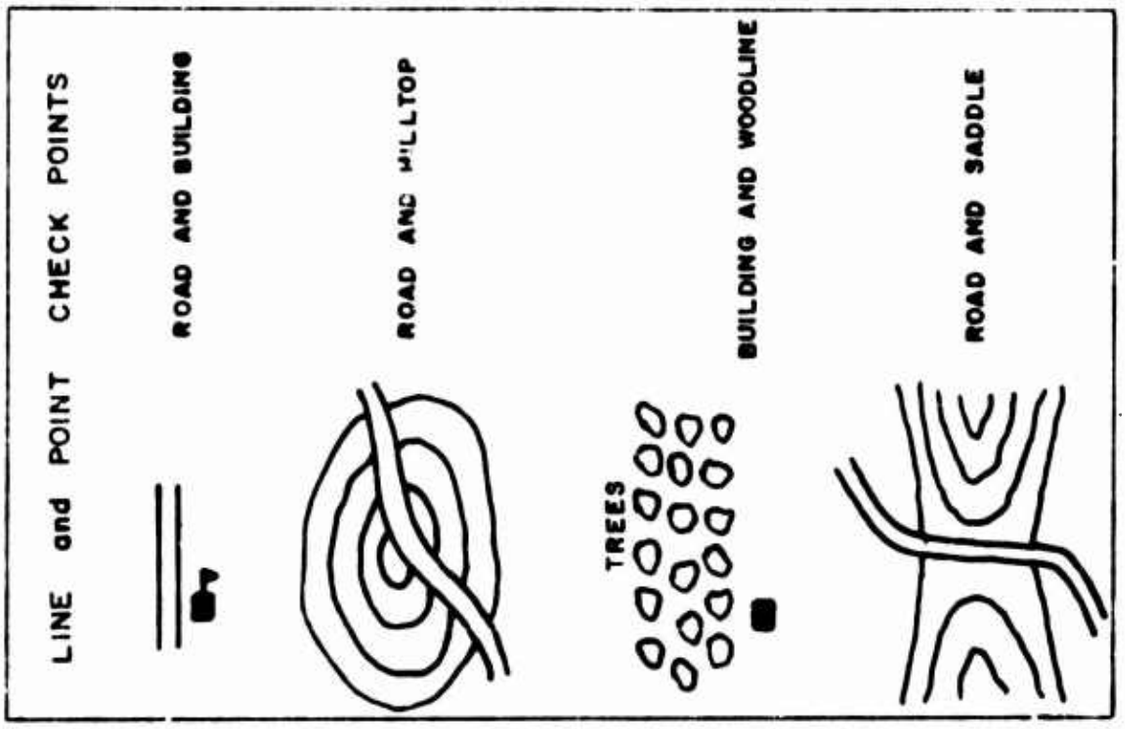
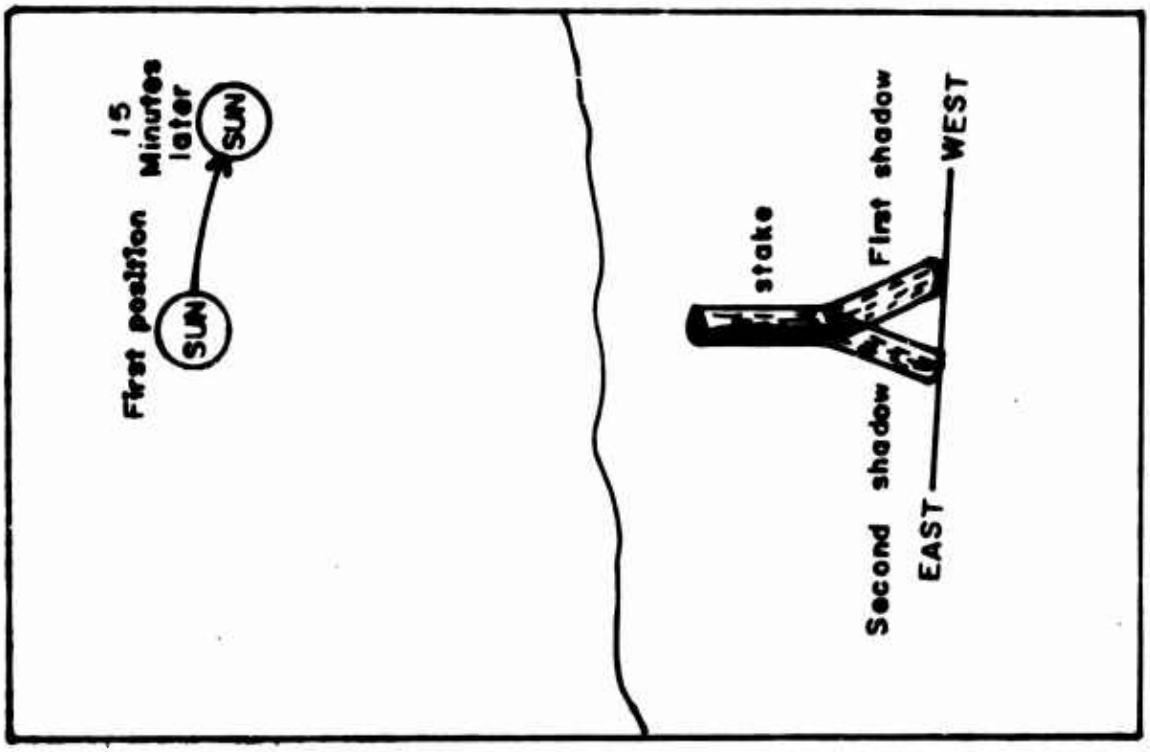
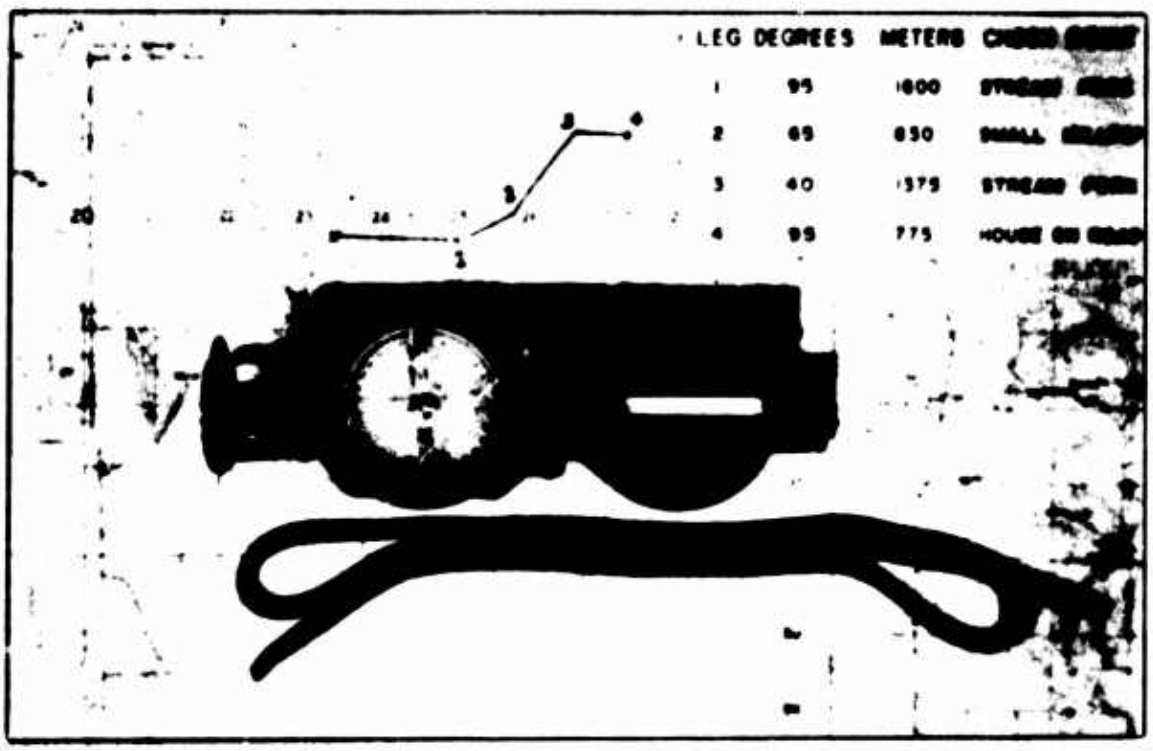


SLIDE 3-5

SLIDE 3-6



SLIDE 3-7



SLIDE 3-8