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LAND NAVIGATION 2

TERMINAL LEARNING OBJECTIVE(S)

1. Given a military topographic map, protractor, and objective, navigate with a map and compass to arrive within 10 meters of the objective. (OCS-PAT-1002)

ENABLING LEARNING OBJECTIVE(S)

1. Given a topographic map, describe the components on the map without error. (OCS-PAT-1002a)
2. Given a topographic map, protractor and two pre-determined grids points, plot the location of each point without error. (OCS-PAT-1002b)
3. Given a topographic map, protractor and two plotted points, determine the distance to a desired location without error. (OCS-PAT-1002c)

1. **TOPOGRAPHIC MAP**. A mathematically determined representation of a portion of the earth's surface systematically plotted to scale upon a plane surface.

2. **MARGINAL INFORMATION**. Information that helps to read and interpret a map. Marginal information consists of a graphic bar scale, declination diagram, representative fraction, contour lines.

- a. **Graphic bar scale**. Rulers used to convert horizontal map distance to ground distance.

- (1) Maps usually have three or more bar scales, each in a different unit of measure, such as meters, nautical miles, statute miles or yards.

- (2) To the right of the zero (0), the scale is marked in full units of measure and is called the primary scale.

- (3) To the left of zero (0), the scale is marked and divided into tenths of a unit and is called the extension scale.

- b. **Declination diagram**. It indicates the angular relationship of the three north(s): true north, grid north, and magnetic north.

- (1) True north is a line from any position on the surface of the earth to the North Pole. All lines of longitude are true north lines. True north is usually indicated by a star symbol.

- (2) Magnetic north is a direction to the North Magnetic Pole, as indicated by the north-seeking needle of a magnetic instrument. A half arrow usually symbolizes magnetic north.

- (3) Grid north is the north that is established by the vertical lines on the map. The letter GN or the letter Y may symbolize grid north.

- (4) The legend illustrates and identifies the topographic symbols used to depict some of the more prominent features on the map. Not all symbols are the same on all maps.

- c. **Representative fraction (RF)**. The representative fraction is the numerical scale of the map that expresses the ratio of horizontal distance on the map to the corresponding horizontal distance on the ground.

- (1) It is usually written as a fraction and is always called the representative fraction.

- (2) The representative fraction is always written with the map distance as one (1).

3. **MAP SCALES**. The scale of a map, “small, medium, or large”, is determined by the value of the denominator. The smaller the scale of the map, the larger the number after the one (1) has to be.

a. **Small-Scale Map**. Maps that have a scale of 1:1,000,00 and smaller (the number after the colon will be larger) are small-scale maps.

(1) Small scale maps are used for general planning and for strategic studies at higher echelons.

(2) The standard small-scale map is 1:1,000,000.

b. **Medium-Scale Map**. Maps of scales larger than 1:1,000,000 but smaller than 1:75,000 are medium-scale maps.

(1) These maps are used for planning of operations, including movement and concentration of troops and supplies.

(2) The standard medium-scale map is 1:250,000.

c. **Large-Scale Map**. Maps at scales of 1:75,000 and larger are large-scale maps.

(1) They are used to meet the tactical, technical, and administrative needs of the field units.

(2) The standard large-scale map is 1:50,000.

4. **COLORS ON A MAP**. Colors are used to facilitate the identification of features by providing a more natural appearance and contrast.

a. The topographic symbols are usually printed in different colors. Each color identifies a class of features.

b. The colors used and the class of features each represents on a standard large-scale map is as follows:

(1) **Black**. The majority of cultural or manmade features.

(2) **Blue**. Water features such as lakes, rivers, and swamps.

(3) **Green**. Vegetation such as woods, orchards, and vineyards.

(4) **Brown**. All relief features such as contours. You will see more of these during your second mapping class.

(5) **Red**. Main roads, built up areas, and special features.

(6) **Reddish-Brown**. The colors red and brown are combined to identify cultural features, all relief features, and elevation, such as contour lines and red-light readable maps.

(7) Other colors may be used to show special information. These, as a rule, are indicated in the marginal information. For example, training areas are shown on the map with large blue letters and numbers.

5. **GRID LINES**. A grid line is a series of straight lines intersecting at right angles and forming a series of squares. It furnishes the map-reader with a system of squares similar to the block system of most city streets.

a. **Principle Digits**. Two digits are printed in large type at each end of the grid line, these same two digits appear at intervals along the grid lines on the face of the map. They are called Principal Digits. They are of major importance to the map-reader because they are the numbers he will use most often for referencing points.

b. **Vertical Grid Lines**. Vertical grid lines are lines drawn on the map that run from the bottom of the map sheet to the top. (grid south-grid north). They function as the left and right (eastern and western) boundaries of a grid square and are labeled in the margin.

c. **Horizontal Grid Lines**. Horizontal grid lines are lines drawn on the map that run from the left side of the map sheet to the right side. (grid west-grid east). They function as the bottom and top boundary (southern and northern) boundaries of a grid square and are labeled in the margin.

d. **Grid Squares**. Intersect at right angles at horizontal and vertical grid lines.

(1) On most military maps, a grid square is 1000 meters by 1000 meters.

(2) Any point located within the grid square is considered to be part of the grid square.

6. **GRID SQUARE IDENTIFICATION.** The Reading Rule is important to understand how to apply the map reading rule to identify a grid square and locate a point within a grid square. Based on the military principle the map reading rule is “read right, and then up.”

- a. Always read right on the vertical lines, then up on the horizon grid lines.
- b. The coordinates of a grid square are found by combining the values of the vertical and horizontal grid lines that form the lower left-hand corner of the grid square.
- c. First read right to the vertical grid line that forms the left (western) boundary of the grid square and record the principal digits.
- d. Next read up on the horizontal grid line that forms the bottom (southern) boundary of the grid square and record the principal digits.
- e. The combination of the principal digits that label the vertical grid line and horizontal grid line are the identification of the grid or its coordinates.
- f. A four-digit grid coordinate locates a point to within 1000 square meters, inside the grid square.

7. **COORDINATE SCALE.** A coordinate scale divides a grid square more accurately than can be done by estimation and the results are more consistent.

- a. The 1:25,000 coordinate scale subdivides the 1000 square meter grid block into 10 major subdivisions, each equal to 100 meters, and is further divided with 4 "tick marks" of 20 meters each.
- b. Points falling in between two "tick marks" can be read by estimation.
- c. To use a coordinate scale to find a point, given as an eight-digit grid, place the scale on top of the designated grid square.
- d. Write the given grid coordinate down with a slash between the fourth and fifth digits. Next, underline the first two digits of each group of four numbers. The grid coordinate **97326371** would look like this: **9732/6371**. The underlined numbers are the ones that identify the grid square; the other numbers will allow us to find a point within that grid square to within 10 meters.
- e. Keeping the horizontal scale on the bottom of the grid square, slide the protractor to the **LEFT** until the horizontal grid line (the first two numbers) crosses the scale at the point specified by the third and fourth digits. In this case, grid line **97** would cross the scale at **3.8**, or **FOUR** tick marks past **3**.
- f. Then make a mark with your pen on the map along the horizontal scale at **6.7**, or one tick mark **between 3 and 4 tick marks above 6**.

8. **LOCATING POINTS WITHIN A GRID SQUARE**

- a. First, look at the given grid square and locate the point to identify. Place the coordinate scale on top of the grid square, as previously described.
- b. Slide the scale to the **LEFT**, until the vertical scale is on top of the symbol. If it is a large symbol put the vertical scale on the center of the symbol.
- c. Write down the first two numbers of the grid square, the ones that designate the vertical grid line that is the left-hand boundary of grid square. Then look at where that grid line crosses the horizontal scale of the protractor. Write down the number value at that point.
- d. Write down the second two numbers of the grid square, the ones that designate the horizontal grid line that is the bottom boundary of grid square. Then write down the number value of the point along the vertical scale of the protractor where the symbol is located.
- e. This is the eight-digit grid of the point.

9. **MEASURING DISTANCE**

- a. **Straight-Line Distance.** The shortest distance between two points or, "as the crow flies."

(1) To determine a straight-line ground distance between two points on a map, lay a straight edge piece of paper on the map so that the edge of the paper touches both points.

(2) Make a mark on the edge of the paper at each point.

(3) Since symbols are positioned on a map in such a manner that the centers of the symbols remain in its true location, always use the center of the symbol to make your tick mark.

(4) Move the paper down to the graphic scale and read the ground distance between the two points.

(a) First determine the full units of measure by placing the straight edge of the paper at the extreme right of the scale. Then determine the remaining tenths of units of measure on the extension scale. This gives the distance to the nearest 100 meters.

(b) Be sure to use the meter scale.

b. **Irregular Distance**. To measure distance along a winding road, stream, or any other curved line, the straight edge of a piece of paper is used again.

(1) Lay the paper down so that the edge is on the start point and along the center of the road or stream.

(2) Make a mark at the start point, and another where the edge of the paper leaves the center of the stream or road. Make this second mark on the paper and the map as well.

(3) Keeping both marks together, place the point of the pencil (pen) on the paper's tick mark to hold it in place. Pivot the paper until the edge of the paper is once again aligned down the center of the road or stream. Make another tick mark where the edge of the paper leaves the center of the road or stream.

(4) Continue in this manner until the measurement is completed.

(5) Place the straight edge of the paper with the marks on the graphic scale and read the ground distance.

NOTES:

REFERENCE:

1. Map Reading and Land Navigation
2. Map Reading and Land Navigation

FM 3-25.26
FM 21-26

Chapters 3-6, 9, 10