ROYAL CANADIAN ARMY CADETS

SILVER STAR

INSTRUCTIONAL GUIDE

SECTION 6

EO M326.04 – NAVIGATE ALONG A ROUTE USING A MAP AND COMPASS

Total Time: 60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-703/PG-001, Chapter 4. Specific uses for said resources are identified throughout the instructional guide within the TP for which they are required.

Review the lesson content and become familiar with the material prior to delivering the lesson.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP 1 to review navigation background material.

A practical activity was chosen for TP 2 as it is an interactive way to allow the cadet to experience navigation in a safe, controlled environment. This activity contributes to the development of navigation knowledge and skills in a fun and challenging setting.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have navigated along a route using a map and compass.

IMPORTANCE

It is important for cadets to understand how to navigate along a route as it provides a foundation for building subsequent navigation skills. Navigation is an important aspect of expedition training. All cadets should take every opportunity to practice and refine these skills.

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Teaching point 1 | **IAW PO 222 (Navigate Along a Route Using a Map and Compass, A-CR-CCP-702/PF-001, Chapter 12), Review Navigation**

Time: 10 min | Method: Interactive Lecture

DETERMINING DISTANCE ON A MAP

Cadets can use their maps to measure the distance between two points (A and B) on the ground. All maps are drawn to scale; therefore, a specified distance on a map equals a specified distance on the ground. The scale of a map is printed at the top and bottom of each map (eg, scale 1 : 50 000). This means that 1 cm on the map equals 50 000 cm (500 m) on the ground. There are two ways to determine distance on a topographical map – point-to-point and along a route.

Measuring Point-to-Point

To measure a distance point-to-point:

1. Lay the straight edge of a piece of paper against the two points.

2. With a sharp pencil, mark the paper at the A (start) and B (finish) points.

3. Lay the paper just under the scale bar (metres) and move the B mark backwards to each thousands mark until the A mark falls within the subdivided thousands (hundreds) to the left of the zero.

4. To calculate the total distance, add the number of thousands where the B mark is, plus the number of subdivided thousands where the A mark is to the left of the zero.

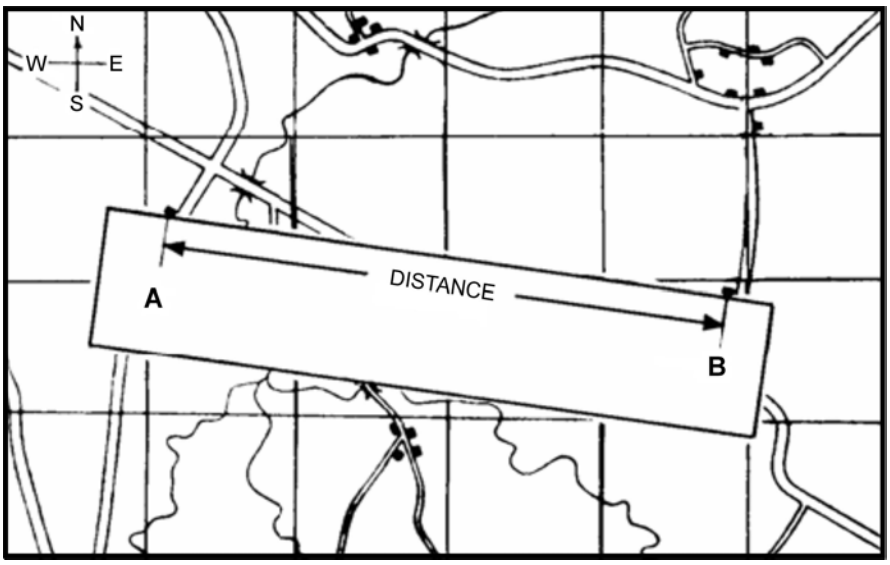

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Figure 1 Measuring Distance Point-to-Point

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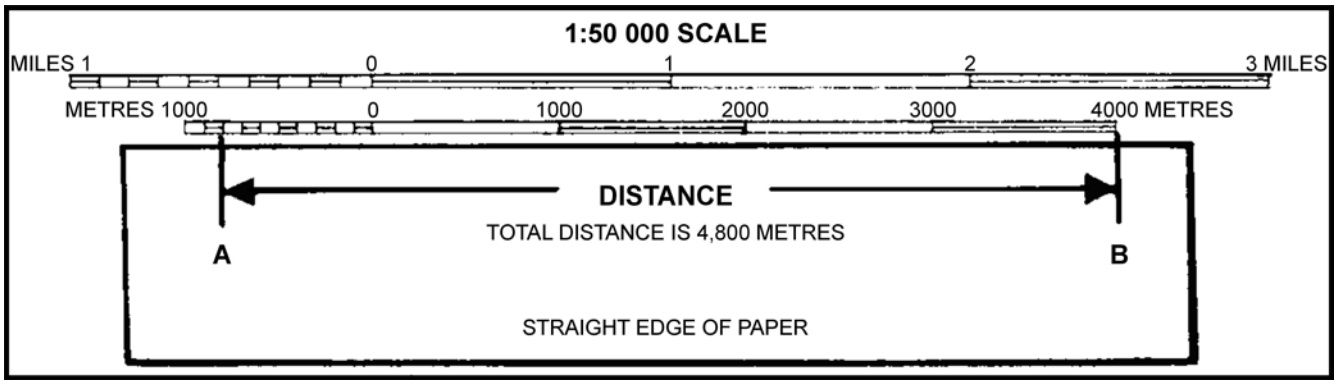

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Figure 2 Calculating Distance

For a distance that is longer than 5 000 m, measure the first 5 000 m and mark the paper with a new line and label it ‘5 000 m’. Place the new mark at the zero or thousands mark until the A mark fits within the subdivided thousands bar. Add the total of that distance to the 5 000 m and that will be the total distance.

Measuring Along a Route

Sometimes the cadets need to find the distance between A and B around curves in a road or along a planned route. To measure a distance along a route between two points:

1. Lay the straight edge of a piece of paper against point A.

2. With a sharp pencil, mark point A on the paper and the map.

3. Line up the paper with the edge of the road until you come to a curve and make another mark on the paper and on the map.

4. Pivot the paper so that it continues to follow the road edge. Repeat until you reach point B.

5. Mark your paper and the map at point B.

6. Lay the paper just under the scale bar (metres) and move the B mark backwards to each thousands mark until the A mark falls within the subdivided thousands to the left of the zero.

7. Add the number of thousands where the B mark is, plus the number of subdivided thousands where the A mark is to the left of the zero, to determine the total distance.

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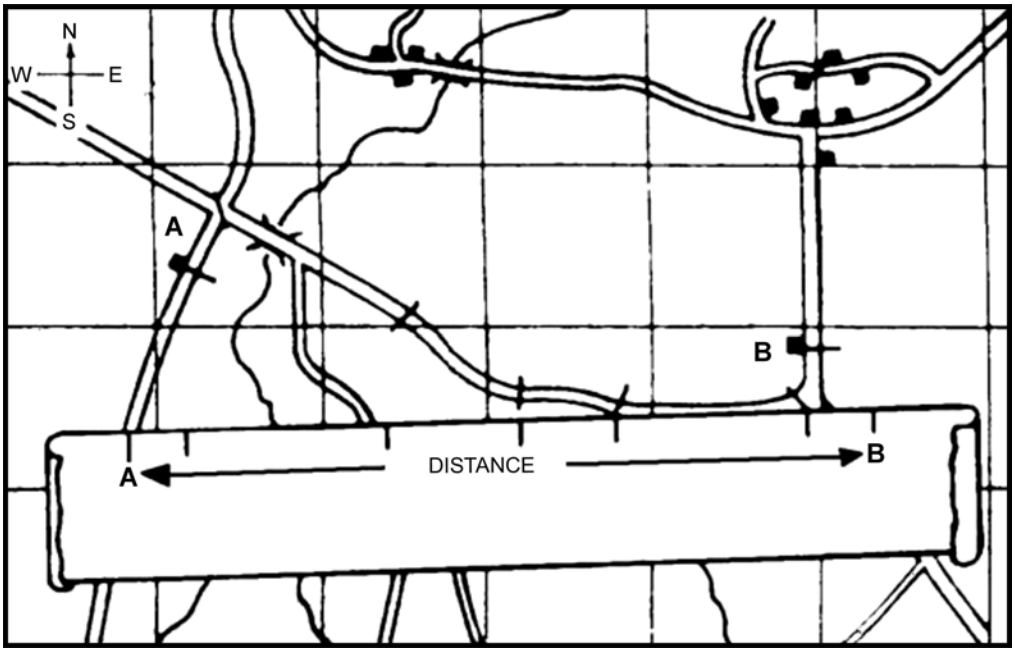

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Figure 3 Measuring Distance Along a Route

DETERMINING INDIVIDUAL PACE

Pace Counting Method

The pace counting method (pacing) is used for measuring a given distance by counting every other step. Two steps equal one pace. Pacing is a very important skill in navigation, as each person has a different pace and needs to determine their pace before it can become a useful measurement tool. Pacing varies between individuals as it uses a natural stride – an average adult will pace about 60–70 paces in 100 m.

To determine an individual pace, practice taking uniform, comfortable steps over a measured distance (100 m) counting every second step of the dominant foot. Do this three to five times. The average will be the individual's pace number and should be remembered.

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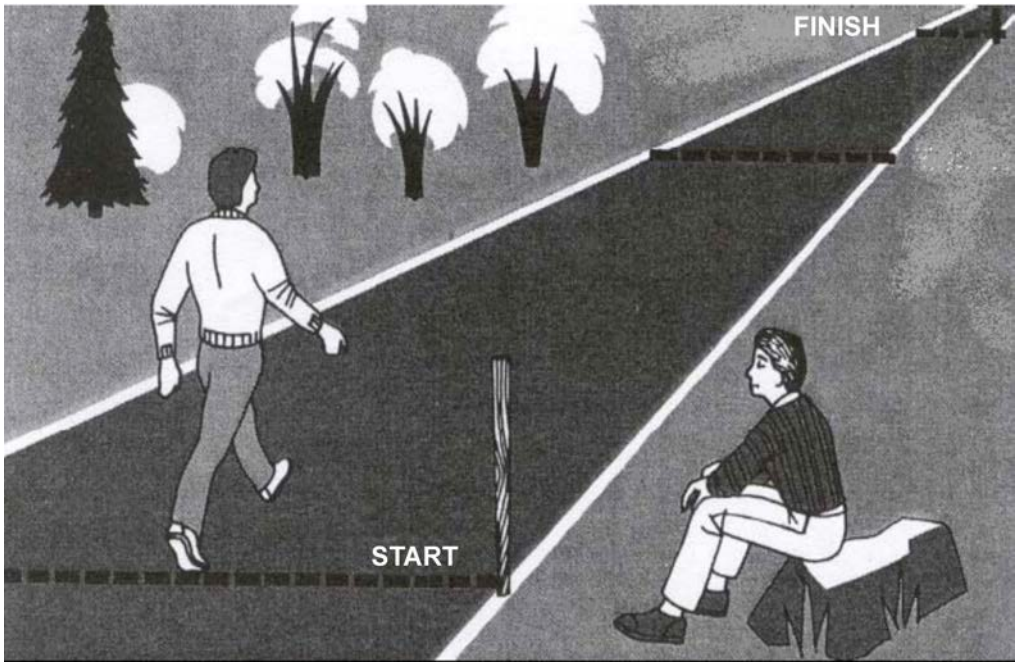

B. Kjellstrom, Be Expert with Map & Compass, Hungry Minds, Inc. (p. 53)

Figure 4 Determining Distance Using Pacing

Remember, pacing is an approximation. A margin of error of 1–2 percent is considered reasonable (eg, 10–20 m for every 1 km walked).

Factors That Affect Pacing

Pacing can be affected by different factors and numbers may vary. Some of the factors and their affect on individual pacing are:

- **Topography.** This is the most common factor. Walking through mud, thick bush and tall vegetation can shorten the paces.
- **Slopes.** Walking uphill will shorten the paces, while walking downhill will lengthen the paces.
- **Fatigue.** Pacing may change from natural in the morning, when cadets are rested, and shorter in the afternoon as they start to get tired.
- **Equipment.** Equipment could affect pacing, such as the wrong type of footwear. Too much or too little clothing and the amount of equipment being carried can shorten the paces.
- **Weather.** Heavy rain, wind velocity, temperature and snow can shorten the paces.

Pacing beads can be used to keep track of the distance walked. One bead is moved for every 100 m walked. If pacing beads are not available, stones can be used by moving them from one pocket to another to count every 100 m.

ORIENTING A MAP USING A COMPASS

To orient a map using a compass:

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1. Check and set the current declination on the compass.
2. Set the compass dial to read 00 (zero) mils or 0 degrees (north).
3. Lay the compass flat on the map with the cover open.
4. Orient the compass to point the mirror to north (top of the map).
5. Align one side of the base plate with an easting line.
6. Turn the map and compass together until the red end of the magnetic needle is over the orienting arrow.



The mnemonic used to remember to put the magnetic needle over the orienting arrow is “Red in the Bed”.



Director Cadets 3, 2007, Ottawa, ON: Department of National Defence

Figure 5 Set Declination



Director Cadets 3, 2007, Ottawa, ON: Department of National Defence

Figure 6 Set Compass to 00



Director Cadets 3, 2007, Ottawa, ON: Department of National Defence

Figure 7 Turn Until Red is in the Bed

TAKING A MAGNETIC BEARING

A compass can be used to identify the cardinal points such as north and south, the direction of travel and the bearing from one’s current location to a prominent object. However, the ability to take a magnetic bearing of a prominent object and to use that information to help identify one’s general location can save hours when trekking. A magnetic bearing is a quick method for determining the direction of travel.

There are two ways to determine a magnetic bearing.

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Using a Prominent Object in Sight

To determine the magnetic bearing of a prominent object:

1. Check and set the predetermined declination on the compass.

2. Hold the compass at eye level, at arms length, and face the prominent object.

3. Aim at the object using the compass sight, ensuring the sighting line is in line with the index pointer.

4. Adjust the compass cover so the compass dial is seen in the sighting mirror.

5. Look in the mirror and turn the compass dial until the magnetic needle is over the orienting arrow (red in the bed).

6. Read the number on the compass dial at the luminous index pointer. The magnetic bearing of the prominent object is read at the luminous index pointer.



A-CR-CCP-121/PT-001 (p. 5-42)

Figure 8 Taking a Magnetic Bearing

Using a Map

To determine a magnetic bearing using a map:

1. Set the predetermined declination on the compass.

2. Identify and mark the start (Point A) and finish (Point B) points on a map.

3. Draw a plotting ray from Point A to Point B.

4. Lay the fully opened compass with the edge of the compass base plate along the plotting ray, in the direction of travel (Point A to Point B).

5. Hold the compass in place, rotate the compass dial so that the compass meridian lines align with the easting lines on the map, ensuring north on the dial indicates north on the map.

6. Read the number on the compass dial at the luminous index pointer.

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Prior to determining a magnetic bearing on a map, it is good practice to first estimate the bearing by drawing a quick compass rose and looking at where the bearing would be on the compass rose. This serves as a good check to ensure the cadet has not accidentally measured the back bearing.



If the bearing is taken from Point B to Point A, the compass will be pointing 180 degrees or 3200 mils in the exact opposite direction of travel wanted. This is called a back bearing.

CONFIRMATION OF TEACHING POINT 1

The cadets' participation in the activity in TP 2 will serve as the confirmation of this TP.

Teaching point 2 **Conduct a Navigation Activity**

Time: 40 min Method: Practical Activity

BACKGROUND KNOWLEDGE

DESCRIBING BEARINGS

Bearing. A bearing is an angle that is measured clockwise, from a fixed zero line; north is always this zero line. Simply, a bearing is just another name for an angle.

Types of Bearings

There are three different types of bearings:

Grid Bearing. A grid bearing is a bearing that is measured between two points on a map. The ability to measure a bearing from a map allows a map user to plan routes or activities before going into the field, and allows an easy method of communicating information about movement or location.

Magnetic Bearing. A magnetic bearing is a bearing that is measured between two points using a compass. A magnetic bearing is a quick and efficient method of describing a route to take. The bearing alone is usually not enough information to navigate with and must also have distance or a target object.

Back Bearing. A back bearing is a bearing that is in the exact opposite direction of the bearing that has been measured. A back bearing can be useful for different reasons; to return to the start location after a hike, or to calculate the bearing from an object to one's current location. Depending on the compass being used, the steps to calculate a back bearing are:

- When the bearing is less than 3200 mils or 180 degrees, add 3200 mils or 180 degrees.
- When the bearing is greater than 3200 mils or 180 degrees, subtract 3200 mils or 180 degrees.

SETTING DECLINATION ON A COMPASS

The compass's declination scale must be set to compensate for the difference between true north and magnetic north. To do this the amount of declination in degrees east or west is needed. Then, turn the compass over and look at the back of the dial.

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From the zero point, using the screwdriver on the end of the safety cord, turn the declination screw to the right for west and to the left for east declination. Each small black line is two degrees.

When setting declination on a compass, it is easier to hold the screwdriver and turn the compass, especially in cold weather. The declination shall *never* be turned past 90 degrees on the declination scale.

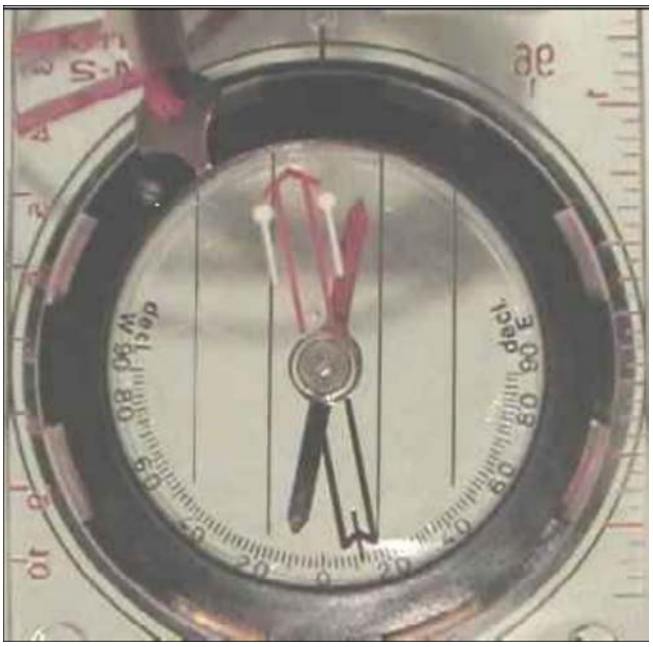

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Figure 9 Declination Screw

ACTIVITY

OBJECTIVE

The objective of this activity is for the cadet to navigate along a route.

RESOURCES

- Topographical map of the area (one per team),
- Compass (one per team),
- Start and end point GR,
- Paper, and
- Pencils.

ACTIVITY LAYOUT

N/A.

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ACTIVITY INSTRUCTIONS

In expedition teams, cadets will navigate a route as part of the practical expedition activity. The mode of travel will vary with each expedition centre. During the activity, cadets will:

1. describe bearings;
2. set declination on a compass;
3. determine distance between two points on a map;
4. determine individual pace;
5. orient a map using a compass;
6. take a magnetic bearing; and
7. travel on a series of bearings along a route.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

The cadets' participation in the navigation activity will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' participation in navigating along a route will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-703/PG-001, Chapter 3, Annex B, Appendix 8 (326 PC).

CLOSING STATEMENT

Map and compass skills take a great deal of practice for a person to become efficient using them in the field. Throughout expeditions, cadets will always be required to navigate routes. Take every opportunity to practice map and compass, whether it is navigating a route or riding a bike. The skills learned in Green and Red Star navigation are building blocks. There are still more navigation skills to acquire.

INSTRUCTOR NOTES/REMARKS

Assistant instructors may be required for this lesson.

Expedition centres are required to select two dynamic modes of travel from EO M326.02a (Paddle a Canoe, Section 2), EO M326.02b (Ride a Mountain Bike, Section 3), and EO M326.02c (Hike Along a Route, Section 4) to incorporate into their weekend training.

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This EO has been allocated one period in the overall course period allocation. Each expedition centre may adjust this allocation to reflect the choice of activities, facilities and available resources at the expedition centre.

Timings for this EO will vary. While there is a requirement for some initial training, the focus should be on having the cadets practice navigation techniques during the practical expedition activity.

REFERENCES

A2-041 B-GL-382-005/PT-001 Canadian Forces. (2006). *Maps, Field Sketching, Compasses and the Global Positioning System*. Ottawa, ON: Department of National Defence.

C0-011 Canadian Orienteering Federation. (1985). *Orienteering Level Two Coaching Certification*. Ottawa, ON: Canadian Orienteering Federation.

C2-041 (ISBN 0-07-136110-3) Seidman, D., & Cleveland, P. (1995). *The Essential Wilderness Navigator*. Camden, ME: Ragged Mountain Press.

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