ROYAL CANADIAN ARMY CADETS

SILVER STAR

INSTRUCTIONAL GUIDE

SECTION 1

EO M322.01 – REVIEW RED STAR NAVIGATION

Total Time: 30 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

Mark off 100 m for pacing.

APPROACH

An interactive lecture was chosen for this lesson to review the basic and background material covered during Red Star navigation.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have reviewed Red Star navigation, to include:

- describing bearings;
- identifying compass parts;
- setting declination;
- determining distance on a map;
- determining individual pace;
- orienting a map using a compass; and
- taking a magnetic bearing using a compass.

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IMPORTANCE

It is important for cadets to participate in a review of Red Star navigation as it is a foundation for building subsequent navigation skills. The review will clarify any areas in question, providing an opportunity for cadets to work on their skills and retard progressive skill decay. Red Star navigation is an important aspect of expedition training and before learning new skills, the skills already taught should be reviewed. All cadets should take every opportunity to practice and refine these skills.

Teaching point 1 **Conduct a Review of Red Star Navigation**

Time: 25 min Method: Interactive Lecture



Briefly review Red Star navigation without spending too much time on any one point.

POINTS OF THE COMPASS ROSE

Four Cardinal Points. Measured at right angles clockwise, they are:

1. north (N),
2. east (E),
3. south (S), and
4. west (W).

Four Inter-Cardinal Points. Located halfway between each of the cardinal points. Measured clockwise, they are:

1. northeast (NE),
2. southeast (SE),
3. southwest (SW), and
4. northwest (NW).

Eight Intermediate Points. Located halfway between each cardinal point and inter-cardinal point. Measured clockwise, they are:

1. north-northeast (NNE),
2. east-northeast (ENE),
3. east-southeast (ESE),
4. south-southeast (SSE),
5. south-southwest (SSW),
6. west-southwest (WSW),
7. west-northwest (WNW), and
8. north-northwest (NNW).

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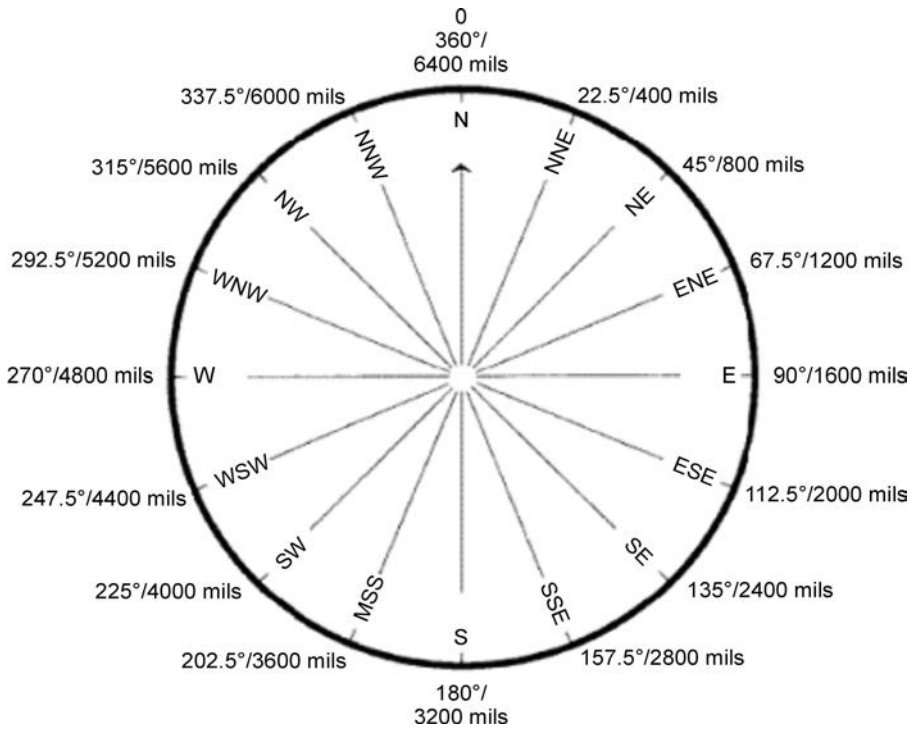

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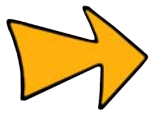
Figure 1 Compass Rose

SCALES ON A COMPASS

To express direction in an accurate and precise method, the full circle of the compass rose is divided into equal measures of angle. This measurement starts and ends at north (top) and always moves in a clockwise rotation. There are two main scales used to measure a circle – degrees and metric milli-radian (mils).

Degrees. The most common method of dividing a circle. There are 360 equal angles in a complete circle and they are represented by the degree symbol (eg, 360°). On the compass rose, north is located at 0 and 360 degrees, east is located at 90 degrees, south is located at 180 degrees and west is located at 270 degrees.

Mils. When a more accurate division of the same circle is required, the mils method is used. The mils method has a military background and is based on the metric system with 6400 equal angles in a complete circle. On the compass rose, north is located at 0 and 6400 mils, east is located at 1600 mils, south is located at 3200 mils and west is located at 4800 mils.



There are 22.5 degrees or 400 mils between each point on a compass rose.

DEFINITION OF A BEARING

Bearing. 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

Bearings are divided into three different types:

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Grid Bearing. 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 provides an easy method of communicating location or movement.

Magnetic Bearing. 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 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:

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

COMPASS PARTS



Refer to Figure 2 or an actual compass to identify the parts of a compass with the cadets.

A - Sight. Located at the top of the compass cover, used to align an objective or bearing.

B - Compass Cover. Protects the compass dial and houses the sighting mirror.

C - Sighting Mirror. Used to see the compass dial while setting a bearing.

D - Sighting Line. Used when aligning the objective or bearing.

E - Luminous Index Point. Located at the top of the compass dial and is where a bearing is set and read from.

F - Compass Dial. Houses the magnetic needle, the orienting arrow and the declination scale on the inside and the dial graduations on the outside.

G - Dial Graduations. The compass dial is graduated in 50 mil divisions from 0 to 6400 mils, or two degree divisions from 0 to 360 degrees. The dial is rotated by hand.

H - Orienting Arrow. The red orienting arrow is located inside the compass dial and is used to line up the magnetic needle. The orienting arrow is always set at 00 mils/degrees.

I - Romer 1 : 25 000. Used to measure a grid reference (GR) on a map with a 1 : 25 000 scale.

J - Compass Base Plate. Clear piece of flat plastic, to which the cover, dial and lanyard are attached.

K - Declination Scale. Used to compensate for the variation of magnetic declination between the compass and the map being used.

L - Compass Meridian Lines. Black or red lines inside the compass dial and are used to line up the compass dial with the grid lines on a map.

M - Magnetic Needle. Spins freely and points to magnetic north. The south end of the compass needle is black and the north end, with a luminous patch, is red. When the magnetic needle is lined up with the red orienting arrows, the mnemonic "Red in the Bed" is used to remember which end of the needle belongs between the arrows.

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N - Luminous Orienting Points. There are two luminous orienting points located on either side of the orienting arrow.

O - Luminous Index Point. The luminous orienting point at the bottom of the compass dial, where a back bearing is read from.

P - Romer 1 : 50 000. Used to measure a GR on a map with a 1 : 50 000 scale.

Q - Safety Cord or Lanyard. Used to fasten the compass to the body.

R - Adjustable Wrist Lock. Used to attach the compass to the wrist.

S - Screwdriver. The tiny screwdriver at the end of the safety cord is used to turn the screw to adjust the declination scale.

T - Declination Adjustment Screw. Located on the back side of the compass dial and is used to adjust the declination scale (not shown).

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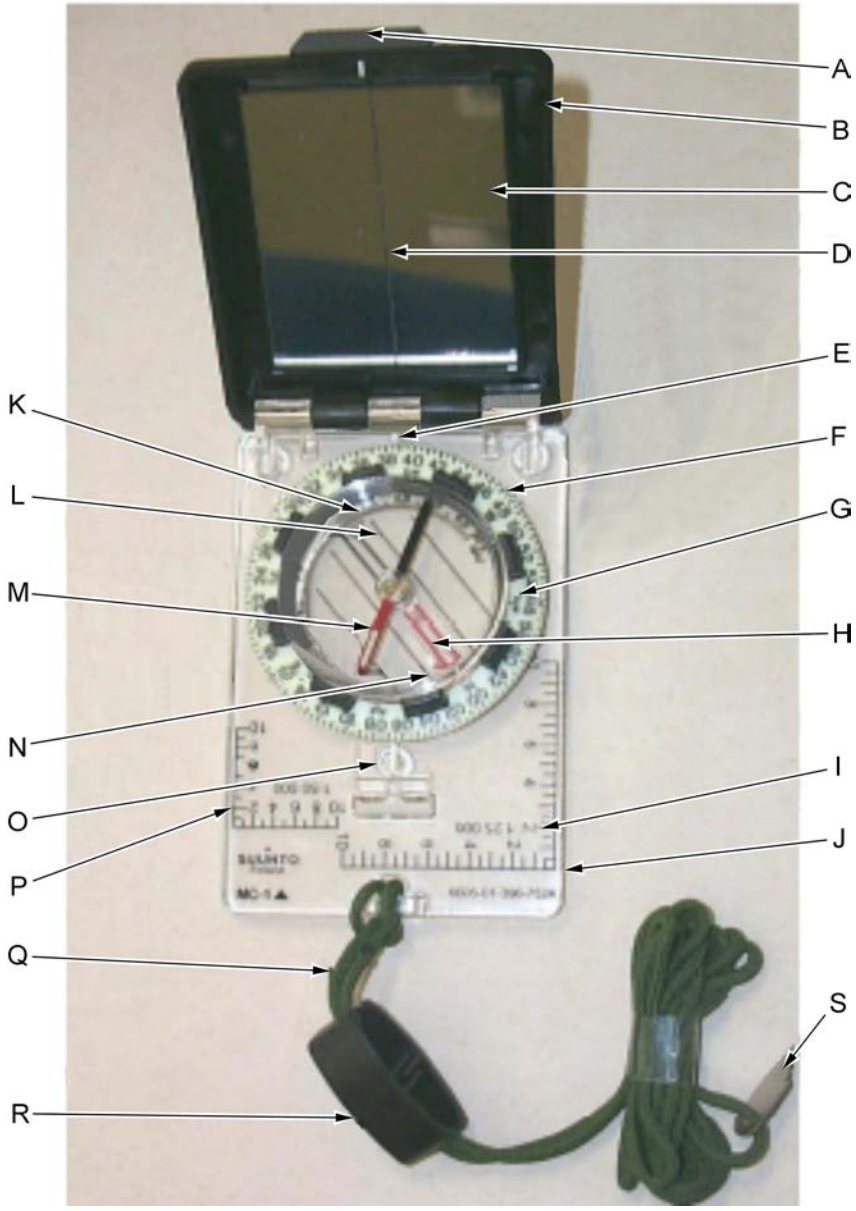

A-CR-CCP-121/PT-001, Royal Canadian Army Cadet Reference Book (p. 5-33)

Figure 2 Compass

SET DECLINATION ON A COMPASS

The compass's declination scale must be set to compensate for the difference between true north and magnetic north. To set declination on a compass the amount of declination adjustment in degrees east or west is needed. Turn the compass over and look at the back of the dial.

From the zero point, use the screwdriver on the end of the safety cord and 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 3 Declination Screw

DETERMINE DISTANCE

Determining Distance on a Map

Cadets can use their maps to measure the distance between two points 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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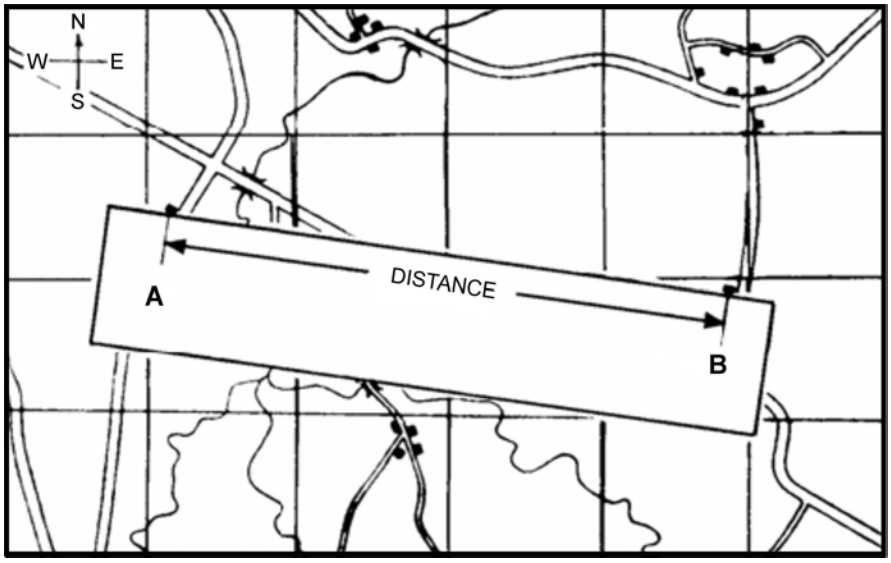
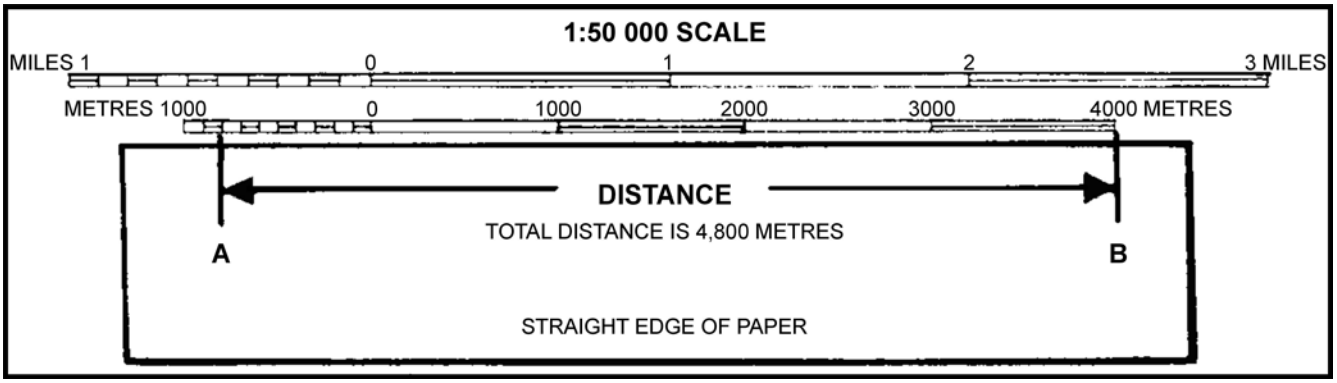


A-CR-CCP-121/PT-001 (p. 5-24)

Figure 4 Measuring Distance Point-to-Point



A-CR-CCP-121/PT-001 (p. 5-25)

Figure 5 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.

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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. Adding 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, will determine the total distance.

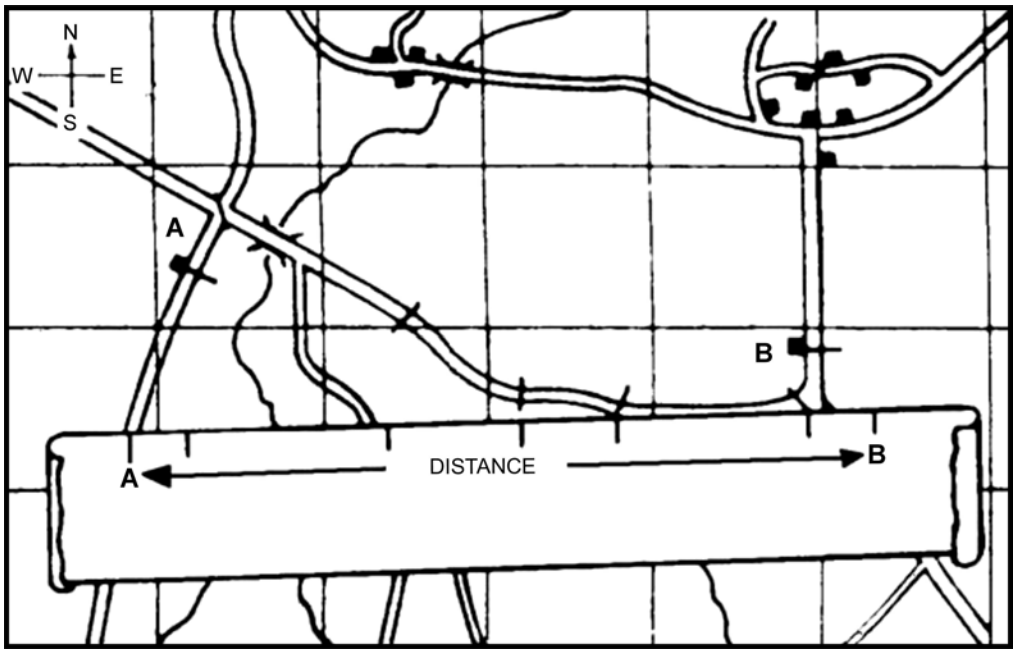

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Figure 6 Measuring Distance Along a Route

Determining Individual Pace

Pace Counting Method (Pacing). 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 establish 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 to get an average. This will be the individual's pace number and should be remembered.

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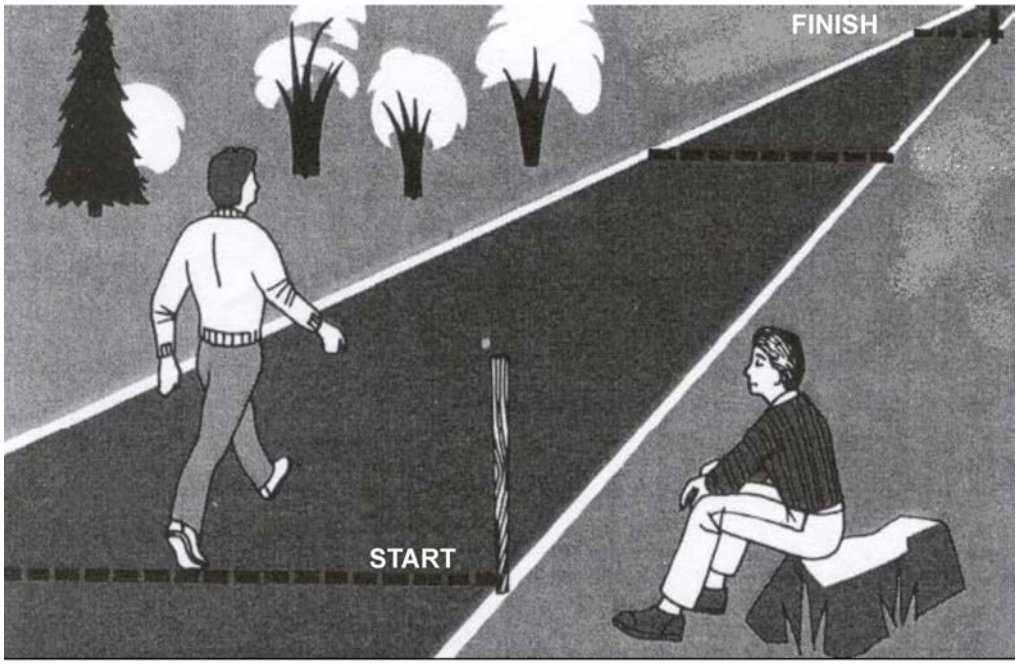

B. Kjellstrom, Be Expert with Map & Compass, Hungry Minds, Inc. (p. 53)

Figure 7 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 the count may vary. Some of the factors and the 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 paces, while walking downhill can lengthen paces.
- **Fatigue.** Pacing may change from natural in the morning, when cadets are rested, to 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.

ORIENT A MAP USING A COMPASS

To orient a map using a compass:

1. set the current declination on the compass;

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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. point the mirror to north (top of the map);
5. align one side of the base plate with an easting line; and
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 putting the magnetic needle over the orienting arrow is "Red in the Bed".



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

Figure 8 Set Declination



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Figure 9 Set Compass to 00



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Figure 10 Turn Until Red is in the Bed

TAKE 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 identifying 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.

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.

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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 11 Taking a Magnetic Bearing

To determine a magnetic bearing on 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 line 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.



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 also called a back bearing.

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CONFIRMATION OF TEACHING POINT 1

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

END OF LESSON CONFIRMATION

The cadets' participation in the review will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

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

INSTRUCTOR NOTES/REMARKS

Assistant instructors may be required for this lesson.

REFERENCES

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

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