ROYAL CANADIAN ARMY CADETS

SILVER STAR

INSTRUCTIONAL GUIDE

SECTION 9

EO C322.03 – IDENTIFY THE PRINCIPLES OF MAP-MAKING

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.

Collect examples of different types of maps.

If available, photocopy an early explorer's map of the local area as a handout.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to present background information on maps and map-making.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have identified the principles of map-making.

IMPORTANCE

It is important for cadets to be able to identify the principles of map-making because using maps is an integral component of expedition activities. Cadets will be required to use a variety of maps throughout their cadet career. Knowing how maps are made will provide the cadets with additional background information that they can use to assist them in navigating. As well, maps are something used in everyday life, whether travelling from home to a relative's house or hiking in a provincial park. Maps show a user where they are going and how they are going to get there.

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Teaching point 1 **Discuss Maps**

Time: 5 min Method: Interactive Lecture



This TP is a review of material presented in previous star levels. Cadets should already have a clear understanding of what a map is. Guide the cadets, through leading questions, to ensure that they understand the main concepts.

Once a person understands the “language” of a map, they will be able to go anywhere.

WHAT IS A MAP

A map is a scale, or proportionately smaller, representation of the ground that uses universally accepted symbols to represent both natural and man-made features found on the ground.

TYPES, CHARACTERISTICS AND FEATURES OF MAPS

There are many types of maps, each determined by the purpose for which it is designed.

Topographical Map. A topographical map is the most common map used by the military. The purpose of a topographical map is to present a picture of the ground as it really exists. Topographical maps show as much detail as the scale allows, generally 1 : 25 000, 1 : 50 000, or 1 : 250 000. Features on a topographical map include physical features of the ground – rivers, woods, contours, roads, buildings, etc – as well as names of specific features – towns, villages, rivers, etc.

Orienteering Map. Through the International Orienteering Federation (IOF), specific rules and standards have been set for the production of an orienteering map, including colour, symbols, and scales. It is more detailed than a topographical map, both with reference to vegetation and landforms. They are usually produced in a scale smaller than 1 : 10 000.

Street and Road Map. A street and road map is designed to assist commuters and tourists to locate key sites such as roads and highways, police stations, fire halls, hospitals, schools and parks.

Relief Map. A relief map is a three-dimensional representation, usually of terrain. The terrain elevation is usually exaggerated by a factor between five and ten. This helps to recognize the terrain features.

Digital Map. A digital map, such as those found on computer programs and when using a GPS receiver, is useful as a reference tool as it is updated regularly. This allows a digital map to be a more accurate reference than other types of maps.

Political Map. A political map shows countries, provinces or other political borders–eg, globes and atlases.

Statistical Map. A statistical map shows statistical information such as the population, and production levels of crops or minerals across a country.

Outline Map. An outline map shows only borders, rivers, coastlines, etc.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is a map?

Q2. What type of map is most commonly used by the military?

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Q3. What type of map provides a three dimensional representation of terrain?

ANTICIPATED ANSWERS

A1. A map is a scale, or proportionately smaller, representation of the ground that uses universally accepted symbols to represent both natural and man-made features.

A2. A topographical map is the most common map used by the military.

A3. A relief map is a three-dimensional representation, usually of terrain.

Teaching point 2 **Discuss Cartography**

Time: 5 min Method: Interactive Lecture



Cartography will be a new concept for most cadets. Have a flip chart detailing the main headings of the TP as a visual aid for cadets.

CARTOGRPAHY

Cartography, as defined by the International Cartographic Association, is a discipline which deals with the conception, production, dissemination and study of maps. In essence, cartography is the entire process of mapping. Cartography is also an academic discipline, which deals not only with the people who make maps, but also with the people who teach about, and complete research on maps. It is an ever-changing, complex field, which has the process of map-making at its centre and all functions related to map-making surrounding it.

TWO ESSENTIAL CHARACTERISTICS OF CARTOGRAPHY

Level of Importance to Society

The Canadian Cartographic Society states that maps perform a fundamental and indispensable role as one of the key elements of civilization. Few, if any, activities related to the earth's surface – property ownership, road construction, emergency response, and navigation – would be possible without maps.

Dynamic Nature

The discipline of cartography is continuously changing. Map-making has always been impacted by technological change; however, the speed with which technology is advancing has enormous implications. While there are still some who use pen and ink techniques for map-making, the majority of maps have been developed using the very latest computer hardware and graphic software. Today images are being generated faster and with less cost, and this will continue to improve with further advances in technology.

ROLE OF A CARTOGRAPHER

Most cartographers are employed in map-making occupations, although, that does not mean they do the same job. A cartographer's job depends on individual specialties and areas of interest.

The following are basic tasks that are generally performed, in some capacity, by all cartographers:

Liaising. Cartographers do not work in isolation. There is a requirement for them to work with outside agencies. It is their responsibility to discuss and set guidelines for the project with the client.

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Editing. Editing encompasses a number of tasks, including the evaluation and processing of data; selecting scales and projections; making design decisions; drawing up flow charts and specifications; preparing compilations; and checking the final product.

Drafting. This is the process of constructing the map image. It is completed using a combination of hand – pen and ink work, scribing, etc – and computer methods.

Researching. A cartographer will have to complete research: search out suitable data for a specific map; analyze output from Global Information Systems (GIS); scientifically study maps and map-making and map-reading processes; and develop new techniques for map-making.

Teaching. Many cartographers work as teachers in colleges and universities.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is the definition of cartography?

Q2. What activities would be impossible without maps?

Q3. The process of constructing the map image is what job of a cartographer?

ANTICIPATED ANSWERS

A1. Cartography, as defined by International Cartographic Association, is a discipline which deals with the conception, production, dissemination and study of maps.

A2. Any activities related to the earth's surface – property ownership, road construction, emergency response and navigation – would be impracticable without maps.

A3. Drafting is the process of constructing the map image.

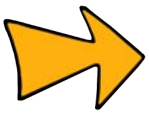
Teaching point 3 **Identify the Principles of Map-Making**

Time: 15 min Method: Practical Activity



Map-making has become a technologically based skill. Understanding the principles of making a map by hand is still very important. Cadets will be introduced to the four-step process used to develop a map during this TP.

Before people took pictures from airplanes, maps were drawn by someone travelling over the terrain and drawing by hand. With aerial photography, map-making has become much easier–but still requires a great deal of work from the map-maker (cartographer).



Much of Canada was mapped by hand by European explorers like Champlain, Tyrell, MacKenzie and Thompson.

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If available, distribute a copy of an early explorer's map of the local area.

STEP 1 – DETERMINING LOCATION

The first step in preparing a map is for the individual to determine their current location. The location of any point or place on the earth's surface can only be understood with reference to its distance from another point or place.

The easiest way to do this is to use landmarks. Landmarks are features that are man-made – houses, buildings, railroads, churches – or natural – a river, lakes, forested areas.



Have the cadets list 'landmarks' which could be in a classroom. These may include desks, chairs, windows, chalkboard, door, tables, OHP, etc.



The exact location of an object must be determined, to ensure that the map-user can easily find the site depicted without depending on another person for guidance. To make this possible, the earth's surface has been divided into a grid system of imaginary lines – lines of longitude (eastings) and lines of latitude (northings) – which provide map-makers with the ability to place and locate landmarks with precision.

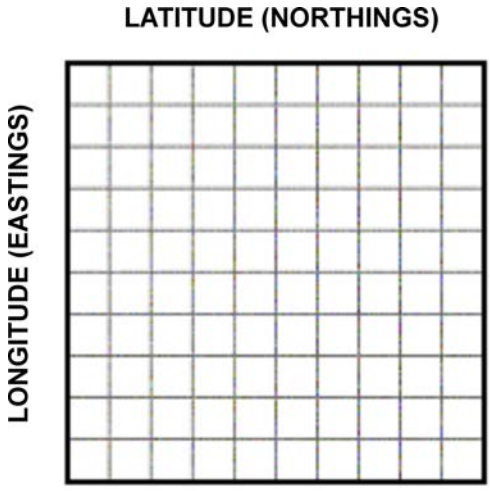

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Figure 1 Representation of Lines of Longitude and Latitude

STEP 2 – DETERMING PROJECTION AND SCALE

Any type of representation of the earth's surface on a flat piece of paper will have distortions because the world is round. These are relatively insignificant on maps that show only small parts of the earth, like street and road maps or 1 : 50 000 scale maps, but are quite considerable for maps of countries and continents.

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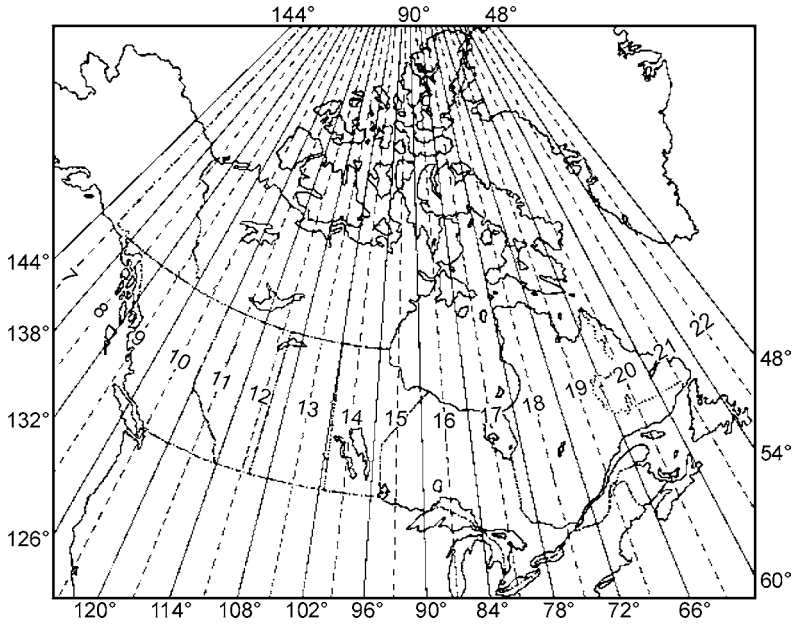
Cadets will not be required to determine projection when developing a map. It is important that they are familiar with the concept, particularly Universal Transverse Mercator (UTM).

Map Projection

Map projection is a geometrical method of reducing the amount of distortion on a flat map. In very large countries such as Canada, map-makers divide the country into strips from north to south, called zones, and project each zone.

UTM. UTM is a system of strip projection which is used by all National Topographical System maps. For UTM Projection, the earth's surface has been divided into 60 zones. Sixteen of these zones, numbered 7–22, cover Canada from west to east.



"Natural Resources Canada", The Universal Transverse Mercator Grid, Copyright 1969 by Department of Energy, Mines and Resource Canada, Surveys and Mapping Branch, Ottawa, ON. Retrieved April 4, 2008, from http://maps.nrcan.gc.ca/topo101/utm2_e.php

Figure 2 UTM Zones – Canada

Scale

Modern maps share one thing in common, they are all drawn to scale – meaning they are exact representations of the area they illustrate. The scale of a map is an expression of the ratio between one unit on the map and the distance it covers, in the same units, on the ground.

For example:

If 2 cm on a map, represents 1 km on the ground, the scale is 2 cm = 1 km.

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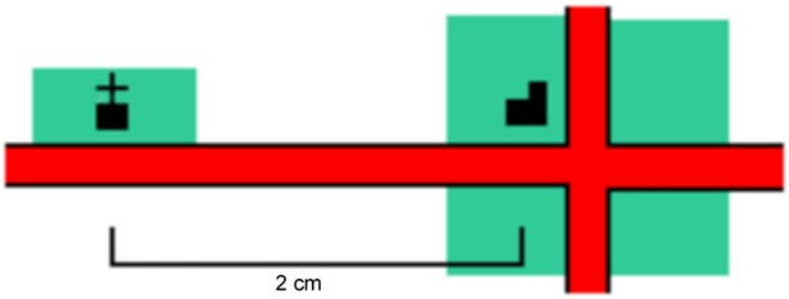
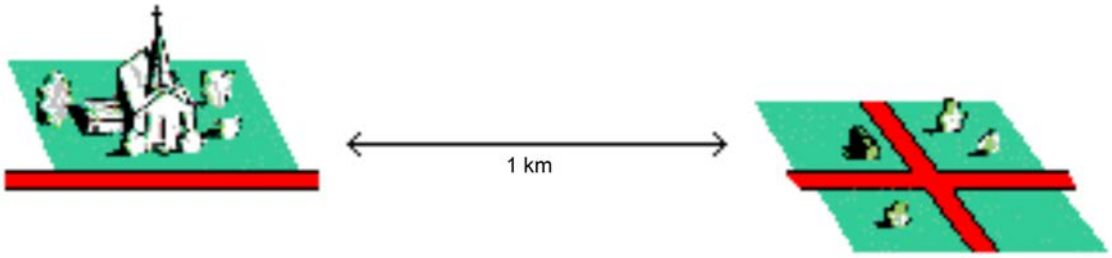


"Natural Resources Canada", Map Scale, Copyright 1969 by Department of Energy, Mines and Resource Canada, Surveys and Mapping Branch, Ottawa, ON. Retrieved April 4, 2008, from http://maps.nrcan.gc.ca/topo101/scale_e.php

Figure 3 Scale – Map



"Natural Resources Canada", Map Scale, Copyright 1969 by Department of Energy, Mines and Resource Canada, Surveys and Mapping Branch, Ottawa, ON. Retrieved April 4, 2008, from http://maps.nrcan.gc.ca/topo101/scale_e.php

Figure 4 Scale – Real Distance

Another way to represent scale would be:

$$\frac{\text{DISTANCE ON THE MAP}}{\text{DISTANCE ON THE GROUND}} = \frac{2\text{ cm}}{1\text{ km}} = \frac{2\text{ cm}}{100\,000\text{ cm}}$$

$$= \frac{1}{50\,000}$$

$$= \textbf{1: 50 000 SCALE}$$

"Natural Resources Canada", Map Scale, Copyright 1969 by Department of Energy, Mines and Resource Canada, Surveys and Mapping Branch, Ottawa, ON. Retrieved April 4, 2008, from http://maps.nrcan.gc.ca/topo101/scale_e.php

Figure 5 Scale Representation



Ask cadets what scale should be used when drawing a map of the classroom. The scale should be in cm, given the size of a classroom. The scale ratio will be very small, as the map will show great detail. Figures 6 and 7 are examples of the scale.



For the map of the classroom the scale will be 1 : 50. This means that 1 cm on the map is equal to 0.5 m (50 cm) on the ground.

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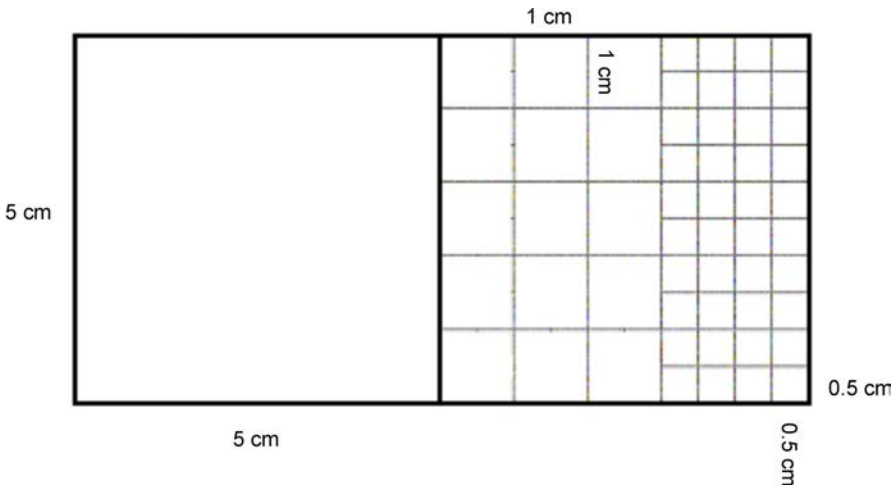

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Figure 6 Grid Square

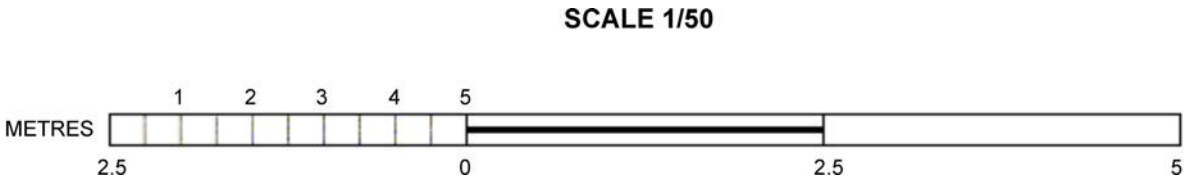

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Figure 7 Map Scale

STEP 3 – IDENTIFYING FEATURES AND ADDING SYMBOLS

Once the map's projection and scale are determined, the next step is to add features of the physical landscapes that will most accurately and vividly represent the area being mapped. This is done by simplifying the features using symbols and colours.

Map Symbols. Map symbols are graphic images that represent something else. They may be depicted by pictorial images, abstract combinations of points and lines, or tonal shading and colour tints.



Have a selection of maps available so cadets can see the types of symbols used.

Map-makers use a key or legend to indicate what symbols represent. On topographical maps, this legend is included on the back of the map and sometimes in the map margin.



Have the cadets brainstorm symbols which correspond to the features they previously identified in the classroom. An example is an "x" to symbolize a chair.

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Placing Symbols on the Map

Once the appropriate symbols have been identified, the map-maker must place them on the map. This is done by:

1. measuring the distance of the area/location which is to be mapped and marking this on the graph paper;

2. selecting a reference point. This could be the centre of the area being mapped, one of the four corners, etc;

3. selecting and plotting the first feature by placing the symbol on the map. This initial feature should be something that is known and easily transferred from the ground to the map;

All maps are drawn from a reference point. The reference point is called the datum. Most map datum only cover a portion of the earth, like the North American Datum of 1927 (NAD–27), which only covers the continent of North America.

4. selecting the next feature, measuring the distance and direction between it and the initial feature, and then placing the symbol on the map; and

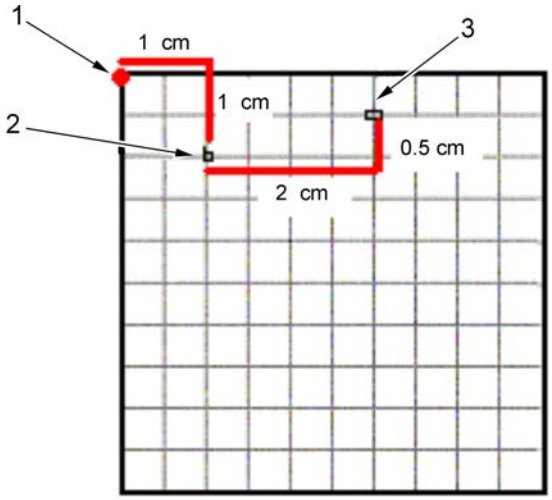

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Figure 8 Adding Symbols to the Map

In the example in Figure 8, the map-maker:

(1) selected the reference point – the northeast corner of the classroom;

(2) measured the actual position (0.5 m across, 0.5 m down), then plotted the symbol in the correct location using the scale (1 cm across, 1 cm down); and

(3) selected the next feature, the desk, and measured the actual distance across from the chair and then up to the desk (1 m [2 cm] by 0.25 m [0.5 cm]).

5. for each new feature added to the map, measuring its position in relation to those already added.

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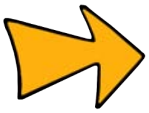

The map-maker should add symbols one grid square at a time.

Step 4 – APPLYING GEOGRAPHICAL NAMES TO FEATURES

The final step in the making of a map is selecting and applying geographical names that identify relevant features, landmarks, and places. Geographical names are fundamental elements of maps.



At this point most natural landmarks have already been named.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Determining location is the first step in making a map. What is the easiest way to do this?

Q2. What is map projection?

Q3. The scale of a map is an expression of what type of ratio?

ANTICIPATED ANSWERS

A1. The easiest way to determine location is to use landmarks. Landmarks are features that are man-made – houses, buildings, railroads, churches – or natural – a river, lakes, forested areas.

A2. Map projection is a geometrical method of reducing the amount of distortion on a flat map. In very large countries such as Canada, map-makers divide the country into strips from north to south, called zones, and project each zone.

A3. The scale of a map is an expression of the ratio between one unit on the map and the distance it covers, in the same units, on the real ground.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What is a map?

Q2. What are the five basic functions that are generally performed, in some capacity, by all cartographers?

Q3. What is the UTM?

ANTICIPATED ANSWERS

A1. A map is a scale, or proportionately smaller, representation of the ground that uses internationally accepted symbols to represent both natural and man-made features.

A2. The five basic functions that are generally performed, in some capacity by all cartographers are liaising, editing, drafting, researching and teaching.

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A3. The UTM is a system of strip projection which is used by all National Topographical System maps. For UTM projection, the earth's surface has been divided into 60 zones. Sixteen of these zones, numbered 7–22, cover Canada from west to east.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Being able to identify the principles of map-making is an important concept to understand because using maps is an integral component to the army cadet training program. Knowing how a map is made and developed will assist cadets in reading a map.

INSTRUCTOR NOTES/REMARKS

Cadets will be given the opportunity to create their own maps in EO C322.04 (Draw a Map of an Area in the Local Training Facility, Section 10).

REFERENCES

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