ROYAL CANADIAN SEA CADETS

PHASE FOUR

INSTRUCTIONAL GUIDE

SECTION 2

EO M423.02 – USE NAVIGATION INSTRUMENTS

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-604/PG-001, *Phase Four Qualification Standard and Plan*, 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.

Review *Chart 3441* and become familiar with the geographical places specified in this lesson.

Set up the classroom or training area so that cadets can work in pairs at tables suitable for chartwork.

Distribute one set of navigation instruments, *Symbols Abbreviations Terms (Chart 1)* and *Chart 3441 Haro Strait, Boundary Pass and / et Satellite Channel* to each pair of cadets.

If desired, an alternative chart, such as one of the local area, may be used. If so, modify the lesson to include the information in the given examples to reflect that chart.

PRE-LESSON ASSIGNMENT

Nil.

APPROACH

A demonstration and performance was chosen for this lesson as it allows the instructor to explain and demonstrate the skills the cadets is expected to acquire while providing an opportunity for the cadets to practice the skills under supervision.

INTRODUCTION

REVIEW

Nil.

OBJECTIVES

By the end of this lesson the cadet shall have used navigation instruments.

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IMPORTANCE

It is important for cadets to know how to navigate as it introduces them to skills necessary for future training opportunities. Knowledge of this information will ensure that cadets are able to create safe and effective navigation plans for on water activities.

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Teaching point 1 **Demonstrate and have the cadets' practice using navigation instruments.**

Time: 50 min Method: Demonstration and Performance



For this TP it is recommended that instruction take the following format:

(1) Explain and demonstrate the use of each navigation instrument.

(2) Explain and demonstrate each step required to use each instrument.

(3) Monitor the cadets' performance as they practice with each navigation instrument.

USE OF NAVIGATION INSTRUMENTS

The purpose of navigation is to find the present position and to determine the necessary speed, direction etc, to arrive at a port or point of destination. The proper use of navigation instruments will greatly effect the accuracy of the navigation and will therefore impact the safe and timely execution of any planned passage.

A navigator's instrument kit will contain, but is not limited to, the following:

- **Pencils.** The recommended pencils for navigation are 2H wooden pencils. These pencils allow clean lines on the chart and will not leave wide, smudgy lines which are difficult to erase. Mechanical pencils (0.5 mm and 0.7 mm) are not recommended as the lead will become very sharp during use and may damage the surface of the chart, leaving permanent lines.
- **Erasers.** Tests done by Canadian Hydrographic Service (CHS) indicate that indian gum erasers work the best on either type of chart. Never use the red erasers which are attached to the pencil. These erasers will leave red smears on the chart and their abrasive material may scrub any information (lines, soundings, etc.) from the surface of the chart.
- **Parallel ruler.** Used for transferring a line across a chart while maintaining its direction. There are two main types of parallel rulers used:



Cadets should be given an opportunity to use both types of rulers (if available).

  - **Hinged parallel ruler.** Two straight edges hinged so that they maintain the same angle. By alternating the moving edge, and securely holding down the non-moving edge, the rulers move about the chart while maintaining the same angle (as illustrated in Figure 1).

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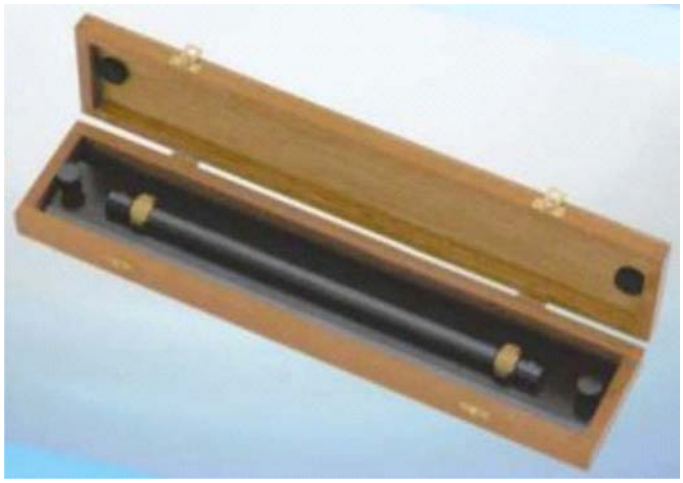
Note. From Wikipedia, 2008, Parallel Ruler, Retrieved November 6, 2008, from www.wikipedia.org/wiki/parallel_ruler

Figure 1 Hinged Parallel Ruler



Instructions on how to use a hinged parallel ruler are located at Attachment A.

- **Rolling parallel ruler**. Designed to roll without sliding laterally and easy to use with little practice. Rolling rulers do not work well near the edge or over folds in charts as they may catch on the fold or edge. (Illustrated in Figure 2).



Note. From Chartroom-online.com, 2008, The Navigators Best Friend, Retrieved November 6, 2008, from www.chartroom-online.com/store/products/equipment/RollingRule.html

Figure 2 Rolling Parallel Ruler



Instructions and an exercise for the cadets on how to use a rolling parallel ruler are located at Attachment B.

- **Dividers.** Dividers are used to measure the distance between two points, and also to help align parallel rulers. There are several styles of dividers available. A good set of dividers will have an adjusting screw to maintain the tension on the divider's arms.

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Note. From Binnacle.com, 2008, Your Online Marine Store, Retrieved November 13, 2008, from http://ca.binnacle.com/Product_info.php

Figure 3 Dividers



Further details on how dividers are used in navigation are provided in EO M423.03 (Describe Latitude and Longitude).

Additional navigation instruments that could be included are:

- **Drafting compass.** A drafting compass can be used for scribing arcs, which indicate distances, on a chart. The best compass for navigation is one with a thumb screw between the legs to keep them in a set position.

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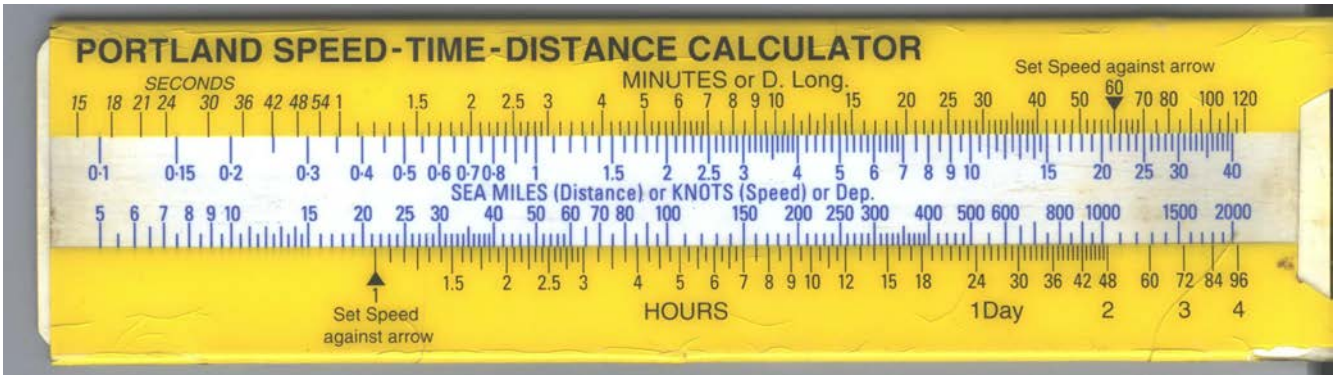
Note. From Staedtler.com, 2008, Retrieved November 13, 2008, from www.staedtler.com/technical_drawing

Figure 4 Drafting Compass

- **Speed-Time-Distance calculator.** A simple slide rule for calculating the speed, distance or time if the other two quantities are known.



Note. Created by Director Cadets 3, 2008, Ottawa, ON: Department of National Defence.

Figure 5 Portland Speed-Time-Distance Calculator



Instructions on how to use a Speed-Time-Distance (STD) calculator are located at Attachment C.

CONFIRMATION OF TEACHING POINT 1

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

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END OF LESSON CONFIRMATION

QUESTIONS:

Q1. What type of pencil is recommended for navigation?

Q2. What are the two types of parallel rulers?

Q3. What instrument is used to measure distance between two objects?

ANTICIPATED ANSWERS:

A1. 2H wooden pencils.

A2. Hinged or rolling.

A3. Dividers.

CONCLUSION

HOMEWORK / READING / PRACTICE

Nil.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-604/PG-001, *Phase Four Qualification Standard and Plan*, Chapter 3, Annex B, 423 PC.

CLOSING STATEMENT

Using navigation instruments accurately will allow the cadets to safely navigate and complete their objectives during actual navigation passages.

INSTRUCTOR NOTES / REMARKS

Nil.

REFERENCES

C1-163 ISBN 0-07-137226-1 Brogdon, B. (1995). *Boat navigation for the rest of us* (2nd ed.). Camden, ME: International Marine.

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HOW TO USE A HINGED PARALLEL RULER

Hinged parallel rulers are used to plot direction or transfer parallel lines on a chart. They are, essentially, two straight edges that are hinged so that they maintain the same angle. By altering the moving edge, and securely holding the non-moving edge, the ruler can be moved about the chart while maintaining the same angle.

The following steps explain how to use a hinged parallel ruler:

1. Align the bottom edge of the ruler with the bottom edge of the chart.

2. Hold the bottom half of the ruler stationary and move the top half until the hinges are straight up and down.

3. While holding the top half stationary, close the ruler.

4. Hold the bottom stationary and move the top half until the upper edge aligns with the first parallel of longitude on the chart (on *Chart 3441* it is 48° 36' N). If the ruler has not moved, the edge of the ruler should be precisely aligned with the line on the chart.

5. Practice moving the ruler up and down the chart.



COMMON ERRORS

It is common for novice navigators to make the following errors when learning to use a hinged parallel ruler:

- Not applying consistent pressure along the stationary side of the ruler by only pushing down on the handles. Spread the pressure along the entire side of the ruler and use the handles only when moving the side.
- Always moving the halves in the same direction when opening and closing the ruler. This will make the ruler move in that direction (eg, if you always open and close the ruler by moving the corresponding half to the right, the ruler will move across the chart to the right).

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HOW TO USE A ROLLING PARALLEL RULER

Rolling parallel rulers are used to plot direction or transfer parallel lines on a chart. These rulers contain two large brass wheels mounted on a single axle which runs through the centre of the ruler. This will allow the ruler to smoothly roll along the chart while maintaining the same angle.

The following steps explain how to use a rolling parallel ruler:

1. Align the bottom edge of the ruler with the bottom edge of the chart.
2. Carefully roll the ruler to the first parallel of latitude on the chart (on *Chart 3441* it is 48° 36' N).
3. If the ruler has not moved, the edge of the ruler should be precisely aligned.
4. Practice moving the ruler up and down the chart.



COMMON ERRORS

It is common for novice navigators to make the following errors when learning to use a rolling parallel ruler:

- Not applying consistent pressure along the length of the ruler. Many times the ruler will wander because the person using it is only pushing down on the centre of the ruler.
- Moving the ruler too fast along the chart. Care must be taken when rolling the ruler to ensure that it remains straight.
- Trying to roll over folds, edges and other obstructions, such as eraser pieces, when moving the roller from one point to another. Before moving the ruler, ensure the path you wish to roll along is clear of anything the ruler may catch on.

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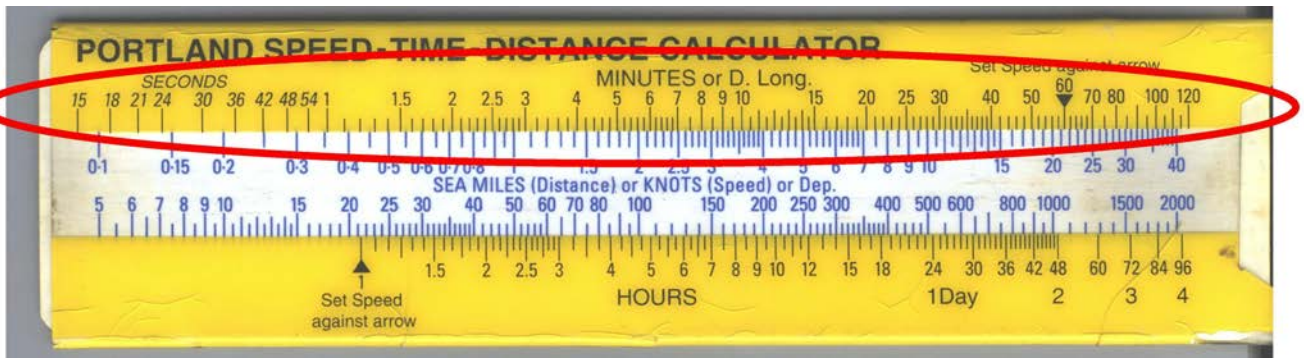
HOW TO USE A SPEED-TIME-DISTANCE CALCULATOR

The Speed-Time-Distance (STD) Calculator is a simple slide ruler which can be a navigator's most used tool. The ruler can assist a navigator in easily and quickly calculating any required value when given two others.

Parts and Scales

1. **Top scale.** This scale is divided into minutes and seconds from 15 seconds to 120 minutes (two hours) (as illustrated in Figure C-1).



Note. Created by Director Cadets 3, 2008, Ottawa, ON: Department of National Defence.

Figure C-1 Top Scale

2. **Bottom scale.** This scale is divided into hours and days. From left to right the scale begins at 1 hour and continues to 96 hours (four days) (as illustrated in Figure C-2).

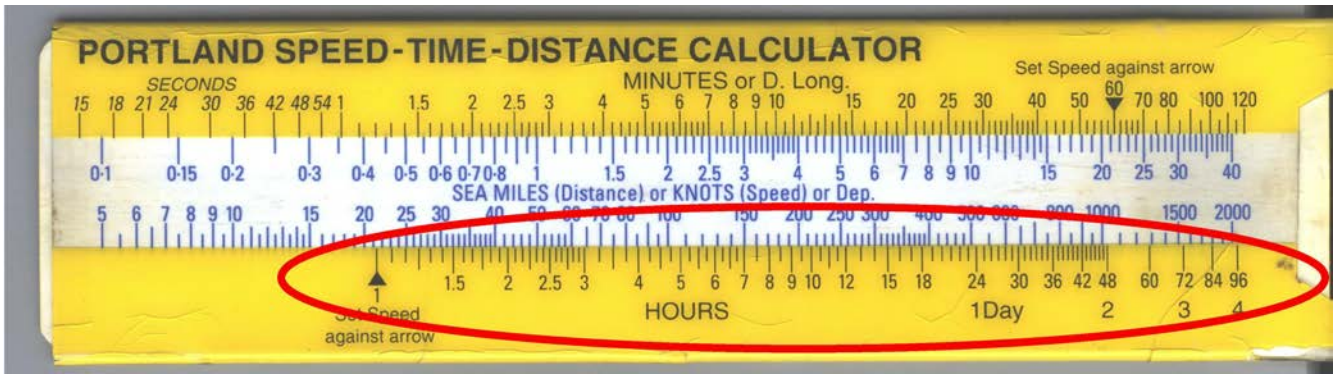


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Figure C-2 Bottom Scale

3. **Top speed arrow.** This speed arrow is used for calculations when the time given or required is two hours or less (as illustrated in Figure C-3).

4. **Bottom speed arrow.** This speed arrow is used when calculating working in hours and days and large distances greater than 5 M (as illustrated in Figure C-3).

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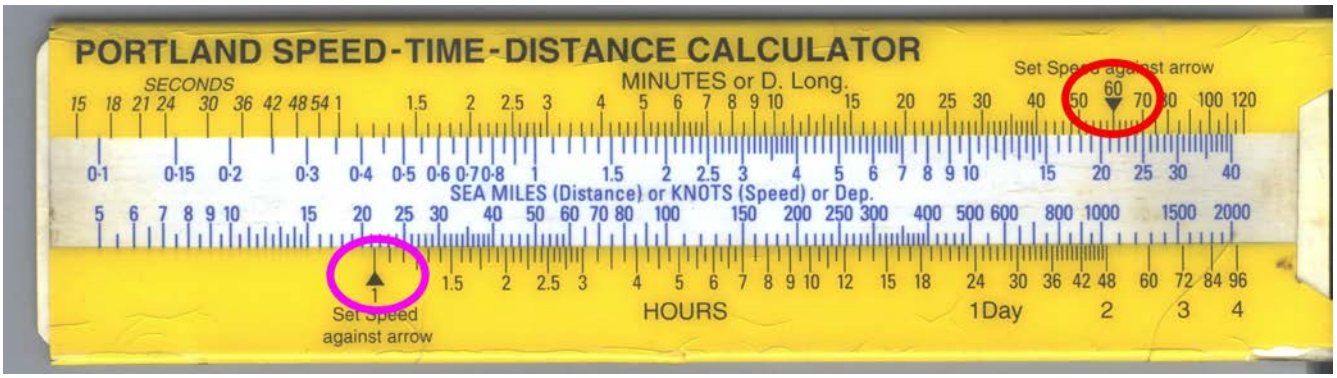

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Figure C-3 Top and Bottom Speed Arrows

5. **Centre scale.** This scale can be used to represent either sea miles (Nautical Miles) or knots depending on which value is being calculated. The upper scale is for any speed up to 40 knots. The lower scale is used for speeds over 5 knots for periods of time longer than one hour (as illustrated in Figure C-4).

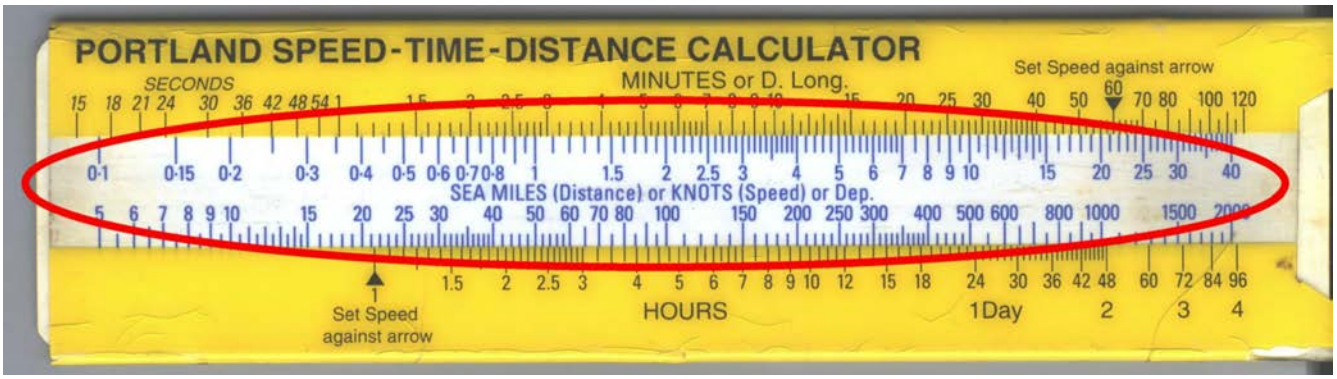

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Figure C-4 Centre Scale

Calculating Time Required

When the speed is known, to find the time required to run a given distance, set the speed in knots on the upper miles scale against the upper arrow and read off the time opposite the distance to travel.

For example:

1. If the boat has a speed of 9 knots and the marina it is going to is 27 M away, how long will it take to get there?

    a. Align 9 knots on the upper miles scale to the upper speed arrow.

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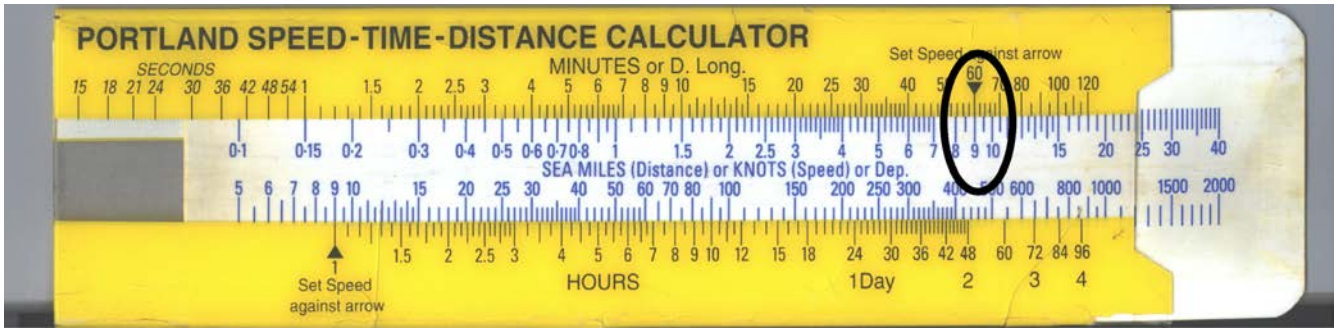

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Figure C-5 Step 1a

b. Read the time opposite the 27 M on the lower miles scale. The answer is 3 hours.

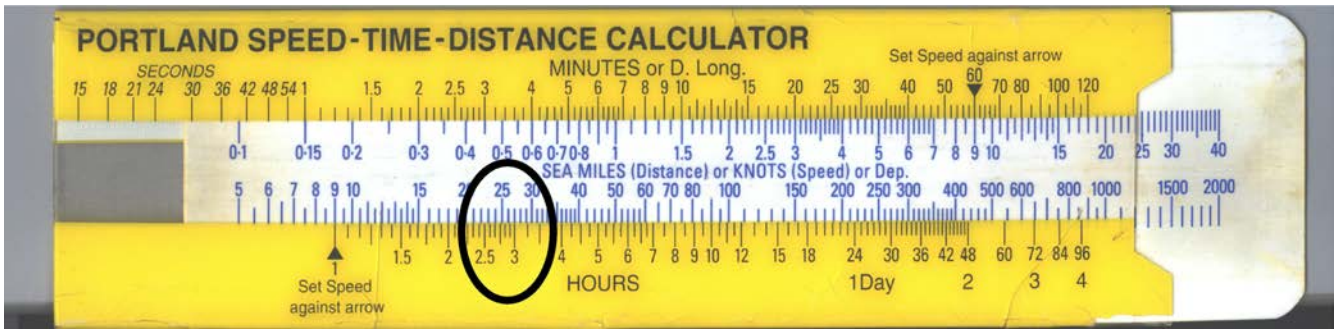

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Figure C-6 Step 1b

Calculating Distance Travelled:

To find the distance travelled, when the speed and time travelled are known, set the speed in knots on the upper miles scale against the upper arrow and read off the distance opposite the time travelled.

For example:

1. If the boat has been travelling at 16 knots for 5 hours, how far will it travel?

   a. Align 16 knots on the upper miles scale to the upper speed arrow.

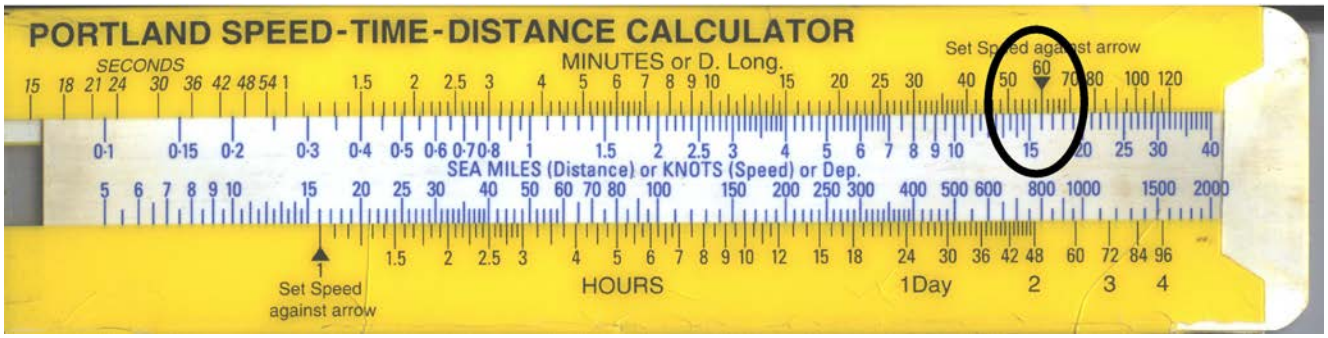

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Figure C-7 Step 2a

b. Read the distance travelled opposite 5 hours on the lower scale. The answer is 80 M.

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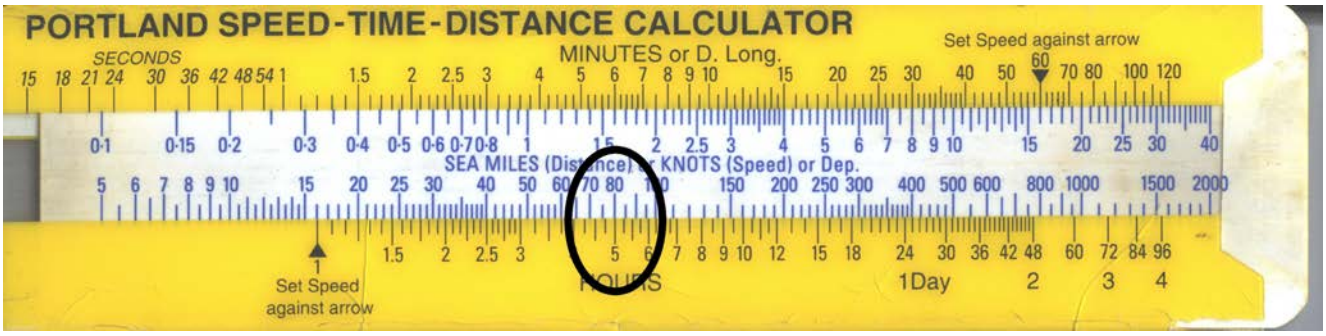

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Figure C-8 Step 2b

Calculating Speed Made Good

Set the distance against the time and read off the speed in knots on the miles scale opposite the upper or lower speed arrow.

For example:

1. The boat has travelled for 15 M in 6 hours. What is the speed made good?

   a. Align 15 M on the lower miles scale with 6 hours on the lower scale.

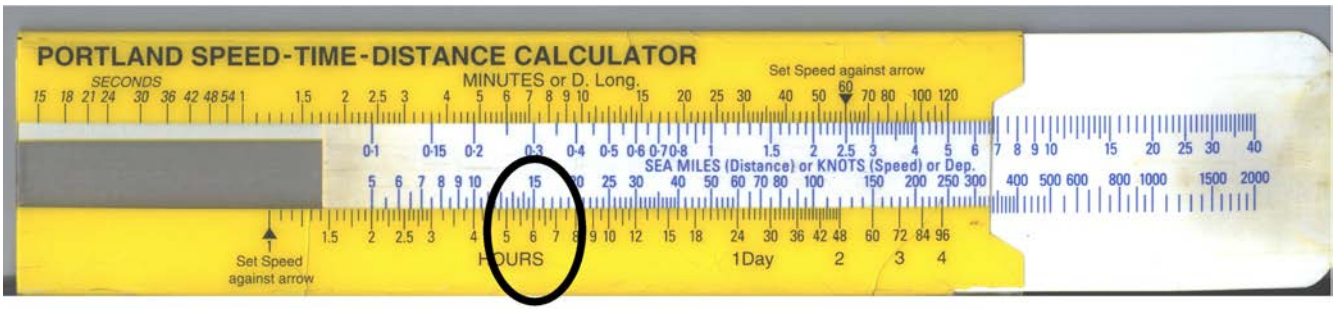

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Figure C-9 Step 3a

   b. Read the speed made good opposite the upper speed arrow. The speed made good is 2.5 knots.

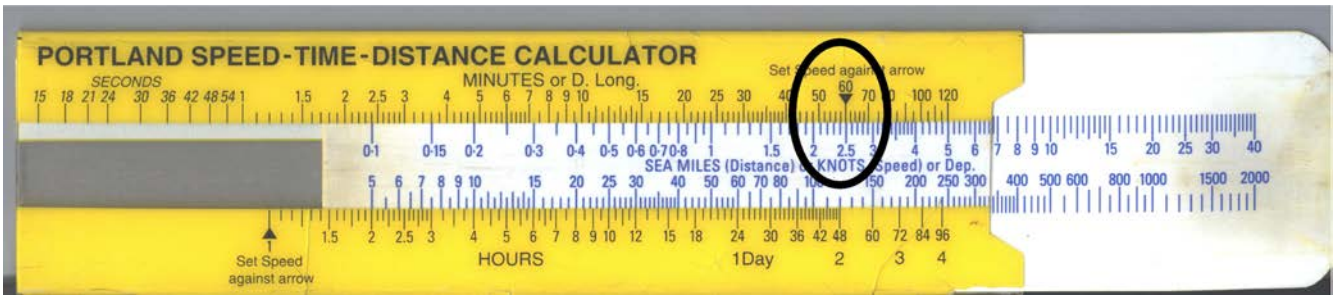

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Figure C-10 Step 3b

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