ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL THREE

INSTRUCTIONAL GUIDE

SECTION 1

EO M337.01 – MEASURE DISTANCE ALONG A ROUTE

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-803/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.

Create a slide of the terms located at Annex A.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TPs 1 and 2 to introduce basic air navigation terms and types of air navigation.

Demonstration and performance was chosen for TP 3 as it allows the instructor to explain and demonstrate measuring distances while providing an opportunity for the cadet to practice this skill under supervision.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have measured distance along a route.

IMPORTANCE

It is important for cadets to learn to measure distance along a route since it is an important skill in all types of navigation. Cadets may travel and being able to determine the distance between points is important. A cadet who continues with flight training will use this skill during flight planning.

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Teaching point 1 **Define Air Navigation Terms**

Time: 5 min Method: Interactive Lecture

AIR NAVIGATION TERMS



Show the slide of the terms located at Annex A.

There are several key terms that must be understood.

Graticule. A three-dimensional geometrical pattern of intersecting circles. Envision the black lines on a basketball, or a globe with only the black lines.

Latitude. Parallels of latitude are imaginary circles on the earth's surface, which lie parallel to the equator. Latitude measures 90 degrees north and 90 degrees south of the equator. Parallels of latitude make up half of the earth's graticule. Latitude is measured in degrees (°), minutes ('), and seconds (").

Longitude. Meridians of longitude are imaginary circles on the earth's surface, which intersect at the true or geographic poles, and join the poles of the earth together. Longitude measures 180 degrees west and 180 degrees east of the prime meridian (0 degrees), which passes through Greenwich, England. Meridians of longitude make up the other half of the earth's graticule. Longitude is measured in degrees (°), minutes ('), and seconds (").

Nautical Miles. A nautical mile (nm) is 6 080 feet and is the average length of one minute of latitude.

Statute Miles. A statute mile is 5 280 feet.

Scale. Scale on a map is the relationship between a unit of distance on the chart to the distance on the earth that the unit represents. For example, a scale of 1 : 250 means that one inch on the map is equal to 250 inches on the ground.

VNC. A visual flight rules (VFR) navigation chart (VNC) is a chart used primarily for visual navigation, at low altitudes (below 18 000 feet) and slower speeds (less than 300 knots). A VNC has a scale of 1 : 500 000, or one inch to eight miles.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is a graticule?

Q2. How many nautical miles are in one minute of latitude?

Q3. How many feet are in a statute mile?

ANTICIPATED ANSWERS

A1. A three-dimensional geometrical pattern of intersecting circles.

A2. One.

A3. 5 280 feet.

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Teaching point 2 **Identify and Describe Types of Navigation**

Time: 5 min Method: Interactive Lecture

TYPES OF NAVIGATION

There are several methods of navigation used by pilots to find their way from place to place. Four of the more common methods used include:

- pilotage,
- dead reckoning,
- inertial navigation, and
- satellite navigation.

Pilotage. This method of navigation is by reference to landmarks only. This is similar to orienteering.

Dead Reckoning. This method of navigation uses predetermined vectors of wind and true airspeed, precalculated heading and groundspeed, and estimated time of arrival. This is the most common method used by private pilots.

Inertial Navigation. This method of navigation is through use of gyroscopic equipment and electronic computers to provide a continuous display of position. This equipment is built into the aircraft.

Satellite Navigation. This method uses position and guidance systems, which transmit to and receive information from orbiting satellites. The global positioning system (GPS) is the most commonly used satellite system with many new aircraft having complex units built into the instrument panel.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is pilotage?

Q2. Which is the most common navigation method used by private pilots?

Q3. What is the most commonly used satellite navigation system?

ANTICIPATED ANSWERS

A1. This method is navigation by reference to landmarks only.

A2. Dead reckoning.

A3. GPS.

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Teaching point 3 **Demonstrate and Have the Cadet Determine the Distance Between Two Predetermined Points Along a Route**

Time: 15 min Method: Demonstration and Performance

MEASURING DISTANCE

International Civil Aviation Organization (ICAO) Ruler

The ICAO ruler is a simple straight edge with four measuring scales embossed into it. The scale used depends on the type of map and unit of measurement desired. For a VNC, the scale would be 1 : 500 000. Since all distances in aviation are given in nm, this is the measurement used when determining distance.

Place the ruler on the map, with the starting point at zero. Be sure to use the 1 : 500 000 side and the nm scale. Adjust the ruler so that the destination point is on the same edge as the start point, and measure across. The value found on the nm scale is the distance between the two points.

Map Scale

The distance can also be measured using the map scale. On the reverse side of the map legend there is a graduated scale for that map. It will show nm, statute miles, and km. Take a piece of paper and line it up on the map between the two points. Use a pencil to mark where the two points are on the paper. Line the paper up with the graduated scale, on the nm line, and determine the distance. If the distance on the map is greater than the graduated scale, simply mark off the end of the graduated scale on the paper, shift the paper down so that the new mark is set to zero and remeasure. Depending on the length of the route, some basic math may be required as the paper may have to be readjusted.



Remember that the distance between minutes of latitude is one nm. This means that if two points are directly north or south of each other, count up the number of minutes of latitude between them and this equals the distance.

ACTIVITY

OBJECTIVE

The objective of this activity is to determine the distance between two points along a route.

RESOURCES

- ICAO ruler,
- VNC,
- Pencil, and
- Eraser.

ACTIVITY LAYOUT

Desks are to be arranged so that cadets can work in pairs.

ACTIVITY INSTRUCTIONS

1. Distribute one VNC to each pair of cadets.

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2. Distribute one ICAO ruler to each pair of cadets.

3. Using two predetermined points, demonstrate to the cadets how to use the ICAO ruler.

4. Provide the cadets with a second set of predetermined points.

5. Have the cadets measure the distance between these two points using the ICAO ruler.

6. Provide the cadets with two more sets of points and allow them to practice.

7. If time permits, demonstrate to the cadets how to measure the distance using the scale of the map.

8. Have the cadets use the scale of the map to determine the distances of the previously used sets of points. Confirm with the results of the ICAO ruler.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

The cadets' participation in the activity in TP 3 will serve as confirmation of this EO.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

This EO is assessed IAW Chapter 3, Annex B, Aviation Subjects – Combined Assessment PC.

CLOSING STATEMENT

Measuring a distance along a route is very useful in aviation as well as other methods of travel. Being aware of scale and knowing how to use that information will ensure efficient trip planning.

INSTRUCTOR NOTES/REMARKS

VNCs and ICAO rulers can be ordered through the Area Cadet Officer (ACO), purchased at a local flight training centre, or ordered online at NavCanada (www.navcanada.ca).

EO C337.02 (Practice Air Navigation Skills, Section 4) may be conducted to provide extra practice of the skills learned in this EO.

REFERENCES

C3-116 (ISBN 0-9680390-5-7) MacDonald, A. F., & Peppler, I. L. (2000). *From the Ground Up: Millennium Edition*. Ottawa, ON: Aviation Publishers Co. Limited.

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C3-139 (ISBN 0-7715511-5-0) Transport Canada. (1999). *Flight Training Manual: 4th Edition Revised*. Ottawa, ON: Transport Canada.

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