ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL THREE

INSTRUCTIONAL GUIDE

SECTION 12

EO C390.07 – DETERMINE DIRECTION AT NIGHT

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.

Choose a suitable night to perform this activity by checking both a moon calendar and local weather conditions.

A sky map should be created for the date and location where the lesson will be taught. Annex P is an example created for reference of what a sky map looks like and how it is used to locate constellations. Photocopy the created sky map for each cadet.

Photocopy the handout located at Annex Q for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration and performance was chosen for this lesson as it allows the instructor to demonstrate determining direction at night while providing an opportunity for the cadet to practice the skill under supervision.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have determined direction at night.

IMPORTANCE

It is important for the cadets to be able to navigate at night so they will have the skills to find their way in the dark. In a survival situation, being able to determine direction in the dark is a skill that can assist in being rescued.

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Teaching point 1 **Explain, Demonstrate and Have Cadets Determine Direction Using the Moon**

Time: 10 min Method: Demonstration and Performance

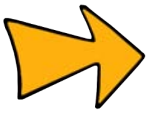


This TP must be conducted during a clear night when the moon is in one of its crescent phases. Determine the phases of the moon on a moon calendar or through the internet.

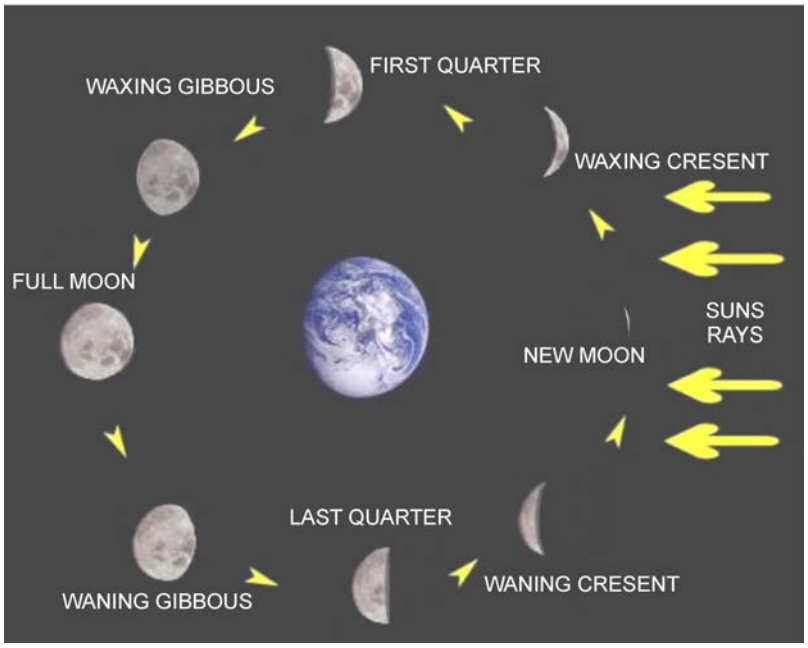
IDENTIFYING THE PHASES OF THE MOON

The phases of the moon are caused by the relative positions of the earth, sun, and moon. The moon rotates around the earth, on average, once every 27 days, 7 hours and 43 minutes.

The sun always illuminates the half of the moon facing the sun (except during lunar eclipses). When the sun and moon are on opposite sides of the earth, the moon appears “full” like a bright, round disk. When the moon is between the earth and the sun, it appears dark, a “new” moon. In between these phases, the moon’s illuminated surface appears to grow (waxing) to full, and then shrink (waning) to the next new moon.



The moon’s familiar crescent shape is formed by the shadow of the earth on the moon’s surface and always points relatively north and south in the sky.



Afreshhorizon.co.uk, Copyright 2008 by A Fresh Horizon. Retrieved November 14, 2007, from http://www.afreshhorizon.co.uk/images/moon_phases.jpg

Figure 1 Moon Phases

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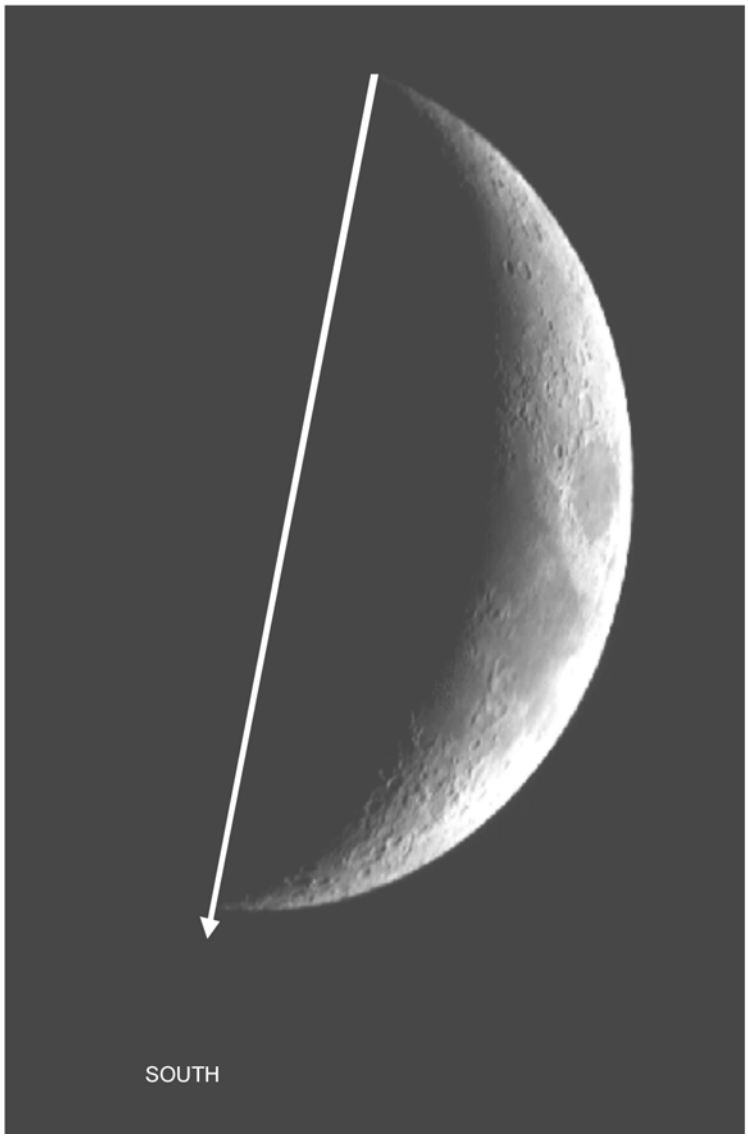
DETERMINING SOUTH

Drop a line along the points of the crescent moon and project it to the horizon. This point on the horizon is in the general direction of south.



The Calvin College Observatory, 2001, The Crescent Moon, Copyright 2001 by The Calvin College Observatory. Retrieved November 14, 2007, from http://www.calvin.edu/academic/phys/observatory/images/moon/

Figure 2 Determining South by the Moon



This method will give a general direction of north and south.

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ACTIVITY

Time: 5 min

OBJECTIVE

The objective of this activity is to have the cadets determine direction using the moon.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Explain, demonstrate and have the cadets drop an imaginary line along the points of the crescent moon and project that line to the horizon (as illustrated in Figure 18-12-2). This point on the horizon is in the general direction of south.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

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

Teaching point 2 — **Explain, Demonstrate and Have Cadets Identify the Major Constellations Required to Find Polaris**

Time: 10 min — Method: Demonstration and Performance



The best watching time for stars is between the moon's last quarter and the first, and three hours after sunset so the sky is dark enough to see the low intensity stars.

CONSTELLATIONS

Constellations are groupings of stars that have been given legendary or historical significance. These groups have been joined together with lines, outlining a figure or symbol, so that they may be found in the sky.

Ursa Major (Big Dipper)

Ursa Major is visible throughout most of the year in the northern hemisphere and is known as the "Great Bear" in Latin. The seven brightest stars are located in the bear's hindquarters and tail and form the well known asterism Big Dipper as it appears to form the shape of a ladle, or dipper shape. The stars Dubhe and Merak, located on the outside edge of the dipper, are also known as "The Pointer" since they point in the direction of Polaris.

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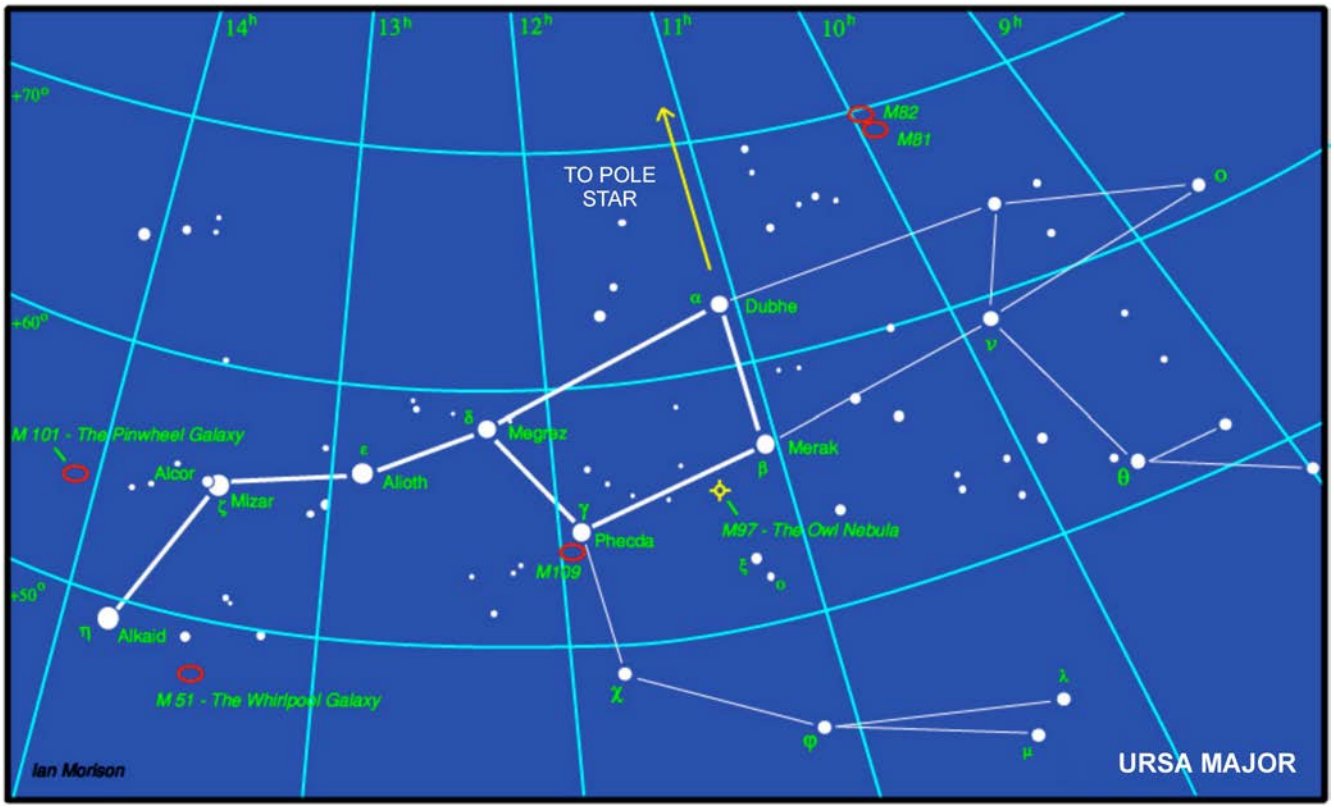

Jobrell Bank Observatory, 2006, Ursa Major, Copyright 2006 by The University of Manchester. Retrieved November 14, 2007, from http://www.jb.man.ac.uk/public/Ursamjor.jpg

Figure 3 Ursa Major

The Big Dipper is not a constellation. It is part of Ursa Major, the Great Bear. The Big Dipper is an asterism – a recognized, but not official, grouping of stars. Some asterisms fall within a single constellation, others span across constellations.

Cassiopeia

Cassiopeia is a northern constellation which in Greek mythology represents a vain queen who boasted about her unrivalled beauty. It is made up of five stars that resemble a lopsided “M” or “W” depending on its position in the sky. Viewing the constellation as an “M”, connect the three bottom stars with an imaginary line. From the right-most star create an imaginary line straight down to find Polaris.

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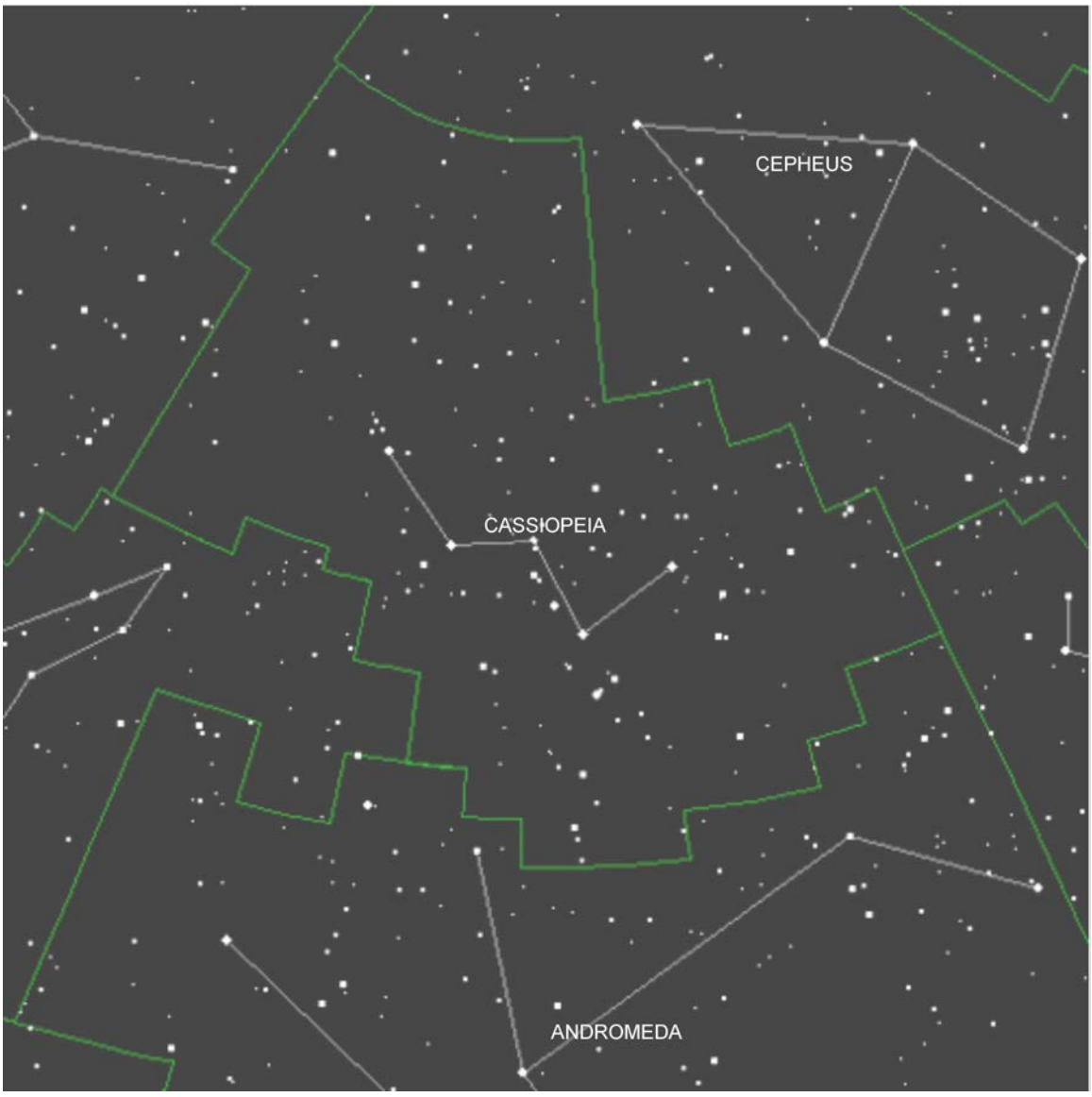

About.com, 2007, Cassiopeia, Copyright 2007 by About Inc. Retrieved November 14, 2007, from http://space.about.com/od/starsplanetsgalaxies/ig/Constellations-Pictures/cassiopeia.htm

Figure 4 Cassiopeia

Orion

Orion is a constellation often referred to as The Hunter. It is one of the largest and most visible constellations in the sky. Its brilliant stars are found on the celestial equator and are visible throughout the world. From mid-northern latitudes, Orion is visible in the evening from November to early May and in the morning from late July to November. The constellation of Orion consists of seven stars. The three stars that are close together are the belt of the constellation. The Orion constellation, rises on the horizon due east and sets due west. At the equator it will pass directly overhead, and in the northern hemisphere it will pass south directly overhead. The top of Orion points in the direction of the Pole Star.

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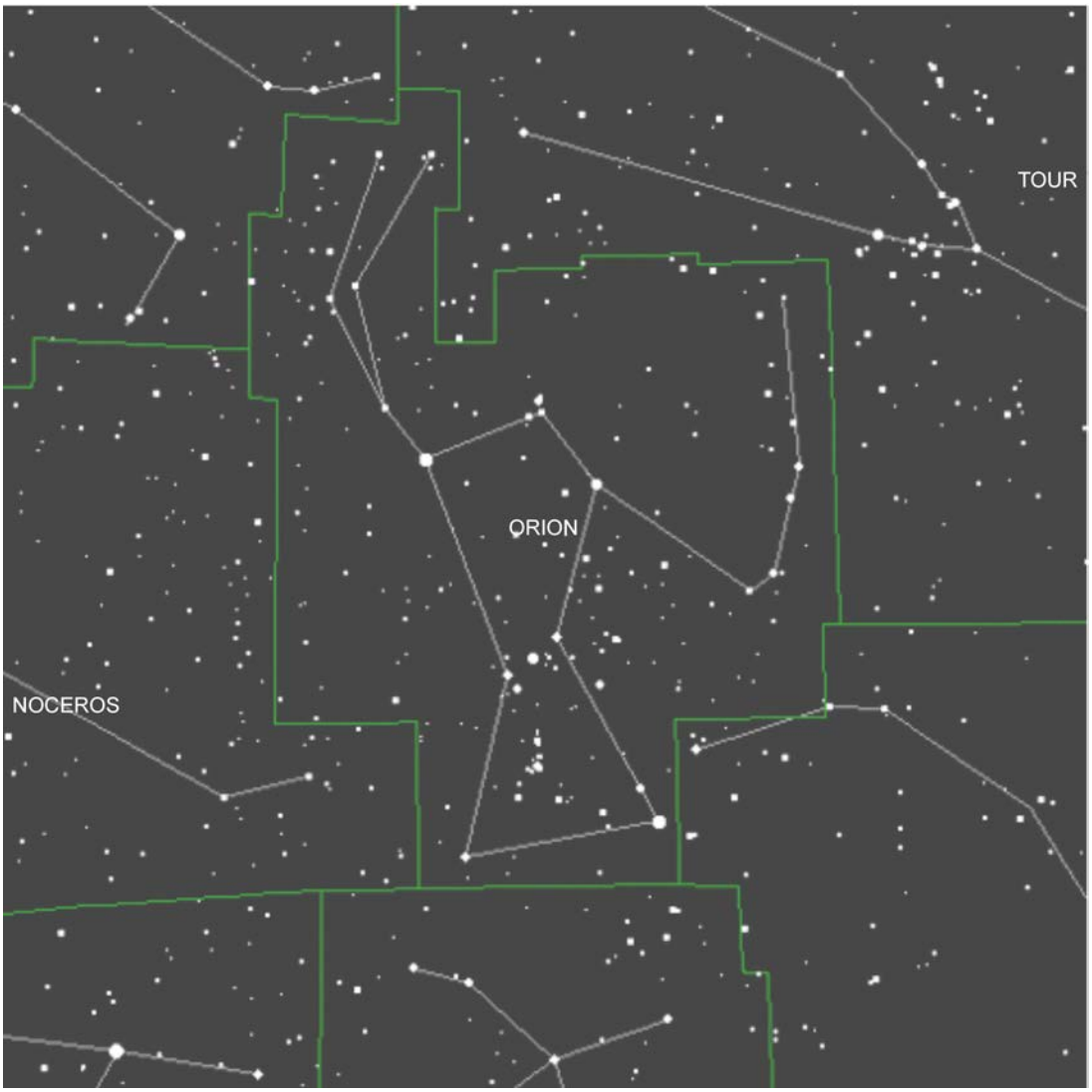

About.com, 2007, Orion, Copyright 2007 by About Inc. Retrieved November 14, 2007, from http://space.about.com/od/starsplanetsgalaxies/ig/Constellations-Pictures/orion.htm

Figure 5 Orion

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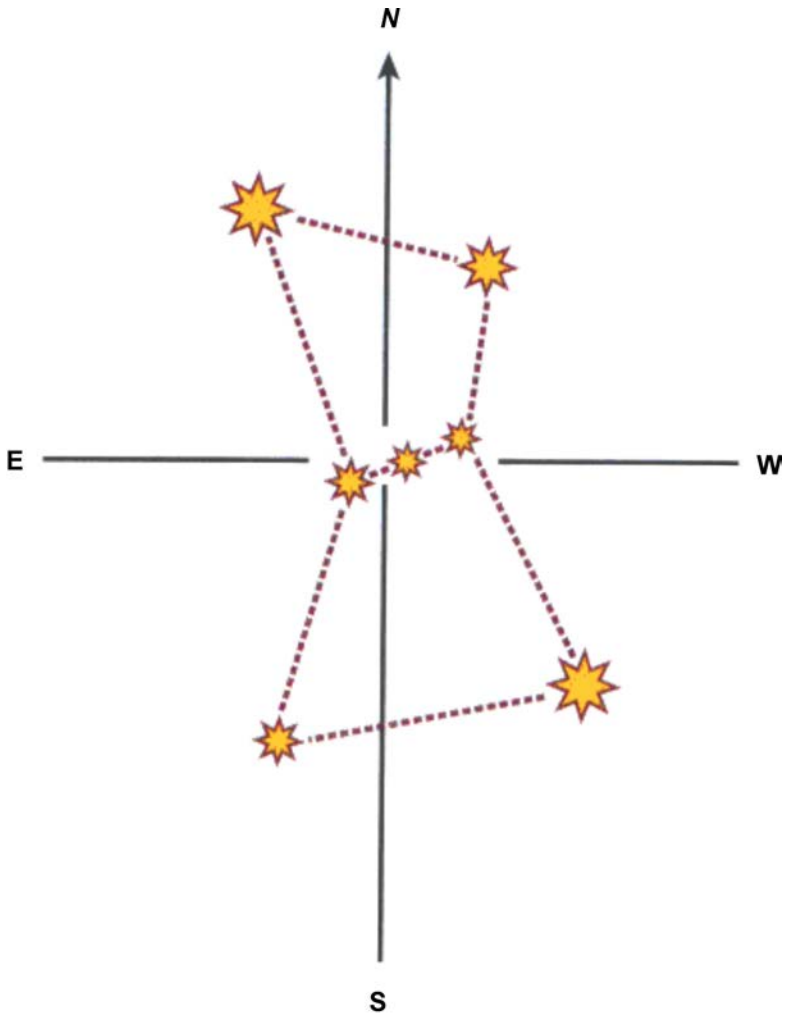

ORION

National Association of Search and Rescue, Fundamentals of Search and Rescue, Jones and Bartlett Publishers, Inc. (p. 78)

Figure 6 Orion and North

Ursa Minor (Little Dipper)

Ursa Major is a constellation in the northern hemisphere. Its name means “Little Bear” in Latin. Ursa Minor is known as Little Dipper because its seven brightest stars appear to form a ladle, or dipper shape. The star at the end of the dipper’s handle is Polaris, the North or Pole Star.

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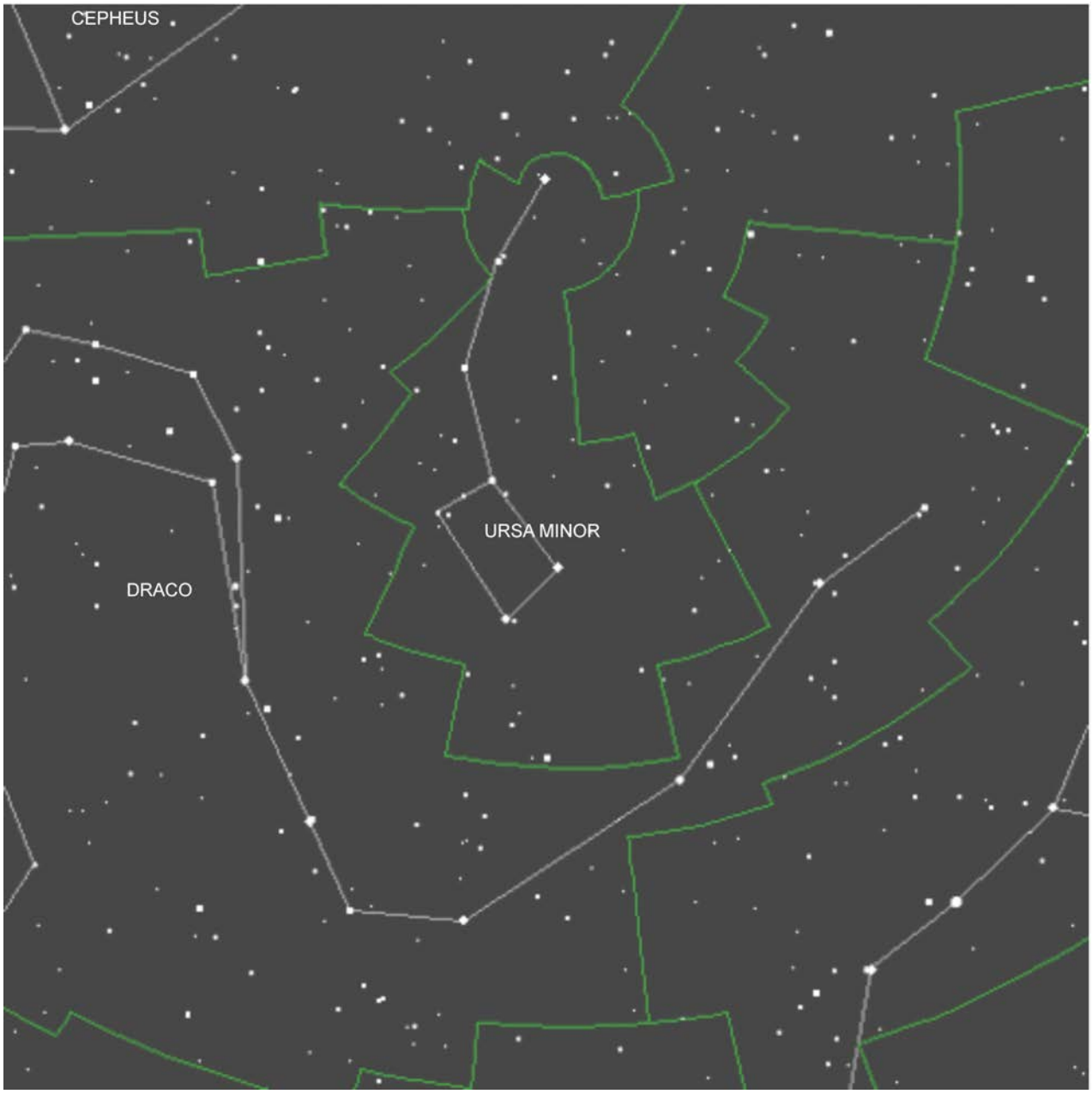

About.com, 2007, Ursa Minor, Copyright 2007 by About Inc. Retrieved November 14, 2007, from http://z.about.com/d/space/1/7/f/P/ursaminor.gif

Figure 7 Ursa Minor

ACTIVITY

Time: 5 min

OBJECTIVE

The objective of this activity is to have cadets locate various constellations.

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RESOURCES

- Sky map, and
- Red-filtered flashlight.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Indicate north to the cadets (use compass if necessary).

2. Hold the sky map upside-down (allowing the cadet to look at it) and overhead with the “N” on the map pointing north.



The east and west printed on the sky map are on the opposite side of the east and west of an earth map. The reason is that when the map is held above the head, the east and west markings will then be the same as on the ground. To better read a sky map in the dark, use a flashlight with a red filter so night vision is not affected.

3. With the aid of a local sky map, have the cadets locate:
   a. Ursa Major,
   b. Cassiopeia,
   c. Orion, and
   d. Ursa Minor.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

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

Teaching point 3 — **Explain, Demonstrate and Have Cadets Locate Polaris Using the Major Constellations Identified in TP2**

Time: 5 min — Method: Demonstration and Performance

POLARIS

Polaris is more commonly known as the North Star. It is the brightest star in the constellation Ursa Minor. It is very close to the celestial pole (0.7 degrees away from the pole rotation), making it the current Pole Star. The star lies in a direct axis above the North Pole and appears to stand almost motionless in the sky and the other stars seem to rotate around it. Polaris has been close to the actual position of north for the past 1000 years and during the course of the 21st century it will continue to close in on being in line with True North and will be closest on March 24, 2100 (almost 0.45 degrees away). After that date it will start to pull away and eventually another star will become the new Pole Star.

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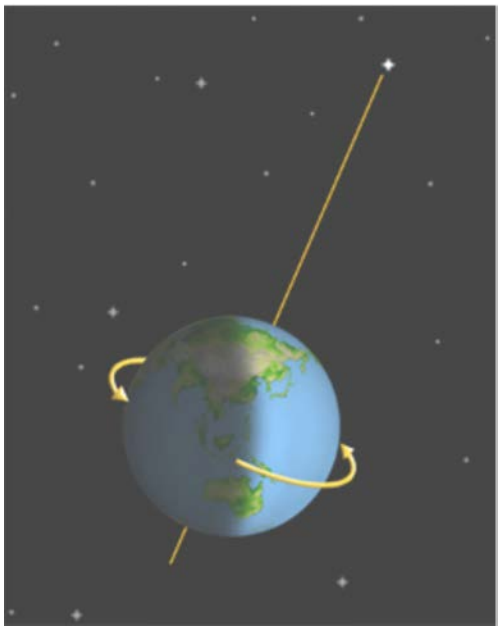
Locating the North Star

Polaris is located in the constellation Ursa Minor, which contains the group of stars that make up the Little Dipper (as illustrated in Figure 18-12-7). Polaris is the star in the end of the Little Dipper's handle. Often the Little Dipper is not very bright and can be challenging to find.



Lunar and Planetary Institute, 2007, Polaris, Copyright 2007 by Lunar and Planetary Institute. Retrieved November 14, 2007, from http://www.lpi.usra.edu/education/skytellers/polaris/about.shtml

Figure 8 Polaris

ACTIVITY

Time: 5 min

OBJECTIVE

The objective of this activity is to have the cadets locate Polaris.

RESOURCES

Handout located at Annex Q.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Hand out copies of Annex Q to each cadet.

2. Have the cadets find the constellation Ursa Major (Big Dipper).

3. Have the cadets draw an imaginary line between the two stars (the pointers Merak and Dubhe) at the end of the big dipper's bowl as they will point toward the Pole Star. The distance to the Pole Star is about five times the distance between the pointers.

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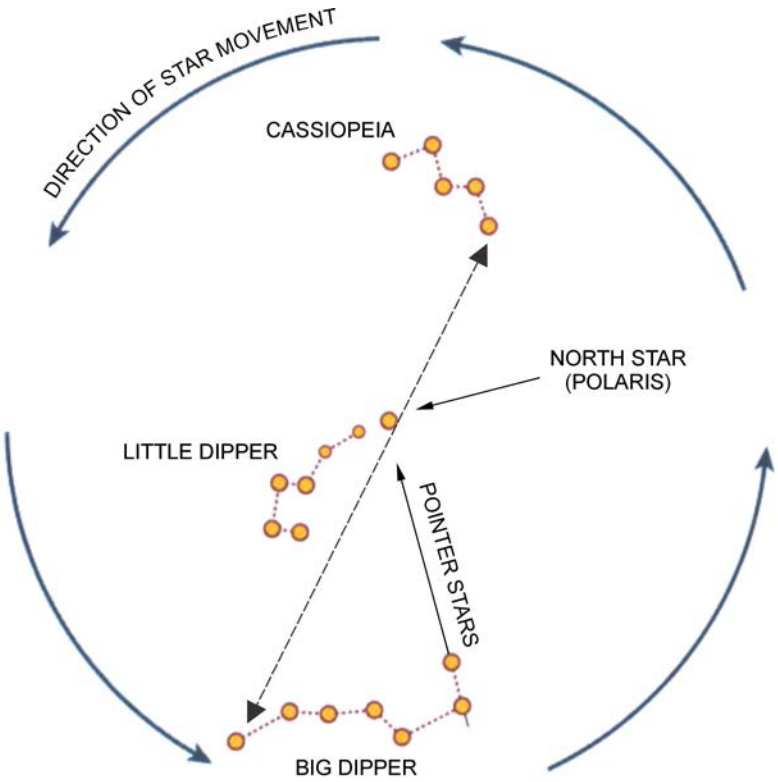

National Association of Search and Rescue, Fundamentals of Search and Rescue, Jones and Bartlett Publishers, Inc. (p. 76)

Figure 9 Finding Polaris

4. Have the cadets locate the constellation Cassiopeia, which is directly across from Ursa Major.

5. Have the cadets draw an imaginary line between the star at the end of Cassiopeia and the last star in the handle of Ursa Major (as illustrated in Figure 18-12-9). Polaris is almost equidistant between Ursa Major and Cassiopeia.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

The cadets' participation in determining south by the phases of the moon, locating the various constellations and locating Polaris will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

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METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important for the cadets to be able to navigate at night so they can find their way in the dark. In a survival situation being able to determine direction in the dark is a skill that can assist in being rescued.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-111 (ISBN 978-0-9740820-2-8) Tawrell, P. (2006). *Camping and Wilderness Survival: The Ultimate Outdoors Book* (2nd ed.). Lebanon, NH: Leonard Paul Tawrell.

C3-002 (ISBN 0-00-653140-7) Wiseman, J. (1999). *The SAS Survival Handbook*. Hammersmith, London: HarperCollins Publishers.

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