ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL THREE

INSTRUCTIONAL GUIDE

SECTION 14

EO C390.09 – IDENTIFY ELEMENTS OF THE NIGHT SKY

Total Time: 120 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.

If there are insufficient quantities of planispheres and red-filtered flashlights, divide the cadets into groups based on the quantities available.

Planispheres may be created from Figures 15U-4 and 15U-5.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP 1 in order to orient the cadets to the conditions required to observe the elements of the night sky.

Demonstration and performance was chosen for TP 2 as it allows the instructor to explain and demonstrate how to use a planisphere star chart while providing an opportunity for the cadets to practice the skill under supervision.

A practical activity was chosen for TP 3 as it is an interactive way to introduce the cadets to elements of the night sky. This activity contributes to the development of astronomy skills and knowledge in a fun and challenging setting.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have identified elements of the night sky.

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IMPORTANCE

It is important for cadets to be able to identify the elements of the night sky so they can apply the knowledge acquired in a practical setting. Observing the night sky will allow the cadets to observe the moon, planets, stars and constellations. This may also assist in overcoming the sixth and seventh enemies of survival: boredom and loneliness.

Teaching point 1 **Describe Conditions Required to View the Elements of the Night Sky**

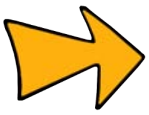
Time: 5 min Method: Interactive Lecture

CLOUDS

The presence of clouds will inhibit observations of the elements of the night sky. Even partial cloud cover will make it more difficult to identify specific constellations by hiding parts of the constellation or obscuring elements used to find the constellation. It is best to observe the night sky on a cloudless night.

MOON

The moon is the brightest object in the night sky. The moon itself does not shine, it reflects sunlight. When the moon is full, its light overpowers the light of the dim stars near it. For example, looking at a small flashlight that is next to a million candlepower flashlight, the light of the smaller flashlight is not any less, but its light is overpowered by the brighter flashlight.



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

The moon is second only to the sun as the largest source of natural light pollution.

LIGHT POLLUTION



T. Dickinson, NightWatch: A Practical Guide to Viewing the Universe, Firefly Books Ltd. (p. 48)

Figure 1 Light Pollution's Effects

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The sun and moon are the main sources of light pollution. However, artificial light pollution exists near built-up areas and makes the sky appear yellowish-gray as opposed to black. This happens because outdoor lighting illuminates the air as well as the ground. To clearly see stars at night, find a location that is free from lights. This includes individual lights, like street lights, as well as the glow that appears from built-up areas (eg, towns and cities). Figure 18-14-1 illustrates the effect of light pollution by contrasting the same section of sky with and without light pollution.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Which natural phenomenon may inhibit the view of part or all of the night sky?

Q2. What is the second brightest object that may be seen from Earth?

Q3. What are examples of artificial light pollution?

ANTICIPATED ANSWERS

A1. Clouds.

A2. The moon.

A3. This includes individual lights, like street lights, as well as the glow that appears from built-up areas (eg, towns and cities).

Teaching point 2 — **Explain, Demonstrate and Have the Cadets Use a Planisphere Star Chart**

Time: 10 min — Method: Demonstration and Performance



Instruct the cadets on the use of the specific planisphere star chart according to directions provided with the planisphere.

Note: Directions, for the *Firefly Planisphere: Latitude 42 deg N*, are included and may serve as an example of directions for the type of planisphere used.

Distribute one each, planisphere and red-filtered flashlight, per group of cadets and have the cadets orient their planisphere.

For this skill lesson, it is recommended that instruction take the following format:

(1) Explain and demonstrate the complete skill while cadets observe.

(2) Explain and demonstrate each step required to complete the skill. Monitor cadets as they imitate each step.

(3) Monitor the cadets' performance as they practice the complete skill.

Note: Assistant instructors may be employed to monitor cadet performance.

Elements of the night sky can be identified with the naked eye, star charts, a planisphere star chart, binoculars or a telescope.

Planisphere Star Chart. An analog computer for calculating the position of stars. It has this name because the celestial sphere is represented on a flat plane, such as paper. Since the Earth is constantly in motion, the time

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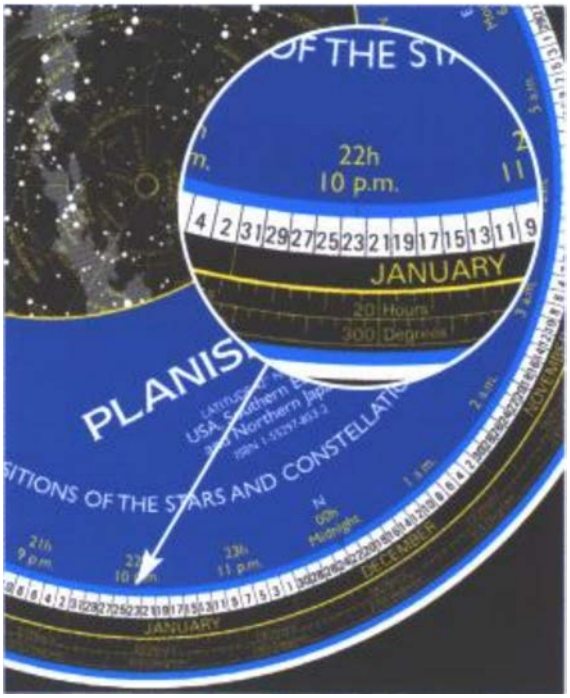
of day, time of year and location influence the appearance of the sky. An individual star chart cannot accurately represent all of these combinations. This would take many different star charts. A preferable method is to use a planisphere star chart which allows the user to twist a dial to show the true position of the stars.

Steps to use the *Firefly Planisphere: Latitude 42 deg N*:

1. Find the date around the outer edge of the disk, and the time of night on the inner, movable wheel. (As illustrated in Figure 18-14-2, the planisphere is set for 10 p.m. (22h) on the evening of January 23.)



R. Scagell, Firefly Planisphere: Latitude 42 deg N, Firefly Books Ltd.

Figure 2 Step 1

Remember to allow for Daylight Savings Time (mid-spring to mid-fall) if it is in effect. This means subtracting one hour from the current time.

2. Hold the planisphere over your head. The oval map shows the entire sky, with the horizon around the edges of the map and the overhead point in the middle (as illustrated in Figure 18-14-3). Rotate the planisphere so that the eastern horizon, western horizon and the ‘N’ by the Midnight marker correspond with the ground.

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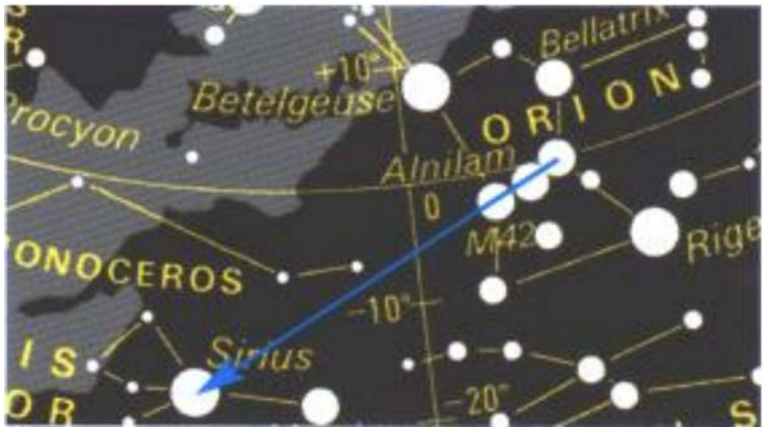
R. Scagell, Firefly Planisphere: Latitude 42 deg N, Firefly Books Ltd.

Figure 3 Step 2

3. Pick out a major constellation by its shape. Remember that the map shows the whole sky, so what looks like a small pattern on the map may cover a large area of the sky. Once one constellation is found, it is used as a guide to locate other constellations. (as illustrated in Figure 18-14-4, the three central stars of Orion, known as Orion's Belt, will be used as a pointer to Sirius in Canis Major. Figure 18-14-5 illustrates a section of the planisphere and a section of night sky with Orion marked and Sirius circled.)



R. Scagell, Firefly Planisphere: Latitude 42 deg N, Firefly Books Ltd.

Figure 4 Step 3 Locating Sirius Using Orion's Belt

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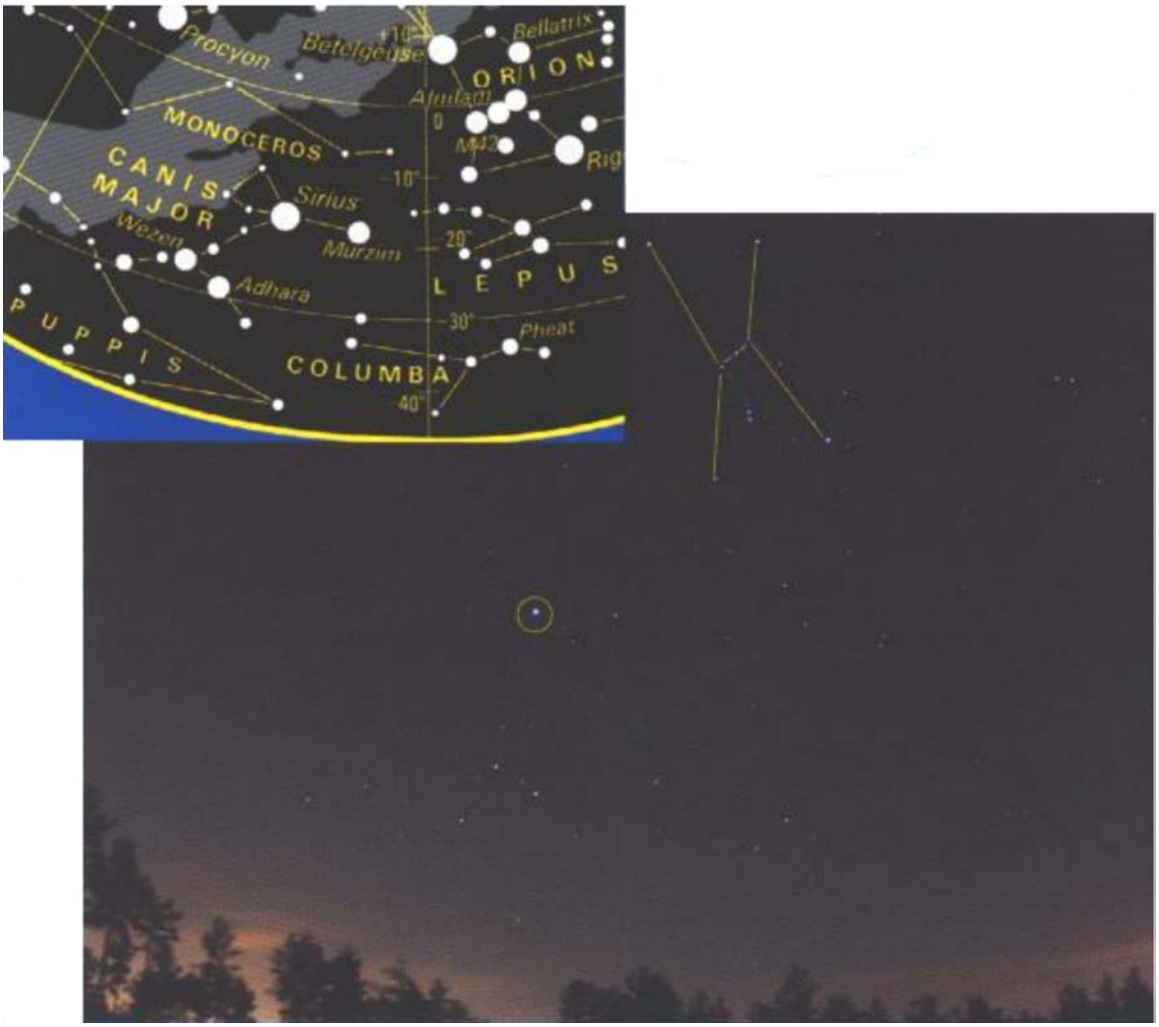

R. Scagell, Firefly Planisphere: Latitude 42 deg N, Firefly Books Ltd.

Figure 5 Step 3 Sirius Located



The above example used Orion as a guide; however, Orion is visible in Canada only from approximately November to April. If Orion is not visible, choose another constellation.

CONFIRMATION OF TEACHING POINT 2

The cadets' participation in using a planisphere will serve as the confirmation of this TP.

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Teaching point 3 **Describe and Have the Cadets Identify Elements of the Night Sky**

Time: 95 min Method: Practical Activity



Depending on viewing opportunities, handouts may be created for the moon and Venus located at Annexes S and T.

MOON

The moon is the brightest object in the night sky. If the moon dominates the night sky making observing other elements of the night sky difficult, the opportunity should be used to observe the moon itself. While it may be a source of light pollution, when the Moon is at least half full, many features may be observed on its surface (see Annex S).

VENUS

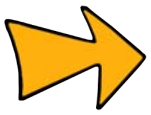
The planet Venus and the Moon are the only natural objects that can be seen while the Sun is in the sky. Venus is normally seen either around dawn or dusk depending on where it is relative to Earth in its orbit (see Annex T).

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 North Star. The star lies in a direct axis above the North Pole and appears to stand almost motionless in the sky. 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 (approximately 0.45 degrees away). After that date it will start to pull away and eventually another star will become the new North Star.

CONSTELLATIONS

Throughout history humanity has gazed upon the stars and created patterns called constellations. These celestial groups are steeped in mythology and, in the case of the signs of the zodiac, embellished with the symbolism of astrology. One of the best known (in Canada) group of stars is known as the Big Dipper, however, it is not a constellation.



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 cross constellations.

Ursa Major

Ursa Major means “Great Bear” in Latin. The seven brightest stars are located in the bear’s hindquarters and tail and form the well known asterism, the 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. Most of Ursa Major is visible year-round in Canada.

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Ursa Minor

Ursa Minor 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. Ursa Minor is visible year-round in Canada.

Cassiopeia

Cassiopeia is a northern constellation which in Greek mythology represented 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. It is visible year-round in Canada.

Orion

Orion is a constellation often referred to as The Hunter. It is one of the largest and most visible constellations in the sky. The constellation consists of seven stars. The three stars that are close together at the centre of the constellation are known as Orion’s Belt. Orion is visible in Canada from approximately November to April.

The Signs of the Zodiac

All of the signs of the zodiac will not be visible at the same time. This is due to the location of the signs around the celestial sphere, which means that several signs will be below the horizon at any one time.

The twelve signs of the zodiac are Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, and Pisces.



See Annex U for more details of the 16 constellations. Use this information to answer questions the cadets may have about these constellations.

ACTIVITY

Time: 85 min

OBJECTIVE

The objective of this activity is to have the cadets identify elements of the night sky.

RESOURCES

- Planisphere star chart, and
- Red-filtered flashlight.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Have the cadets locate the Moon (if visible).
2. Have the cadets locate Venus (if visible, see Annex T).
3. Have the cadets locate Polaris (always visible).

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4. Have the cadets locate Ursa Major (always visible).
5. Have the cadets locate Ursa Minor (always visible).
6. Have the cadets locate Orion (if visible).
7. Have the cadets locate Cassiopeia (always visible).
8. Have the cadets, using a planisphere, locate signs of the zodiac.

SAFETY

The site chosen for observing the night sky should be flat as the cadets will be concentrating on the sky and not where they are stepping.

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' identification of elements of the night sky will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Observing the night sky will allow the cadets to observe the moon, planet, star and constellations. This may assist in overcoming the sixth and seventh enemies of survival: boredom and loneliness.

INSTRUCTOR NOTES/REMARKS

It is recommended this lesson be conducted after EO C340.04 (Describe Elements of the Night Sky, Chapter 15, Section 6).

REFERENCES

C3-179 (ISBN 1-55209-302-6) Dickenson, T. (2006). *Night Watch: A Practical Guide to Viewing the Universe*. Richmond Hill, ON: Firefly Books Ltd.

C3-180 (ISBN 1-55297-853-2) Scagell, R. (2004). *Firefly Planisphere: Latitude 42 Deg N*. Toronto, ON: Firefly Books Ltd.

C3-221 National Research Council of Canada. (2007). *Explore the Night Sky*. Retrieved December 3, 2007, from http://www.nrc-cnrc.gc.ca/eng/education/astronomy/constellations/html.html.

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