ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL THREE

INSTRUCTIONAL GUIDE

SECTION 11

EO C340.10 – IDENTIFY ONLINE STARGAZING PROGRAMS

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.

Visit the SkyView and SKY-MAP.ORG websites and navigate through the various databases presented.

Create slides of Annexes AD and AE.

Photocopy the handout located at Annex AF for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets, generate interest, present background material, and clarify online stargazing.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet should be expected to identify two online stargazing programs.

IMPORTANCE

It is important for cadets to identify online stargazing programs because online stargazing supports amateur astronomy. When weather and background light make outdoor viewing impossible, these programs make stargazing possible.

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Teaching point 1 **Discuss NASA's SkyView**

Time: 5 min Method: Interactive Lecture

NASA'S SKYVIEW

SkyView is a virtual observatory on the Internet, which generates images of any part of the sky.

SkyView takes observations that other astronomers have made and uses them to create an image of the celestial target of interest. The user must specify which survey or surveys to use.

How to Access SkyView



Show the cadets Figure 15AD-1.

1. Type the URL http://skyview.gsfc.nasa.gov/ in the address field on the Internet.

2. On the SkyView home page, select the Non-Astronomers page using a blue button found halfway down the page, on the left side of the screen.



Show the cadets Figure 15AD-2.

3. Choose the SkyView Query Form button. Access an interactive form to select the desired view of the sky. There are, at a minimum, two required parameters:

   a. the celestial coordinates of the sky to be viewed or the object's name, and

   b. the database to be accessed for creating the view.



The celestial coordinate system describes an object's position as right ascension and declination.

Right Ascension. This is comparable to longitude on the earth, but measured in hours, minutes and seconds.

Declination. This is comparable to latitude on the earth, measured in degrees.



The easiest way to determine coordinates is to visit SKY-MAP.ORG; details of which are explained in the next TP. If the desired target is known, put it in the SkyView Query Form.

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Show the cadets Figure 15AD-3.

NGC 4030, a galaxy in the constellation Virgo, was entered as the target in the text box, the image returned is shown in Figure 15AD-3.

The target is the object or area of interest – the name or position of a star, galaxy or nebula, or perhaps the coordinate position of some newly discovered object. Specify the position as a target name, for example, 3C273, M31 or 'Crab Nebula', or by using celestial coordinates.

SkyView cannot be used to look at images of objects in our solar system such as planets, asteroids or comets. SkyView is for deep space only.

SkyView's Non-Astronomers Page



Show the cadets Figure 15AD-4.

With SkyView, one can look at the sky in many different wavelengths of light. This includes the optical light that people see, along with the invisible radio, infrared, X-ray and gamma-ray data. Different kinds of objects show up in these different regimes; that is, the sky looks very different at radio wavelengths than in the optical. The Non-Astronomers page discusses each in turn, working down from the most energetic radiation, gamma-ray, through visible light and down to the radio spectrum.

The table shown in the Non-Astronomers page gives a quick overview of what can be seen in each regime and suggests a survey and image size for each. These suggested sizes are generally quite close to the defaults, which are useful for cadets who have no image size preference.

Databases accessible from SkyView are explained on the Non-Astronomers page, and include:

- EGRET >100 MeV Gamma-ray wavelengths
- PSPC 2Deg-Int X-ray wavelength
- EUVE 83 Extreme Ultraviolet (EUV) wavelength
- DSS Optical wavelength
- 2MASS K, or IRIS 100 Infrared (IR) wavelength
- FIRST or 1420 MHz Radio wavelength



While not all cadets will want to pursue these various databases, those that do will find adequate explanations on the Non-Astronomers page. Cadets should be encouraged to take advantage of NASA's explanations of the databases and how to use them.

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CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is NASA's SkyView?

Q2. Where can more information about operating SkyView be found?

Q3. What two parameters are required to operate SkyView?

ANTICIPATED ANSWERS

A1. SkyView is a virtual observatory on the Internet, which generates images of any part of the sky.

A2. On SkyView's Non-Astronomers page.

A3. The coordinates of the sky to be viewed and the database to be accessed.

Teaching point 2 **Discuss SKY-MAP.ORG**

Time: 5 min Method: Interactive Lecture

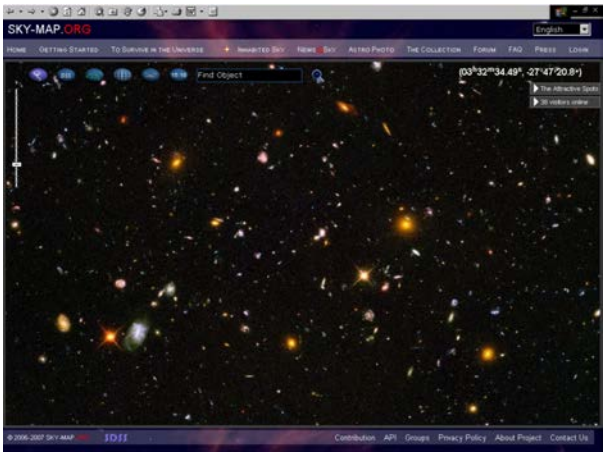
SKY-MAP.ORG

SKY-MAP.ORG is an interactive information-management system, which encompasses the entire universe. The basic element of the system is a detailed map of the sky that depicts more than half a billion celestial objects. Instructions are provided on the display. No additional instructions are necessary to browse the map or change its scale.

By using the smallest scale, the whole sky can be viewed at once. Using the largest scale, tiny areas with distant and extremely dim celestial objects, such as distant galaxies, can be viewed – courtesy of the Hubble Space Telescope (HST).

Purpose

SKY-MAP.ORG, according to its Ontario-based creators, is an attempt to show the beauty of the universe to everybody – to small children and their parents, the amateur astronomer and the professional astrophysicist.



SKY-MAP.ORG, 2008, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 1 The View From the Hubble Space Telescope

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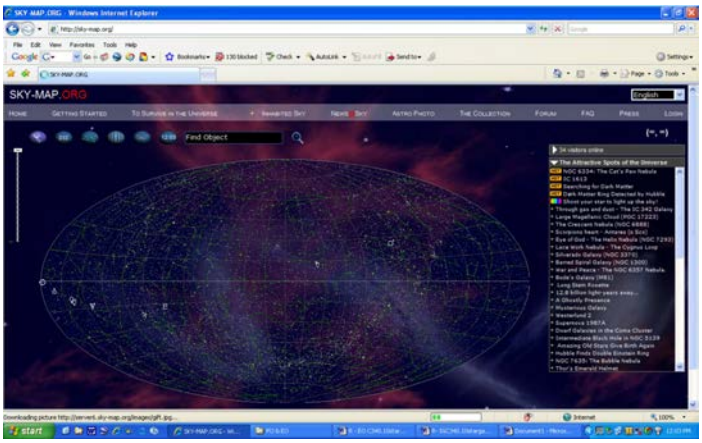


Show the cadets Figure 15AE-1.

How to Access SKY-MAP.ORG

1. Type http://sky-map.org in the address field on the Internet.

2. On the first screen presented, click on the “Home” button above the top of the star-field and the full universe, seen from Earth, will be shown.



SKY-MAP.ORG, 2008, “SKY-MAP.ORG”. Retrieved March 19, 2008, from http://sky-map.org/

Figure 2 SKY-MAP.ORG Home Page



Show the cadets Figure 15AE-2.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is SKY-MAP.ORG?

Q2. Where are operating instructions for SKY-MAP.ORG found?

Q3. Where is SKY-MAP.ORG based?

ANTICIPATED ANSWERS

A1. SKY-MAP.ORG is an interactive information-management system which encompasses the entire outer space.

A2. Instructions are provided on the display.

A3. Ontario.

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Teaching point 3 **Explain the SKY-MAP.ORG User Interface**

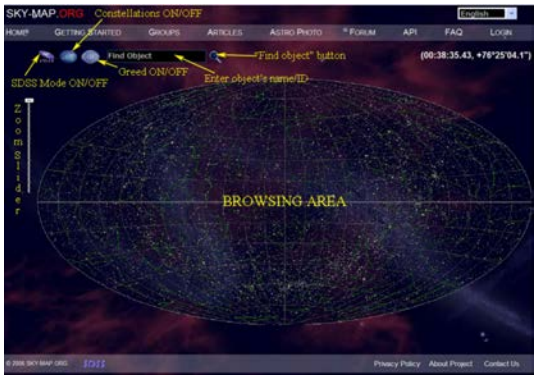
Time: 15 min Method: Interactive Lecture

THE SKY-MAP.ORG USER INTERFACE

When using SKY-MAP.ORG, the browsing area of the screen portrays the selected view of the sky.



Show the cadets Figure 15AE-3.



SKY-MAP.ORG, 2008, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 3 SKY-MAP.ORG Instruction Page

PROGRAM CONTROL FEATURES

Placing the mouse cursor over a button without clicking reveals the purpose of the control button at the top of the browsing area. As the program becomes more sophisticated, new buttons will be added. The basic controls needed to navigate are shown in Figure 15-11-3. The "Home" button returns the program to the home page showing the entire night sky as seen from the Solar system.

SKY-MAP.ORG offers two different browsing modes:

- Normal Mode, and
- Sloan Digital Sky Survey (SDSS) Mode.

Normal Mode



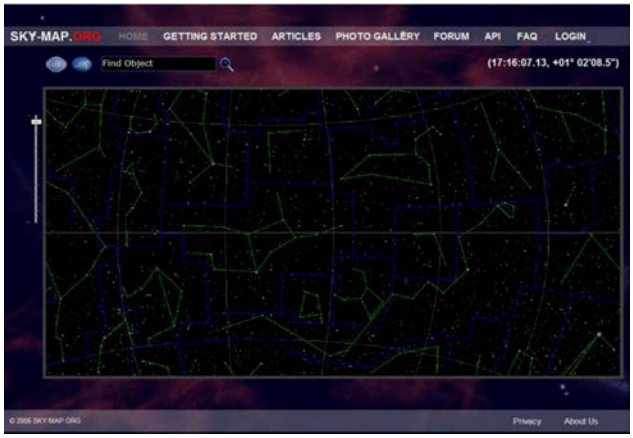
Show the cadets Figure 15AE-4.

The image in this figure shows the sky in Normal Mode. When in Normal Mode, SKY-MAP.ORG can access various databases to display the desired fields of view.

In the example shown, a planar projection of the whole sky is seen. Pointing the mouse at any object inside the browsing area will cause an information window to automatically appear, providing basic scientific data about

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the object. Left-clicking on the zoom slider causes the scale of the sky map to be changed, thereby altering the detail of the browsing area.



SKY-MAP.ORG, 2008, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 4 SKY-MAP.ORG Normal Mode

In this figure, the scale has been changed to a higher magnification so that only a portion of the sky can be viewed. The scale can be enlarged again using the zoom slider, to view very faint objects.

An Object's Basic Information Window (BIW)

If the mouse cursor is close enough to an object (or on an object), its BIW appears, showing the data about the object. The basic data includes ID, names, constellations, exact coordinates, distances from Earth and apparent magnitudes. Left-clicking once while the BIW is still open, causes the object page to open. An object page contains detailed information about its star. In addition an object page displays all photo images where the star is present, articles and all external links about the star.

To view the stars at this moment, use the button provided with the correct time shown. When the button is pushed, the program asks for the user's location. When the user enters the name of the closest town or the latitude and longitude, the star field that is overhead will be presented. This feature only works in Normal Mode, not in SDSS Mode.

SDSS MODE

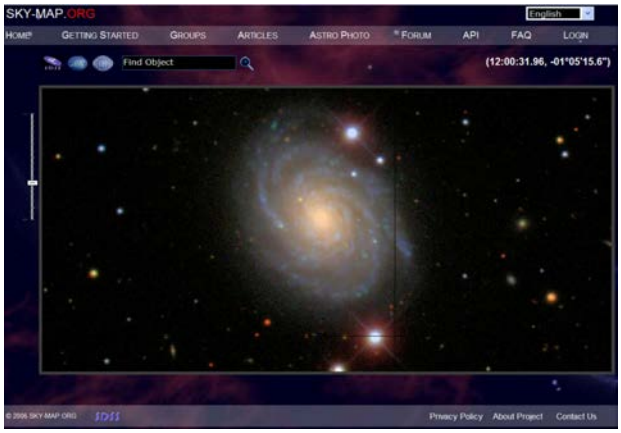


Show the cadets Figure 15AE-5.

This figure shows a view of the browsing area in SDSS mode. In this case, SKY-MAP.ORG has found galaxy NGC 4030 in constellation Virgo. NGC 4030 is at celestial coordinates:

- Right ascension: 12 hours 00 minutes 23.40 seconds
- Declination: -01°06'03.0"

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SKY-MAP.ORG, 2008, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 5 Spiral Galaxy in SDSS Mode

When online, the photographic plate can be found by entering the name NGC 4030 into the "Find Object" text box or by entering the coordinates as right ascension followed by a comma and then declination. If coordinates are entered, however, considerable magnification must be applied to see NGC 4030. At this scale, it is only magnitude 0, appearing as a bright star.



Star brightness is called magnitude. The lower the magnitude, the brighter the object. The brightest star visible in the night sky is Sirius, classified as a magnitude of −1.

Sirius, the brightest star, is found at coordinates 06 45 08.90, -16 42 58.0 in Normal Mode. SDSS does not currently cover this part of the sky, but many astro photos of Sirius can be located through Sirius' BIW.

Navigating in Normal Mode

Normal Mode uses a drag-and-drop operation to shift the sky in the browsing area. To move the browsing area, place the mouse in the browsing area without pointing at any object. Press and hold the left button of the mouse and move the mouse – the star field will move with the mouse cursor.

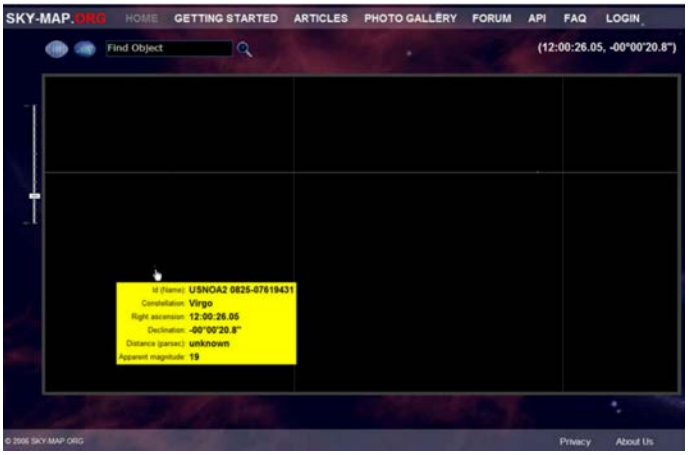
There are about 500 million stars in the databases. Only a small amount of these stars can be displayed simultaneously in the browsing area at any given period of time. Faint celestial objects (the less bright stars) can be viewed by increasing the scale of the map.



Show the cadets Figure 15AE-6.

This figure is a view, at a large scale, corresponding to high magnification, at the right ascension and declination coordinates shown near the top right corner of the screen.

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SKY-MAP.ORG, 2006, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 6 Magnitude 19 in Virgo

In the example there are only two stars present in the browsing area. Both objects have a magnitude close to 19. That means these two stars can only be seen with powerful telescopes.

Photo Gallery

From the main menu, the photo gallery page with photo images can be accessed. The photo gallery index is a view similar to Figure 15AE-7.



SKY-MAP.ORG, 2006, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 7 SKY-MAP.ORG Photo Gallery

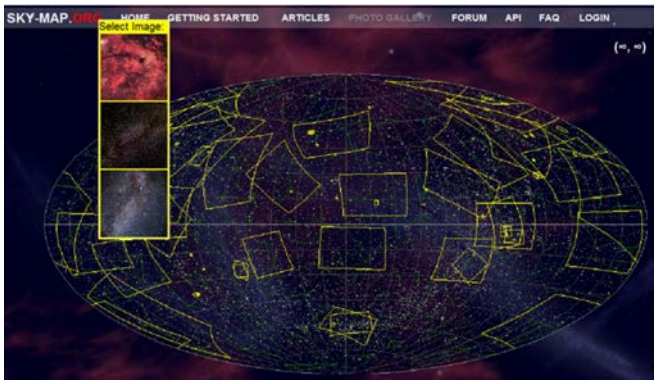


Show the cadets Figure 15AE-7.

Each field with yellow borders determines the boundaries of a star field photograph. When the mouse cursor is inside these boundaries, a minimized version of the photograph appears near the pointer. If the mouse cursor points to the area where fields meet, the photographs of all the fields will be displayed. For example, in this figure, the mouse points to the intersection of three different fields. The user can see the minimized versions of all three images. Left-clicking the mouse will change the mode to "Select Image" as shown in the next figure.

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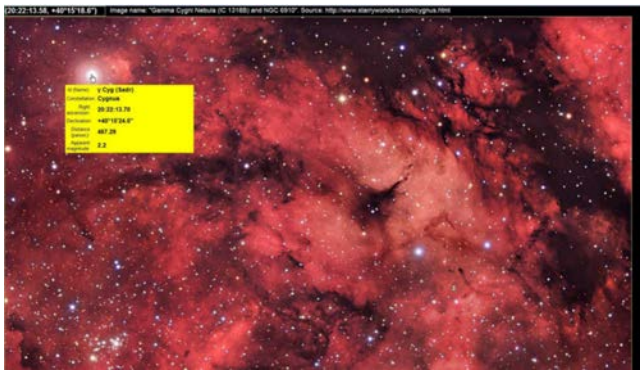
Show the cadets Figure 15AE-8.



SKY-MAP.ORG, 2006, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 8 Image Selection

Clicking on the desired image in Figure 8 will load it as shown in Figure 15-11-9.



SKY-MAP.ORG, 2006, "SKY-MAP.ORG". Retrieved March 19, 2008, from http://sky-map.org/

Figure 9 Gamma Cygni Nebula Image Selected

Show the cadets Figure 15AE-9.

Pointing the mouse on an object on the photograph causes the object's BIW to open exactly the same way as it did in the browsing area. Left-clicking on the object loads the object's page. The current coordinates of the mouse will be shown, with the original source directly above it.

CATALOGUES AND DATABASES AVAILABLE FOR ACCESS

Infrared Astronomical Satellite (IRAS) Sky Survey

The IRAS conducted a survey of 98 percent of the sky from low Earth orbit during a ten-month period from January to November 1983. The purpose of the survey was to produce an extremely reliable catalogue of

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infrared point sources at a sensitivity that was unobtainable from within the Earth's atmosphere. The stability of the orbiting IRAS infrared detectors allowed the viewing of extended, or non-point-like, astronomical sources with the IRAS survey data.

H-ALPHA SKY SURVEY

H-alpha is a particular frequency of radiation associated with hydrogen atoms. Hydrogen is the primary component of celestial nebulae. H-alpha can indicate the shape and size of a gas cloud.

Astro Photo Survey

SKY-MAP.ORG's Astro Photo Survey is a collection of astronomical photos. Credit is usually given at the top of the individual photo so that the user knows where it originated.

Sloan Digital Sky Survey (SDSS)

Simply put, the SDSS is the most ambitious astronomical survey ever undertaken. When completed, it will provide detailed optical images covering more than a quarter of the sky, and a three-dimensional map of about a million galaxies and quasars, which are extremely bright, mysterious objects. As the survey progresses, the data is released to the scientific community and general public in annual increments.

The SDSS uses a dedicated, 2.5-metre telescope on Apache Point, New Mexico, equipped with two powerful special-purpose instruments. The 120-megapixel camera can image 1.5 square degrees of sky at a time, about eight times the area of the full moon. A pair of spectrographs fed by optical fibres measure spectra of (and hence distances to) more than 600 galaxies and quasars in a single observation. A custom-designed set of software data pipelines keeps pace with the enormous data flow from the telescope.

This data, as well as more catalogues and additional databases, will be added from time to time to the list of images that SKY-MAP.ORG can access.



Give each cadet a copy of the Astronomy Basics handout located at Annex AF.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What are the two modes that SKY-MAP.ORG can operate in?

Q2. In the SKY-MAP.ORG Photo Gallery, what marks the boundaries of a star field photograph?

Q3. What can be entered into the "Find Object" text box to select a target object?

ANTICIPATED ANSWERS

A1. Normal Mode and SDSS Mode.

A2. Yellow borders.

A3. The object's name or the object's celestial coordinates.

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END OF LESSON CONFIRMATION

QUESTIONS

Q1. Where is SKY-MAP.ORG based?

Q2. What two parameters are required to operate NASA's SkyView?

Q3. When completed, approximately how much of the sky will be mapped in SDSS Mode?

ANTICIPATED ANSWERS

A1. Ontario.

A2. The coordinates of the sky to be viewed and the database to be accessed.

A3. When completed, it will provide detailed optical images covering more than a quarter of the sky.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Industrialization and the growth of cities has made viewing the sky difficult for the majority of Canadians but online stargazing provides an alternative way to pursue this interesting hobby.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-230 ET.SKY-MAP. (2008). *SKY-MAP.ORG*. Retrieved February 8, 2008, from http://sky-map.org/.

C3-231 NASA HEASARC. (2008). *SkyView*. Retrieved February 8, 2008, from http://skyview.gsfc.nasa.gov/.

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