ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL THREE

INSTRUCTIONAL GUIDE

SECTION 4

EO C340.02 – DISCUSS THE CANADIAN SPACE PROGRAM

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 slides of Annexes M and N.

Photocopy Annex O for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to the Canadian space program and to generate interest.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have discussed the Canadian space program.

IMPORTANCE

It is important for cadets to learn about the Canadian space program so they know that Canada participates in space exploration. The Canadian Space Agency (CSA) and its partners are leading the world in research involving space technologies. This information may also generate interest in the many scientific and technical careers involved in the exploration of space.

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Teaching point 1 **Describe Canada's Involvement in Space Technologies**

Time: 10 min Method: Interactive Lecture



Show slide of Annex M.

CANADA'S INVOLVEMENT IN SPACE TECHNOLOGIES

The CSA headquarters is located at the John H. Chapman Space Centre in Saint-Hubert, Que. Canada is involved in many aspects of space exploration. Canadian scientists and researchers are particularly interested with the development and testing of space technologies.

Canadian Space Agency, 2008, Canadian Space Agency Logo. Retrieved April 14, 2008, from http://upload.wikimedia.org/wikipedia/en/0/01/Canadian_Space_Agency_logo.png

Figure 1 CSA Logo

The David Florida Laboratory (DFL)

The David Florida Laboratory is Canada's world-class spacecraft assembly, integration and testing centre. Named in honour of one of Canada's pioneers in space research, C. David Florida, it is located west of Ottawa, Ont. The laboratory is maintained by the CSA. On a fee-for-service basis, the DFL is available for use by Canadian and foreign aerospace and telecommunication companies and organizations for testing hardware to be used in space. Since its creation in September 1972, DFL has made substantial contributions to satellite communications and remote sensing in Canada and continues to play an essential role in our space program.

The Canadian Analogue Research Network (CARN)

CARN is the organization that uses Canadian sites for field studies. These analogue sites approximate conditions that may exist or have existed on Mars and other planetary bodies such as the moon and the Solar System's icy moons.

They provide a unique opportunity to investigate geological and biological processes and hypothesize about planetary bodies. Analogue sites can be used to develop and test specific technology and to understand how to explore and live on other planets. The following are the first three CARN sites selected in 2005:

- Haughton-Mars Project Research Station, Devon Island, Nunavut, 75° 22' N, 89° 41' W;

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- McGill Artic Research Station, Axel Heiberg Island, Nunavut, 79° 26’ N, 90° 46’ W; and
- Pavilion Lake, B.C., 50° 51’ N, 121° 44’ W.

It is envisioned that CARN will expand in future years with the inclusion of other selected sites.

Partnerships With the CSA

The CSA, formed in 1989, has many partners including international space agencies, industry, post-secondary researchers and educational projects.

One example of the CSA’s partnership with international space agencies is the CSA’s participation in the International Space Station (ISS). These partners include space agencies from Europe, Japan, Russia and the United States. All of these agencies have sent astronauts to the ISS and they each have ground crews and researchers that support each element of the project.

Industrial partners with the CSA include various Canadian technology companies. MD Robotics is one partner best known for developing and building the first Canadarm. MD Robotics is the prime contractor for the Mobile Servicing System, a sophisticated robotic system critical to assembly, maintenance and servicing of the ISS.

Another technology partner is EMS Technologies, Canada, Ltd. They are a leading provider of wireless, satellite and broadband communication products. EMS Technologies hardware has flown on more than 200 spacecraft.

Many partners of the CSA come from academic institutions. Most of these institutions have a space technology research faculty and their students may be granted money from the CSA to conduct their studies. These schools include the University of British Columbia and the University of Toronto.

The CSA takes great pride in their partnership with educational projects. CSA has a Youth Outreach Group which develops and organizes special educational projects for teachers and youth. CSA believes that students in primary and secondary schools are Canada’s next generation of space explorers and researchers. Some of these students are given opportunities to pursue their studies and begin a career in science and technology.



For more information on the CSA and its Youth Outreach Group, access their website at www.space.gc.ca.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Where is DFL located?

Q2. Analogue sites are used to develop what?

Q3. List some CSA international partners.

ANTICIPATED ANSWERS

A1. It is located west of Ottawa, Ont.

A2. Analogue sites can be used to develop and test specific space technology.

A3. Space agencies from Europe, Japan, Russia and the United States.

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Teaching point 2 **Describe CSA Missions**

Time: 15 min Method: Interactive Lecture

CSA MISSIONS

CSA has participated in many space missions with its partners. Canadian astronauts or Canadian technology has gone into space with agencies from the United States, Russia, Europe and Japan. There are four basic types of CSA missions.

Telecommunications

Canada is the second largest country on earth and finding ways to communicate over great distances is a challenge. Telecommunication satellites are the most economical way to connect Canadian communities. Being able to keep all places in the country connected with advanced telecommunication services assists every Canadian in competing in the global marketplace. These telecommunication satellites assist search and rescue teams, provide ships and aircraft with geopositioning information, and connect instructors with classrooms across the country.



Ask cadets to list instances where they have probably used telecommunication satellites (eg, long distance cell phone conversations, satellite TV, etc).

Canada's most famous telecommunication satellites are the ANIK series, which were launched in the 1980s, 1990s and as recently as 2004.

Earth Observation



Ask cadets to list ideas about what satellites are seeing when they look at the earth.

Canada's earth-observation initiatives enhance our understanding of the planet and its environment. By observing the earth from space, essential information about oceans, ice, land environments and the atmosphere is gathered. Earth-observation satellites collect data that assist scientists monitoring and protecting the environment and managing resources. Some earth-observation satellites gather data that is used by the government to ensure the safety and security of Canadians. Satellite imagery and expertise is also used for global humanitarian efforts. Some examples of earth-observation satellites include:

Radarsat-1. Launched in 1995, Radarsat-1 provides the world with an operational radar satellite system capable of the timely delivery of large amounts of data. Radarsat-1 quickly acquires images of the earth day or night, in all weather conditions and through cloud cover, smoke and haze.

Envisat. Launched in 2002, Envisat collects specific data for the scientific community in order to better understand climatic processes. Data is collected on ocean-atmosphere heat exchange, interaction between the atmosphere and land or ice surfaces and the composition of the atmosphere and its associated chemical processes. This data helps scientists improve climate models.

Cloudsat. Launched in 2006, Cloudsat gathers new data and improve our knowledge of clouds and their effect on climate. Traditional satellites studying the atmosphere can portray the cloud surface accurately, but are limited to a two-dimensional representation of cloud cover. No data has been available on cloud thickness

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that would help determine the volume and quantity of water, snow, or ice that clouds contain. Cloudsat was developed by National Aeronautics and Space Administration (NASA) in partnership with the CSA.

Radarsat-2. Launched in 2007, Radarsat-2 is Canada's next generation commercial satellite and offers powerful technical advancements. Radarsat-2 has higher resolution cameras and better discrimination of surface types than Radarsat-1. Radarsat-2 will enhance marine surveillance, ice monitoring, disaster management, environmental monitoring, resource management and mapping in Canada and around the world.

Space Exploration

The CSA is involved with exploring space. Canadian astronauts have been on many missions in various space shuttles and continue to investigate the solar system one small step at a time.



Have the cadets name Canadian astronauts.

Canada is renowned for the exceptional instruments in its science satellites. Some of these satellites collect data that will expand our understanding of the origin, formation, structure and evolution of celestial bodies and the universe.

Another example of the CSA exploring space is the use of Canadian technology in various Martian missions. A Canadian weather station was delivered to an arctic region on Mars in 2008. The instruments measure pressure and temperature, and assess local climate patterns as well as dust, clouds and fog in the lower atmosphere.

Canadians are developing integrated communications networks that will be needed to run a successful international mission on Mars. This will enable Canadians to play a key communications role in future manned exploration to the Red Planet and beyond.

The CSA is supporting a study that focuses on the development of biological air filters for maintaining air quality in a closed system. This research may be used for life support systems and will be crucial for any long duration space exploration missions.

Space Medicine



Show slide of Annex N.

Space medicine combines many medical specialties to examine the effects of spaceflight on humans and prevent problems associated with living in a unique, isolated, and extreme environment like space. The CSA has a medical department called the Operational Space Medicine (OSM) Group. It is responsible for the health and safety of Canadian astronauts. Studies have shown that the longer an astronaut remains in space, the more changes will take place in the body. While in space many of these changes tend not to be problematic. It is on their return to earth where the effects of living in space are felt. Some examples of effects may be reduced blood volume, diminished reflexes, loss of bone mass and radiation-induced health problems. OSM group is studying many of these changes to try to overcome them in order to send astronauts on longer flights.

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Canadian Space Agency, 2008, Operational Space Medicine Logo. Retrieved April 14, 2008, from http://www.space.gc.ca/asc/eng/astronauts/osm_crest.asp

Figure 2 OSM Logo



Ask cadets if they think that space medicine will help people on earth and how that will happen.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. Why are telecommunication satellites so important to the CSA?

Q2. How can earth-observation satellites assist scientists monitoring and protecting the environment and managing resources?

Q3. Name the CSAs medical group.

ANTICIPATED ANSWERS

A1. Telecommunication satellites are the most economical way to connect Canadian communities.

A2. By collecting data.

A3. OSM Group.

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END OF LESSON CONFIRMATION

QUESTIONS

Q1. Where are the three CARN sites in Canada?

Q2. What are the four basic types of missions that CSA participates in?

Q3. Where was a Canadian weather station delivered in 2008?

ANTICIPATED ANSWERS

A1. Devon Island, Nunavut, Axel Heiberg Island, Nunavut, and Pavilion Lake, B.C.

A2. Telecommunications, earth observation, space exploration and space medicine.

A3. To an arctic region on Mars.



Distribute Annex O to each cadet.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Even without any domestic launch capabilities of our own, Canadians have made a large impact on space exploration. There are many scientific and technical careers involved in the exploration of space and the CSA and its partners are leading the world in research involving space technologies.

INSTRUCTOR NOTES/REMARKS

This material must be updated each year to reflect CSA progress.

REFERENCES

C3-238 Canadian Space Agency. (2008). *Canadian Space Agency*. Retrieved February 9, 2008, from http://www.space.gc.ca/asc/eng/default.asp.

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