National Defence / Défense nationale

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO – INSTRUCTIONAL GUIDES

(ENGLISH)

(Supersedes A-CR-CCP-802/PF-001 dated 2015-09-01)

Cette publication est disponible en français sous le numéro A-CR-CCP-802/PF-002.

Issued on Authority of the Chief of the Defence Staff

Canada

National Defence / Défense nationale

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO – INSTRUCTIONAL GUIDES

(ENGLISH)

(Supersedes A-CR-CCP-802/PF-001 dated 2015-09-01)

Cette publication est disponible en français sous le numéro A-CR-CCP-802/PF-002.

Issued on Authority of the Chief of the Defence Staff

OPI: D Cdts & JCR 4 – Cdts & JCR Training **2016-09-13**

Canada

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable orders.

NOTE

On a changed page, the portion of the text affected by the latest change is indicated by a vertical line in the margin of the page. Changes to illustrations by miniature pointing hands, or black vertical lines.

Dates of issue for original and changed pages are:

Original	0	2016-09-13	Change	3
Change	1		Change	4
Change	2		Change	5

Zero in Change No. column indicates an original page. Total number of pages in this publication is 956, consisting of the following:

Page No.	Change No.
Cover page	0
Title	0
A to C	0
i to xviii	0
1-X01-1/2	0
1-X01-1 to 1-X01-2	0
2-X02-1/2	0
2-X02-1 to 2-X02-2	0
3-203-1/2	0
3-M203.01-1 to 3-M203.01-6	0
3-M203.01A-1 to 3-M203.01A-2	0
3-M203.02-1 to 3-M203.02-8	0
3-M203.03-1 to 3-M203.03-8	0
3-M203.04-1 to 3-M203.04-8	0
3-M203.05-1 to 3-M203.05-8	0
3-M203.05A-1 to 3-M203.05A-2	0
3-M203.05B-1 to 3-M203.05B-2	0
3-M203.05C-1 to 3-M203.05C-2	0
3-M203.06-1 to 3-M203.06-6	0
3-M203.06A-1 to 3-M203.06A-2	0
3-M203.07-1 to 3-M203.07-6	0
3-M203.08-1 to 3-M203.08-4	0
3-C203.01-1 to 3-C203.01-4	0
3-C203.01A-1 to 3-C203.01A-4	0
3-C203.02-1 to 3-C203.02-6	0
3-C203.02A-1 to 3-C203.02A-2	0
3-C203.03-1 to 3-C203.03-6	0
3-C203.03A-1 to 3-C203.03A-2	0
3-C203.05-1 to 3-C203.05-6	0
3-C203.06-1 to 3-C203.06-6	0
4-X04-1/2	0
4-X04-1 to 4-X04-2	0
5-X05-1/2	0
5-X05-1 to 5-X05-2	0
6-206-1/2	0
6-M206.01-1 to 6-M206.01-8	0
6-M206.01A-1 to 6-M206.01A-2	0
6-M206.01B-1 to 6-M206.01B-4	0
6-M206.01C-1 to 6-M206.01C-2	0
6-M206.01D-1 to 6-M206.01D-2	0
6-M206.01E-1 to 6-M206.01E-2	0
6-M206.01F-1 to 6-M206.01F-2	0
6-M206.01G-1 to 6-M206.01G-2	0
6-M206.01H-1 to 6-M206.01H-2	0
6-M206.01I-1 to 6-M206.01I-2	0
6-M206.01J-1 to 6-M206.01J-2	0
6-M206.01K-1 to 6-M206.01K-2	0
6-M206.01L-1 to 6-M206.01L-2	0
6-C206.01-1 to 6-C206.01-8	0
6-C206.02-1 to 6-C206.02-8	0
6-C206.03-1 to 6-C206.03-6	0
7-207-1/2	0
7-M207.01-1 to 7-M207.01-12	0
7-M207.01A-1 to 7-M207.01A-6	0
7-M207.01B-1 to 7-M207.01B-4	0
7-M207.01C-1 to 7-M207.01C-4	0
7-M207.01D-1 to 7-M207.01D-2	0
7-M207.02-1 to 7-M207.02-4	0
7-M207.02A-1 to 7-M207.02A-2	0
7-M207.02B-1 to 7-M207.02B-4	0
7-M207.02C-1 to 7-M207.02C-2	0
7-M207.03-1 to 7-M207.03-8	0
7-M207.04-1 to 7-M207.04-8	0
7-C207.01-1 to 7-C207.01-8	0
7-C207.01A-1 to 7-C207.01A-2	0
7-C207.01B-1 to 7-C207.01B-4	0

LIST OF EFFECTIVE PAGES (CONT)

LIST OF EFFECTIVE PAGES (CONT)

Contact Officer: D Cdts & JCR 4-7-4 – Staff Officer Air Cadet Program Development

FOREWORD AND PREFACE

1. **Issuing Authority.** This Instructional Guide (IG) A-CR-CCP-802/PF-001 was developed under the authority of the Director Cadets and Junior Canadian Rangers, and issued on the authority of the Chief of Defence Staff.

2. **Development.** Development of this IG was in accordance with the performance oriented concept of training outlined in the A-P9-050 Series, *Canadian Forces Individual Training and Education System*, with modifications to meet the needs of the Canadian Cadet Organization.

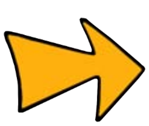
3. **Purpose of the IG.** The IG to be used by Royal Canadian Air Cadet Squadrons in conjunction with other resources to conduct the Proficiency Level Two Program. The IG provides instructors with the base means from which to deliver training. Individual IGs are to be reviewed in conjunction with the Lesson Specifications (LSs) found in Chapter 4 of A-CR-CCP-802/PG-001, *Royal Canadian Air Cadets Proficiency Level Two Qualification Standard and Plan*, before instructing, so that each instructor can adequately plan for and prepare each lesson. Instructors may be required to develop instructional materials to support training in addition to any that may be provided, e.g. posters, videos, handouts, models, etc., supplemental to training control and support documents. Suggested instructional activities are included in most IGs to maximize learning and fun. Instructors are also encouraged to modify and/or enhance the activities, as long as they continue to contribute to enabling objectivity achievement.

4. **Use of the IG.** Throughout these instructional guides, a series of information boxes are used to highlight information; they include:

Note to the Instructor.

Key information to pass along to cadets.

Refer to the following CF regulations and policies.



Points of interest or special instructions the instructor should pass along to cadets.

5. **Suggested Changes.** Suggested changes to this document may be sent directly to cadettraining@canada.ca.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

PAGE

TABLE OF CONTENTS (Cont)

TABLE OF CONTENTS (Cont)

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

LIST OF FIGURES (Cont)

CHAPTER 1

PO X01 – PARTICIPATE IN CITIZENSHIP ACTIVITIES

COMMON TRAINING

ALL TRAINING LEVELS

INSTRUCTIONAL GUIDE

CITIZENSHIP

PO X01 – PARTICIPATE IN CITIZENSHIP ACTIVITIES

Total Time:

For the following EOs, refer to the lesson specifications located in A-CR-CCP-801/PG-001, *Royal Canadian Air Cadets ProficiencyLevel One Qualification Standard and Plan*:

- MX01.01A – Participate in a Citizenship Tour,
- MX01.01B – Attend a Presentation by a Community Organization,
- MX01.01C – Attend a Presentation by a Citizen-of-Interest,
- MX01.01D – Participate in the Canadian Citizenship Challenge,
- MX01.01E – Host a Citizenship Ceremony, and
- CX01.01 – Participate in Citizenship Activities.

For the following EOs, refer to the instructional guides located in A-CR-CCP-801/PF-001, *Royal Canadian Air Cadets Proficiency Level One Instructional Guides*:

- MX01.01F – Participate in an Election,
- MX01.01G – Participate in Heritage Minutes Video Activities, and
- MX01.01H – Participate in Citizenship Learning Stations.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 2

PO X02 – PERFORM COMMUNITY SERVICE

COMMON TRAINING

ALL TRAINING LEVELS

INSTRUCTIONAL GUIDE

COMMUNITY SERVICE

PO X02 – PERFORM COMMUNITY SERVICE

Total Time:

For the following EOs, refer to the instructional guides located in A-CR-CCP-801/PF-001, *Royal Canadian Air Cadets Proficiency Level One Instructional Guides*:

- MX02.01 – Perform Community Service, and
- CX02.01 – Perform Community Service.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 3

PO 203 – DEMONSTRATE LEADERSHIP ATTRIBUTES WITHIN A PEER SETTING

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 1

EO M203.01 – DISCUSS LEADERSHIP WITHIN A PEER SETTING

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-802/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.

The list of responsibilities of Proficiency Level Two cadets will vary for each squadron. Information about the specific responsibilities should be available in the squadron Standing Orders or by speaking to the squadron Commanding Officer/Training Officer.

Photocopy the handout located at Annex A, one for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to leadership within a peer setting, to generate interest and to present basic material.

An in-class activity was chosen for TP2 as an interactive way to provoke thought, stimulate an interest among cadets and present leadership within a peer setting.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to discuss leadership within a peer setting.

IMPORTANCE

It is important for cadets to learn about leadership within a peer setting because there are responsibilities for second year cadets. Being aware of the responsibilities second year cadets perform will assist them in setting achievable goals and adapting to their new role as leaders in the squadron.

Teaching Point 1	**Explain Leadership Within a Peer Setting**
Time: 15 min	Method: Interactive Lecture

Within junior leadership, there are responsibilities for a Proficiency Level Two cadet at the squadron. To make the second year of cadets a fun, challenging and dynamic experience, second year cadets should know their responsibilities.

Have cadets brainstorm a list of what they think the responsibilities of a Proficiency Level Two cadet are. As you teach each of the following points, try to match them to the cadet generated list.

There are some responsibilities common to every Proficiency Level Two cadet in the squadron. They are:

- **Following the Chain of Command.** Following the chain of command ensures that all information that must be passed up and down the chain is delivered. Following the chain of command prevents gaps in the information flow.
- **Setting the Example.** A Proficiency Level Two cadet must set a personal example in dress and deportment. A good leader will never ask more of their followers and teammates than they are willing to give themselves.
- **Being Firm, Fair and Friendly With Everyone, Especially New Recruits.** No one is impressed with a Proficiency Level Two cadet who yells, least of all new cadets. A highly influential and respected Proficiency Level Two cadet is one who is consistent in their approach to people and each situation. Being approachable at all times should enable the cadet to fulfill all duties and responsibilities in an effective manner.
- **Being Respectful to Superiors and Subordinates.** Using a proper tone of voice, looking people in the eyes when they speak and standing up straight is a physical way to show respect. If the Proficiency Level Two cadet wishes to be treated with respect, they must display respect toward others.
- **Being Aware of Safety Hazards.**
- **Displaying Initiative.** Undertaking small matters, like cleaning up, before being told to do so is an example of using initiative. Superiors notice when small tasks are completed without any request to do so.
- **Setting Goals.** Every leader needs to set goals. Goals allow people the opportunity to turn ideas into results. A goal is a glimpse of the future. Setting goals like improving their drill, dress and deportment, gives Proficiency Level Two cadets something to strive for. By setting goals, and working towards them, a Proficiency Level Two cadet will show commitment.

If the squadron has no specific duties for Proficiency Level Two cadets, do not teach the following point.

There are specific responsibilities of a Proficiency Level Two cadet in this squadron.

Explain the squadron specific Proficiency Level Two cadet responsibilities.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. List the responsibilities of Proficiency Level Two cadets in the squadron.

Q2. Why is setting goals important for a Proficiency Level Two cadet?

Q3. List the specific Proficiency Level Two cadet duties and responsibilities for your squadron.

ANTICIPATED ANSWERS

A1. The responsibilities of every Proficiency Level Two cadet in the squadron are:

- following the chain of command;
- setting the example;
- being firm, fair and friendly with everyone, especially new recruits;
- being respectful towards your superiors and subordinates;
- being aware of safety hazards;
- displaying initiative; and
- setting goals.

A2. By setting goals and working towards them, the Proficiency Level Two cadet will show commitment.

A3. Answers will vary.

Teaching Point 2	**Conduct a Goal Mapping Activity**
Time: 10 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets map out personal short-term goals achievable at the squadron and personal long-term goals for the training year.

RESOURCES

- Flip chart paper,
- Markers, and
- Goal mapping template located at Annex A.

ACTIVITY LAYOUT

Divide the class into groups of no more than six cadets.

ACTIVITY INSTRUCTIONS

For this in-class activity, short-term goals are goals that can be achieved within three months, and long-term goals are goals that can be achieved by the end of Proficiency Level Two.

Have cadets, in groups of no more than six, brainstorm, then generate a list on flipchart paper, of personal short-term goals, in order to fulfill their Proficiency Level Two responsibilities, such as:

- improving their uniform;
- improving their drill; and
- attending all parade nights for the next three months, etc.

Record all the cadet generated short-term goals on a whiteboard/flipchart/OHP so cadets may use the examples.

Have cadets, in groups of no more than six, brainstorm, then generate a list on flipchart paper, of personal long-term goals for the training year, such as:

- getting promoted;
- achieving perfect attendance; and
- attending summer training, etc.

Record all the cadet generated long-term goals on a whiteboard/flipchart/OHP so cadets may use the examples.

Distribute the goal recording sheet located at Annex A. Have the cadets write down two short-term and two long-term personal goals and the steps involved in achieving those goals. These goals may be from the generated list, or they may be completely individual.

After the activity is complete, have the cadets hand in their list of goals. Make a copy to file in each cadet's training file. These lists of goals may be used for periodic interviews by Proficiency Level Officers to see if cadets met their goals. The list of goals may also be used at the beginning of the next training year to assist cadets in creating goals for Proficiency Level Three.

Return the original copy of the short-term and long-term goals to the cadet. Encourage cadets to post their personal short-term and long-term goals in a visible place at home, so cadets will be reminded of the goals they have set and whether they are moving towards achieving them.

SAFETY

N/A.

END OF LESSON CONFIRMATION

The cadets' participation in TP1 and TP2 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

In order for a cadet to be successful in the role of a Proficiency Level Two, they must know their responsibilities. By setting personal short and long term goals, cadets have something to work toward and may be more motivated to complete the tasks ahead.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-022 (ISBN 0-02864-207-4) Cole, K. (2002). *The Complete Idiot's Guide to Clear Communication.* Indianapolis, IN: Alpha Books.

C0-134 (ISBN 0-7852-7440-5) Maxwell, J. (1999). *The 21 Indispensable Qualities of a Leader: Becoming the Person Others Will Want to Follow.* Nashville, TN: Thomas Nelson Publishers.

THIS PAGE INTENTIONALLY LEFT BLANK

GOAL MAPPING EXERCISE

SHORT-TERM GOALS

Goal No. 1: ____________________

Steps To Take: ____________________

____

____

____

____

Goal No. 2: ____________________

Steps To Take: ____________________

____

____

____

____

LONG-TERM GOALS

Goal No. 1: ____________________

Steps To Take: ____________________

____

____

____

____

Goal No. 2: ____________________

Steps To Take: ____________________

____

____

____

____

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 2

EO M203.02 – DISCUSS THE PRINCIPLES OF LEADERSHIP

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-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP2 to orient the cadets to the principles of leadership, to generate interest and to present basic material.

A group discussion was chosen for TP3 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about leaders who display positive influence.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to discuss the principles of leadership.

IMPORTANCE

It is important for cadets to learn the principles of leadership because they are fundamentals of leadership theory. As listed in CATO 11-03, *Cadet Program Mandate*, leadership is inherent in the participant outcomes of social competence and it is one of the three aims of the Cadet Program.

Teaching Point 1	**Discuss the Principles of Leadership**
Time: 5 min	Method: Interactive Lecture

Leadership is a demonstrable skill. This means it can be displayed and observed. Leadership can be learned and the skills involved can be improved with practice. Within leadership there are set of principles that may be used to improve leadership ability.

PRINCIPLES OF LEADERSHIP

Leadership is influence.

The ability to influence others is fundamental within the leadership process. Everyone influences someone. People are influenced by those around them on a daily basis: friends, family, teachers, newsmakers, athletes, etc. all influence others. In turn, those same people are influenced.

INFLUENCE CAN BE POSITIVE OR NEGATIVE.

There are many people who use their influence in a positive manner and while doing so help their community, their school, their family, and the world around them. There are some people who use their influence in a negative manner and while doing so do not help anyone including themselves.

LEADERSHIP CAN CREATE OPPORTUNITIES IN LIFE.

Qualities of leadership are learned and practiced, therefore improving your ability to lead may create opportunities in life. Throughout the Cadet Program, cadets may be given many occasions to lead. Success in a leadership role may lead to greater leadership opportunities with bigger challenges, more responsibility, rewards, etc.

Ask cadets what occupations they know of in which leadership skills would be an asset.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Why is leadership a demonstrable skill?

Q2. Name the three principles of leadership discussed during the class.

Q3. Success in a leadership role may lead to what?

ANTICIPATED ANSWERS

A1. Leadership can be displayed and observed by you and by others.

A2. The three principles of leadership discussed are:

- Leadership is influence.
- Influence can be positive or negative.
- Leadership can create opportunities in life.

A3. Success in a leadership role may lead to greater leadership opportunities with bigger challenges, more responsibility, rewards, etc.

Teaching Point 2	**Share a Brief Narrative of Youth Who Have Influenced the Environment or their Community**
Time: 10 min	Method: Interactive Lecture

Choose one of the following four narratives to read to the class.

SIMON JACKSON

When he was seven, Simon Jackson's parents took him from his home in Vancouver, British Columbia to Yellowstone National Park in the United States. Ever since then he has been fascinated with bears. "I came to realize that humans had an option - we had the power to destroy or preserve these magnificent monarchs of the wilderness," says Simon. He set up a lemonade stand in grade two and raised $60 to protect grizzly bears. A few years later Simon heard about Kermode bears. "I have followed a dream to ensure wild bears a wild place for generations to come." Simon Jackson is one of the few people to have seen the white Kermode or Spirit bear. If things go his way, Simon won't be the last. Simon is doing all he can to save these rare bears from becoming extinct. Loggers want to take trees from the ancient rainforest where they live. Simon has been trying to save the bears for years now. Simon speaks at schools to spread the word about the bears. He persuaded 700 kids to write letters asking the BC government to keep logging companies out of the bear's habitat. In 1996, the government received more letters about the Kermode bear than any other preservation issue. Simon also started the Spirit Bear Youth Coalition. "Many people ask me why I chose to campaign for the future of the spirit bear rather than other endangered animals such as the panda or the elephant," Simon explains. "As I saw it, the spirit bear was as unique to the world as the panda bear is to China and lived only in my home province. This bear, I thought, deserved our admiration, respect and most of all, our protection. I knew I had to help." Simon works with naturalist Jane Goodall, scientist David Suzuki, Native Leader Chief Leonard George and artist Robert Bateman. All of them are trying to save the last of about 100 Kermode bears which live around the Terrace area of BC and Princess Royal Island. So far, the support from tens of thousands of people from around the world helped to protect 135 000 hectares from loggers. Simon hopes the Spirit Bear Youth Coalition will be able to protect the remaining 125 000 hectares for the Kermode bears. "It is like ripples in a pond. If I can get through to one person, that person will get to another," he says. "That is how issues are won." Time magazine named Simon Hero of the Planet – one of six young people selected from around the world in their Spring 2000 edition.

CRAIG KIELBURGER

Craig Kielburger was born 17 December 1982 in Thornhill, Ontario, and is an accomplished child rights advocate and leadership specialist, an award-winning author and a popular speaker. He is the founder of Free The Children, the world's largest network of children helping children through education, and the co-founder of Leaders Today, the world's top youth leadership training organization. When Craig was 12, he was shocked to learn about the murder of a child labourer-turned-child rights activist. Eager to take action, he established Free The Children to help free children from poverty, exploitation and powerlessness. The organization began as a small group of classmates and quickly evolved into an international phenomenon. Under Craig's leadership, Free The Children has now changed the lives of more than one million young people around the world. The organization has built more than 450 primary schools, providing daily education to more than 40 000 children. Free The Children's many accomplishments in the areas of education, alternative income, health care, water and sanitation provision and peace building have earned three Nobel Peace Prize nominations and facilitated high profile partnerships with organizations such as the United Nations and Oprah's Angel Network. Convinced of the importance of leadership development in empowering youth, Craig co-founded Leaders Today in 1999. Leaders Today empowers young people through leadership education, providing them with the inspiration and tools to affect positive social change. The organization delivers one-of-a-kind local and international training experiences, reaching more than 350 000 youth every year. Craig has travelled to more than 50 countries, visiting underprivileged children and speaking out in defence of children's rights. An internationally renowned speaker, Craig frequently addresses business groups, government bodies, educators, unions and students. A sought-after speaker, he has shared the podium a number of times with former U.S. president Bill Clinton, as well as with such world renowned leaders as Nelson Mandela, Queen Noor, Archbishop Desmond Tutu and the Dalai Lama. Craig has shown the world that no one is ever too young to make a difference. His work has been featured on The Oprah Winfrey Show, CNN, CBC, BBC, 60 Minutes and profiled in The Economist, Time and People magazines and numerous newspapers.

THE GREENKIDS

GreenKids was established during 1990-1991 school year by the sixth grade students in Lafayette Regional School in rural Franconia, New Hampshire. It started as a part of an integrated subject, Critical Skills L.B.R.P. (Learning By Real Problems). The students knew of an absence of children's environmental projects in New England and they wanted to alleviate the problem of the environment. The first group of students, First Generation GreenKids, brainstormed and came up with a list of goals that they hoped to achieve during the school year. Goals included establishing the group, writing a Book of Issues, For Kids by Kids, having it published, writing quarterly newsletters, promoting recycling and responsible environmental attitudes throughout the area and finally, showing that adults will listen to the opinions of children when their opinions are presented intelligently. These lofty goals might seem impossible for a group of 11 and 12 year olds, but through hard work and empowerment they realized all but one of their goals: that of getting their book published. The First Generation succeeded in producing a quality newsletter, and parts of it were featured in the quarterly newsletter of the New Hampshire Wildlife Federation. They researched, edited, and entered their product into a word processor, developed a group of subscribers, and helped pay for materials. The book was based on environmental issues which they felt were very important. They followed the same processes in publishing the book as they did in creating the newsletter. Their work was high quality. GreenKids also had the opportunity to visit other schools to talk about their experiences and to help start their own activist groups. Letters were written to persons in power to expand recycling. But the year was ending and the completed, illustrated book was not yet published. GreenKids Second Generation decided to make these goals its yearly objective: keep the newsletter going; get the school to recycle; buy trees for all nursery school and Kindergarten through grade 5 students; promote community cleanups; and raise funds to publish the book.

KIDS FOR A CLEAN ENVIRONMENT

In 1989, Melissa Poe, a fourth grader in Nashville, Tennessee, founded a children's environmental club called Kids For A Clean Environment or Kids F.A.C.E. In three years the club had grown from a group of six within her elementary school to a positive, proactive international youth organization with more than 200 000 members. She also wrote for the newsletter she created for her club, which had a worldwide distribution of 2 million. In August 1989, Melissa began an ongoing campaign to encourage children and adults to become involved with the protection of our natural resources. Kids F.A.C.E. started when Melissa wrote a letter to the President of the United States. Dissatisfied with the President's initial response, she decided to take action on her own. In January of 1990, she appeared on NBC's Today show after writing a letter requesting an appearance. In April of 1990, 250 billboards were placed nationwide with her letter to the President. She also began speaking to encourage children to get involved, and she established chapters of Kids F.A.C.E. In May 1990, she wrote a letter to Wal-Mart Corporation asking for help for her club, and in November 1990, Melissa created her club newsletter: Kids F.A.C.E. Illustrated. In October 1991, she drafted the Children's Forest concepts with another organization and prepared and circulated petitions. In September 1992, she launched Kids F.A.C.E. Save-A-Tree project with tree-planting programs. In January 1993, she created the design for International Kid's Earth Flag and began the campaign to get kids to help make the flag. Kids For A Clean Environment is an international children's environmental organization whose purpose is to sponsor educational, community-wide programs in order to further children's involvement in environmental causes; to present information to children concerning the environment and the detrimental effects of pollution and waste on the environment; and to sponsor membership organizations designed to heighten awareness of hazards to the environment and ways of curbing such hazards.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. How do cadets feel about the person or people in the narrative?

Q2. Do cadets feel these leaders were using the principles of leadership discussed in TP1?

Q3. How were these principles used?

ANTICIPATED ANSWERS

A1. Answers will vary.

A2. Answers will vary.

A3. Answers will vary.

Teaching Point 3	**Discuss a Peer Leader Who has Influenced the Environment or the Community in a Positive Way**
Time: 10 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. Describe what types of things could be considered being a positive influence in their community.

Q2. Describe a situation where their peers have used their influence to help the environment or to help their community.

Q3. Describe a situation where they have used their influence to help the environment or to help their community.

Q4. Describe what types of things youth at their age level could do in their community to be a positive influence.

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

END OF LESSON CONFIRMATION

The cadets' participation in the group discussion in TP3 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Throughout the Cadet Program, cadets may be given many occasions to lead. To improve their leadership ability, cadets may incorporate the principles of leadership into their own leadership style. Cadets may learn from the situations discussed that they are never too young to use their influence in a positive manner.

INSTRUCTOR NOTES/REMARKS

Instructors are encouraged to research recent newsworthy articles of youth in the area that have positively influenced the environment or their community, to share as in-class stories.

REFERENCES

A0-010 CATO 11-03 D Cdts 2. (2006). *Cadet Program Mandate.* Ottawa, ON: Department of National Defence.

C0-112 (ISBN 0-8407-6744-7) Maxwell, J. C. (1993). *Developing the Leader Within You.* Nashville, Tennessee: Thomas Nelson Inc. Publishers.

C0-113 (ISBN 1-882664-12-4) Karnes, F. A. & Bean, S. M. (1995). *Leadership for Students: A Practical Guide for Ages 8-18.* Waco, Texas: Prufrock Press.

C0-131 Free The Children. (2007). *Craig Kielburger Biography.* Retrieved 13 March 2007, from http://www.freethechildren.com/aboutus/craigmarc/craigkielburger.htm.

C0-132 Kidz World. (2007). *Teen Protects White Bear.* Retrieved 13 March 2007, from http://www.kidzworld.com/article/1065-teen-protects-white-bear.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 3

EO M203.03 – DISCUSS EFFECTIVE COMMUNICATION IN A PEER SETTING

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-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to effective communication in a peer setting, to generate interest and to present basic material.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall discuss effective communication in a peer setting.

IMPORTANCE

It is important for cadets to learn effective communication in a peer setting to continue to improve their leadership skills. Effectively communicating in a peer setting may improve the leadership skills of cadets because communication is the most basic way to influence others. Effective communication may be used to resolve and/or reduce problems and conflict. By experiencing the benefits of effective communication in a peer setting, cadets may enhance their self-confidence and self-esteem.

Teaching Point 1	Discuss How Communication Is Fundamental to Influencing Others
Time: 10 min	Method: Interactive Lecture

Effective communication is a critical skill for leaders in a peer setting. Communication is the exchange of thoughts, messages and information. It is the process of sharing knowledge, interests, attitudes, opinions, feelings and ideas with others. Through communication one person can influence others. Effective communication may also be used to resolve and/or reduce problems and conflict.

COMMUNICATION IS A SKILL

Like any skill, the ability to communicate with competence must be learned and developed over a lifetime. Communication skills permit the flow of ideas from one individual to another or to a group, and vice versa. The process of communication can include both verbal and non-verbal messages.

NON-VERBAL COMMUNICATION

Non-verbal communication uses many channels for sending and receiving information. Information is received through all our senses (taste, sight, smell, touch and sound). Some aspects of non-verbal communication include:

Eye Contact. Looking directly at another person when speaking is an effective way of indicating sincerity and getting someone's attention.

Body Posture. The weight of the message being sent will be increased when facing the person being spoken to, standing or sitting closer to them and leaning forward. Using correct body posture when listening is also an effective way of indicating interest in the conversation.

Gestures. A message that has a body gesture attached to it takes on added emphasis.

Facial Expressions. When making a statement, make sure facial expressions agree with the message.

Voice Tone, Volume Changes. Shouting may cause people to become defensive, just a whispering may cause people to tune out the message. Make sure voice levels are correct for the space and that statements are convincing without being intimidating.

Being able to read non-verbal responses to communication, while leading in a peer setting, may help cadets understand how they are being perceived.

SENDING, RECEIVING AND RESPONDING TO A MESSAGE

Communication consists of three things: sending, receiving and responding to a message.

The sender must deliver a clear message, taking into consideration the characteristics of the individual(s) receiving the message. Is the person a child or an adult? Is there one person, or are there 20? These and similar factors all determine how the message should be sent.

Next, the message is received. It is important to remember that receivers translate what they have heard based on their own set of definitions, which may differ greatly for those of the sender.

The final component of communication is response. A response lets the sender know the message has been received. All three parts are necessary for effective communication.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Why are communication skills a fundamental part of leadership?

Q2. List some aspects of non-verbal communication.

Q3. Communication consists of three things, name them.

ANTICIPATED ANSWERS

A1. Communication skills are a fundamental part of leadership because they permit the flow of ideas from one individual to another or to a group, and vice versa.

A2. Some aspects of non-verbal communication include:

- eye contact;
- body posture;
- gestures;
- facial expressions; and
- voice tone, volume changes.

A3. Communication consists of three things: sending, receiving and responding to a message.

Teaching Point 2	Explain the Three Styles of Communication
Time: 5 min	Method: Interactive Lecture

THREE STYLES OF COMMUNICATION

Aggressive Communication. A person who is an aggressive communicator puts their own wants and needs ahead of everyone else and they often ignore or belittle other people's concerns.

Aggressive communicators often:

- talk over people and interrupt;
- make sarcastic, demeaning or threatening remarks;
- consider only their own point of view; or
- stand too close, lean over you or in some other way make you feel physically uncomfortable.

Aggressive communication usually leads to hostility, anger and resentment.

Passive Communication. A person who is a passive communicator puts other people's wants and needs ahead of their own and often denies what they want or need.

Passive communicators often:

- hardly ever say what they want or need;
- let others make decisions for them;
- avoid conflict and disagreement at all costs; and

- drop hints rather than directly request that something gets done.

Passive communication usually leads to bad feelings and damages relationships.

Assertive Communication. A person who is an assertive communicator uses skills based on mutual respect. Assertive communicators can say how they see things and hear how others see things. They work towards outcomes that satisfy everyone.

Assertive communicators often:

- are open and honest about what they are thinking and feeling;
- make direct requests if they want something done, leaving the option to say “no”;
- respect themselves and show respect to others; and
- are able to disagree without creating bad feelings.

Assertive communication usually results in clear and open communication.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. Name the three styles of communication.

Q2. What are some characteristics of assertive communicators?

Q3. Assertive communication usually results in what?

ANTICIPATED ANSWERS

A1. The three styles of communication are aggressive, passive and assertive.

A2. Assertive communicators often:

- are open and honest about what they are thinking and feeling;
- makes direct requests if they want something done, leaving the option to say “no”;
- respect themselves and show respect to others; and
- are able to disagree without creating bad feelings.

A3. Assertive communication usually results in clear and open communication.

Teaching Point 3	**Discuss Assertive Communication**
Time: 10 min	Method: Interactive Lecture

Assertive people use a number of important communication skills. They ask questions to gather information and check that they have understood correctly. Assertive people say what is on their mind in a direct yet courteous way so there is no hidden message.

USING “I” STATEMENTS

One of the most important skills that an assertive communicator uses is making “I” statements. Assertive people use “I” language. An assertive communicator uses statements like “I’d like…”, “I’d appreciate…”, “I think….” and “I feel”… etc. They own their own messages and speak for themselves. Their suggestions are not weighted with advice, commands, and “shoulds” or “oughts”. Their feedback is constructive and free from blame.

Non-verbally assertive people:

- make appropriate eye contact;
- sit or stand comfortably erect;
- use open gestures to support their comments;
- speak in a clear, steady, firm tone of voice; and
- maintain open, unchanging and relaxed facial expressions that accurately reflect their thoughts.

ACTIVE LISTENING SKILLS

Assertive people also use active listening skills. These skills include:

- repeating the conversation back to the speaker, in their own words, to understand the speakers meaning;
- not talking about themselves;
- letting the speaker take the lead by encouraging them back to the issue if the speaker digresses;
- concentrating fully on what the speaker is saying;
- asking for clarification if it is needed;
- acknowledging the speaker's feelings; and
- allowing for silence.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Give three examples of "I" statements.

Q2. Give some examples of non-verbal communication used by assertive people.

Q3. Give some examples of active listening skills.

ANTICIPATED ANSWERS

A1. "I'd like…", "I'd appreciate…", "I think…" and "I feel"… etc.

A2. Non-verbally assertive people:

- make appropriate eye contact;
- sit or stand comfortably erect;
- use open gestures to support their comments;
- speak in a clear, steady, firm tone of voice; and
- maintain open, unchanging and relaxed facial expressions that accurately reflect their thoughts.

A3. Active listening skills include:

- repeating the conversation back to the speaker, in their own words, to understand the speakers meaning;
- not talking about themselves;

- letting the speaker take the lead by encouraging them back to the issue if the speaker digresses;
- concentrating fully on what the speaker is saying;
- asking for clarification if it is needed;
- acknowledging the speaker's feelings; and
- allowing for silence.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. Communication consists of three things; name them.

Q2. What are some characteristics of assertive communicators?

Q3. Why do assertive people use "I" statements?

ANTICIPATED ANSWERS

A1. Communication consists of three things: sending, receiving and responding to a message.

A2. Assertive communicators often:

- are open and honest about what they are thinking and feeling;
- makes direct requests if they want something done, leaving the option to say "no";
- respect themselves and show respect to others; and
- are able to disagree without creating bad feelings.

A3. Assertive people use "I" statements because they own their own messages and speak for themselves.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Effective communication is a critical talent for leaders. Effectively communicating in a peer setting may improve the leadership skills of cadets because communication is the most basic way to influence others. Using their influence in a peer setting, cadets may resolve and/or reduce problems and conflict and it may enhance cadets' self-confidence and self-esteem.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-022 (ISBN 0-02864-207-4) Cole, K. (2002). *The Complete Idiots Guide to Clear Communications.* Indianapolis, IN: Pearson Education, Inc.

C0-115 (ISBN 0-7879-4059-3) Van Linden, J. A. & Fertman, C. I. (1998). *Youth Leadership.* San Francisco, California: Jossey-Bass Inc.

C0-144 (ISBN TBA) Colver, E. & Reid, M. (2001). *Peacebuilders 2: Peer Helping.* Ottawa, ON: YouCAN.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 4

EO M203.04 – DEMONSTRATE POSITIVE GROUP DYNAMICS

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

A group discussion was chosen for TP1 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions, and feelings about positive group dynamics.

An interactive lecture was chosen for TP2 to orient the cadets to positive group dynamics, to generate interest and to present basic material.

An in-class activity was chosen for TP3 as an interactive way to provoke thought and stimulate interest among cadets.

INTRODUCTION

REVIEW

The review for this lesson will be from EO M103.03 (Participate in Team-building Activities).

QUESTIONS

Q1. What are the characteristics of a successful team?

Q2. What are the advantages of effective teamwork?

ANTICIPATED ANSWERS

A1. The characteristics of a successful team are:

- clear communication,
- mutual cooperation and support,
- share a common goal, and
- high esprit de corps.

A2. The advantages of effective teamwork are:

- everyone is included ensuring a better outcome;
- tasks are often easier when more people are involved; and
- communication skills are developed.

Write down the characteristics of a successful team and advantages of effective teamwork on a whiteboard/flipchart/OHP.

OBJECTIVES

By the end of this lesson the cadet shall be expected to demonstrate positive group dynamics.

IMPORTANCE

It is important for cadets to learn about positive group dynamics to continue to improve their leadership skills. By experiencing the benefits of working as a supportive and encouraging team member in a peer setting, cadets may enhance their self-confidence and self-esteem.

Teaching Point 1	**Discuss Positive Group Dynamics**
Time: 10 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

According to “Youth Leadership”, as individuals begin to work in groups, they discover that there are patterns of group development; they learn that all groups develop in predictable ways. Information about group development and dynamics dispels myths about groups. One myth many cadets believe is that “nobody feels the way I do.” Feelings of isolation and detachment are common among individuals who enter a new group. As cadets learn more about the tasks necessary for groups to evolve, they discover that there is more to forming a positively functioning group than just bringing people together.

Cadets learn why people have come to the group. Through activities, cadets share what they are feeling and why they are there. As cadets discover how groups operate and as they learn about the kinds of forces that exist within groups, they begin to understand how they fit into their own group.

In order for a peer group or team to perform at its highest level, each member of the team should display positive group dynamics. To demonstrate positive group dynamics, group members should:

- contribute to the group's goal;
- exhibit trust in the group;
- create a safe environment for others to share their opinions;
- follow the leader;
- finish the task;
- display esprit de corps; and
- appreciate others within the group.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. What attributes must a cadet display within the team, to help the team be successful?

Have cadets brainstorm a list of the attributes that enable positive group dynamics. Copy the list on a whiteboard/flipchart/OHP.

Q2. Are there some attributes that contribute more to the success of the team than other attributes? Why or why not?

Q3. Besides cadets, where else would these attributes be advantageous in a peer setting?

> The attributes brainstormed by the cadets may not match the attributes in the background knowledge. Correct cadets during the discussion if the attributes suggested do not match the criteria for positive group dynamics.

> Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

> Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 1

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

Teaching Point 2	**Explain How to Display Positive Group Dynamics**
Time: 25 min	Method: Interactive Lecture

When placed within a peer setting, each cadet should display positive group dynamics.

> After explaining each point below, have cadets give examples of when they have seen the attribute displayed.

To display positive group dynamics, cadets must:

- Contribute to group discussions by providing input. This means contributing to every discussion. Even if a cadet has no new or original ideas, agree or disagree with other member's suggestions. Ask questions. Offer support and volunteer to take on extra assignments.
- Be motivated. Be enthusiastic and ensure the best effort each time when working in a team setting.
- Participate in establishing the team's goals. Cadets will have to work to meet the team's goals, so cadets should have a say in determining them. Ensure group goals are consistent with the aims of the cadet organization.
- Try new things. Do not be afraid to take risks. Trying new things shows courage, and courage is a leadership quality. Remember the turtle: it is perfectly safe when it stays in its shell, but to move ahead, the turtle must stick its neck and feet out.
- Be sensitive to other points of view. Listen to the opinions of other team members. Do not be afraid to express your view even if it is different or even the opposite of everybody else's. Deal respectfully with teammates who disagree. Be willing to compromise to achieve a consensus.

- Know teammates' strengths and weaknesses. If members know their teammates' talents and limitations, it enables the team to use all its personnel to its best advantage. Being aware of teammates individual habits may make working with them easier.
- Increase self-confidence through positive self-talk. Focusing on one's positive characteristics leads to increased self-confidence. To feel better about yourself, concentrate on the things done well and compliment yourself on those things. This is not always easy.
- Be cooperative. Be polite, be a team player, and support your teammates. Help them by distributing work evenly and by sharing information; do not compete.
- Resolve conflicts as quickly as possible at the lowest and most appropriate level. As mentioned in the CHAP program, if teammates have a conflict, find a solution. Do not let problems fester and do not hold a grudge. Once conflicts are resolved, let them go.
- Celebrate successes. When the team completes a task or completes a goal, share in the enjoyment. Have a quick team meeting and compliment all team members on a job well done. Praise team members in front of others. Show appreciation to teammates who have been especially helpful. Everyone likes to be congratulated. This may lead to increased feelings of enthusiasm and self-confidence by members of the team.

> Compare the list of attitubutes developed during the group discussion with the attributes taught in TP2.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. How can cadets contribute to group discussions?

Q2. Why should cadets not be afraid to try new things within a team setting?

Q3. Why should successes be celebrated?

ANTICIPATED ANSWERS

A1. Cadets can contribute to group discussions by providing input. This means contributing to every discussion.

A2. Trying new things shows initiative, and initiative is a leadership quality.

A3. Successes should be celebrated because everyone likes to be congratulated. This may lead to increased feelings of enthusiasm and self-confidence by members of the team.

Teaching Point 3 — **Demonstrate Positive Group Dynamics**

Time: 15 min — Method: In-Class Activity

> It is very difficult to find an activity that will display all the aspects of positive group dynamics at once. This activity was chosen to give cadets the opportunity to be sensitive to other points of view, to listen without interrupting, to learn their teammates' strengths and weaknesses and to increase their self-confidence through positive self-talk.

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets demonstrate positive group dynamics within a peer setting to build mutual support and trust.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Remind cadets that the ability to build mutual trust is based on being able to communicate openly with members of the team.

1. Ask the cadets to find a partner, preferably someone they do not know well, or someone they would like to know better.
2. Have the cadets sit facing each other.
3. Have the cadets decide who will go first. Tell them to make eye contact with one another and get comfortable. Cadets must maintain an open body posture (no crossing of the arms or legs and no slouching). Cadets must tell their partners “What I like about myself.” Cadets must speak for two minutes.
4. The passive partner cannot say a word, but through body language, (head nodding, leaning forward, smiling, etc.) must express a keen interest in what is being said.
5. At the end of two minutes, have the cadets switch roles and repeat the speaking/listening exercise.
6. Have cadets switch back to their original positions. Tell them to make eye contact with one another and get comfortable. Cadets must maintain an open body posture (no crossing of the arms or legs and no slouching). Have the first cadet speak about “What I don’t like about myself”. Cadets must speak for one minute.
7. The passive partner cannot say a word, but through body language, (head nodding, leaning forward, smiling, etc.) must express a keen interest in what is being said.
8. At the end of one minute, have cadets switch roles and repeat the speaking/listening exercise.
9. After everyone is finished speaking/listening, conduct a short de-brief with the cadets to include the following questions:
   - Was it difficult to remain passive, silent and interested?
   - Was it easier to listen to another cadet speaking about their strengths or their weaknesses? Why?
   - Was it easier to speak about their own strengths or their own weaknesses? Why?
   - Did having the listener show interest through body language help them be more open with their remarks? Why?

SAFETY

N/A.

Ensure cadets understand that this activity was chosen to give them an opportunity to demonstrate positive group dynamics by being sensitive to other points of view, listening without interrupting, learning your teammates' strengths and weaknesses and increasing their self-confidence through positive self-talk.

END OF LESSON CONFIRMATION

The cadets' participation in the activity in TP3 will serve as confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important to demonstrate positive group dynamics by being a supportive and encouraging team member within a peer setting. As a full participant in team activities, cadets may enjoy their tasks more and they may make more effective contributions to the team's success. This may assist in building the cadet's self-confidence and self-esteem and may improve their basic leadership skills.

INSTRUCTOR NOTES/REMARKS

The instructor shall provide a safe learning and team-building environment in which the cadets will display and demonstrate positive group dynamics.

REFERENCES

C0-028 (ISBN 0-07-046513-4) Newstrom, J. & Scannell, E. (1998). *The Big Book of Team Building Games.* USA: McGraw-Hill Companies.

C0-114 (ISBN 0-02-863656-2) Pell, A. R. (1999). *The Complete Idiot's Guide to Team Building.* USA: Alpha Books.

C0-115 (ISBN 0-7879-4059-3) Van Linden, J. A. & Fertman, C. I. (1998). *Youth Leadership.* San Francisco, California: Jossey-Bass Inc.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 5

EO M203.05 – DISCUSS INFLUENCE BEHAVIOURS

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-802/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.

Make six copies of the handouts located at Annexes A, B and C for the activities in TP1 to TP3.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 to TP3 as an interactive way to provoke thought and stimulate an interest among cadets.

A group discussion was chosen for TP4 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about influence behaviours.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to discuss influence behaviours.

IMPORTANCE

It is important for cadets to acknowledge the influence they have in a peer setting. Learning influence behaviours may enable cadets to choose the correct influence behaviour for the situation to successfully accomplish tasks in a peer setting.

Teaching Point 1	**Perform in a Skit to Portray Directive Behaviour**
Time: 5 min	Method: In-Class Activity

The earliest studies of leadership commonly referred to influence behaviours as leadership styles or approaches. The three influence behaviours listed below are chosen from a spectrum of eight influence behaviours.

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets perform in a skit to portray directive behaviour and to recognize its use.

RESOURCES

Skit located at Annex A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Have cadets volunteer to perform in the skit.
2. Distribute the scripts to the cadets who volunteered.
3. Have cadets perform the skit.
4. Ask cadets to brainstorm a list of traits they noticed about Cadet Purple in this skit.
5. Copy the list on a whiteboard/flipchart/OHP.
6. Have cadets return the scripts.

Upon completion of the brainstorming conclude by summarizing directive behaviour before moving on to the next TP.

DIRECTIVE BEHAVIOUR

Generally, directive behaviour involves telling teammates what they are to do, and possibly, when, how and to what standard they are to accomplish the task. Directive behaviour may be expressed as a simple request, a formal order or something in between. Directive behaviour is appropriate when passing on and executing a superior's objective, when assigning and co-ordinating tasks and when teammates lack information or experience and need guidance.

Directive behaviour is used most often in emergency situations where time, safety, and control of personnel are factors. Another example is drill. Drill is normally conducted using directive behaviour.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What does directive behaviour involve?

Q2. When is directive behaviour appropriate?

Q3. Where is directive behaviour used most often?

ANTICIPATED ANSWERS

A1. Directive behaviour involves telling teammates what they are to do, and possibly, when, how and to what standard.

A2. Directive behaviour is appropriate when passing on and executing a superior's objective, when assigning and co-ordinating tasks and when teammates lack information or experience and need guidance.

A3. Directive behaviour is used most often in emergency situations where time, safety, and control of personnel are factors.

Teaching Point 2	**Perform in a Skit to Portray Persuasive Behaviour**
Time: 5 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets perform in a skit to portray persuasive behaviour and to recognize its use.

RESOURCES

Skit located at Annex B.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Have cadets volunteer to perform in the skit.
2. Distribute the scripts to the cadets who volunteered.
3. Have cadets perform the skit.
4. Ask cadets to brainstorm a list of traits they noticed about Cadet Purple in this skit.
5. Copy the list on a whiteboard/flipchart/OHP.
6. Have cadets return the scripts.

Upon completion of the brainstorming conclude by summarizing persuasive behaviour before moving on to the next TP.

PERSUASIVE BEHAVIOUR

Generally, persuasive behaviour is intended to influence decision-making and motivation. This is accomplished by explaining to, or convincing others why a certain course of action is necessary. Persuasive behaviour may involve rational argument based on facts, reason and logic and/or inspirational appeals which motivate others. This behaviour may allow teammates to understand the potential benefits to them created by the course of action and should aid teammates in their commitment to the task. Persuasive behaviour is appropriate to secure agreement or commitment and when particularly high or sustained levels of effort are required to accomplish a task.

There are many situations when persuasive behaviour is used. These may include problem-solving, counselling, teaching, etc. Persuasive behaviour is usually effective in a peer setting if all teammates display positive group dynamics.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. When is persuasive behaviour used?

Q2. What are the potential benefits of the persuasive behaviour?

Q3. Name three situations where persuasive behaviour may be used?

ANTICIPATED ANSWERS

A1. Persuasive behaviour is used to influence decision-making and motivate others.

A2. Persuasive behaviour may allow teammates to understand the potential benefits to them created by the course of action and should aid teammates in their commitment to the task.

A3. Persuasive behaviour may be used when problem-solving, counselling, teaching, etc.

Teaching Point 3	**Perform in a Skit to Portray Participative Behaviour**
Time: 5 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets perform in a skit to portray participative behaviour and to recognize its use.

RESOURCES

Skit found at Annex C.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Have cadets volunteer to perform in the skit.
2. Distribute the scripts to the cadets who volunteered.
3. Have cadets perform the skit.
4. Ask cadets to brainstorm a list of traits they noticed about Cadet Purple in this skit.
5. Copy the list on a whiteboard/flipchart/OHP.
6. Have cadets return the scripts.

Upon completion of the brainstorming conclude by summarizing participative behaviour before moving on to the next TP.

PARTICIPATIVE BEHAVIOUR

Generally, participative behaviour involves sharing decision-making with others. The primary objective is to improve the quality and/or acceptance of decisions. Participative behaviours employ two basic methods – individual or group consultations and joint decision-making. Obtaining advice, opinions and recommendations from others before sharing decision-making is essential. Sometimes teammates possess critical information or expertise and that knowledge may make the difference between success or failure of the task. The use of the participative behaviour depends on the availability of time to involve others. Teammates expect to be consulted on and have a voice in decisions that affect them.

There are many situations when participative behaviour is used including problem-solving, participating in team-building activities, resolving conflict in a peer setting, etc. Participative behaviour is usually effective in a peer setting because all teammates have a part to play in making the decision.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What does participative behaviour involve?

Q2. What are the two basic methods of employing persuasive behaviours?

Q3. Name three situations where participative behaviour may be used.

ANTICIPATED ANSWERS

A1. Participative behaviour involves sharing decision-making with others.

A2. Participative behaviours employ two basic methods – individual or group consultations and joint decision-making.

A3. Participative behaviour may be used during problem solving, participating in team-building activities, resolving conflict in a peer setting, etc.

Teaching Point 4	**Discuss Situations in Which Cadets May Employ the Various Influence Behaviours in Peer Group Settings**
Time: 10 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

Different influence behaviours will be used during different situations. A good leader may use a combination of behaviours based on the situation, the experience of the followers, the time to get a task done, etc. Each of the influence behaviours has its place and can be used effectively under the correct conditions.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer.
- Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. When is directive behaviour most effective at cadets or at school?

Q2. When is persuasive behaviour most effective at cadets or at school?

Q3. When is participative behaviour most effective at cadets or at school?

Q4. What are the differences between persuasive and participative behaviours?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 4

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

END OF LESSON CONFIRMATION

The cadets' participation in the activities in TP1 to TP3 and the group discussion in TP4 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Through the Cadet Program there may be many opportunities for cadets to influence their peers. Choosing the correct influence behaviour for a situation may assist them in accomplishing tasks in a peer setting.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-047 A-PA-005-000/AP-004 DND. (2005). *Leadership in the Canadian Forces: Conceptual Foundations.* Ottawa, ON: Department of National Defence.

A0-048 A-PA-005-000/AP-003 DND. (2005). *Leadership in the Canadian Forces: Doctrine.* Ottawa, ON: Department of National Defence.

C0-113 (ISBN 1-882664-12-4) Karnes, F. A. & Bean, S. M. (1995). *Leadership for Students: A Practical Guide for Ages 8-18.* Waco, Texas: Prufrock Press.

C0-115 (ISBN 0-7879-4059-3) Van Linden, J. A. & Fertman, C. I. (1998). *Youth Leadership.* San Francisco, California: Jossey-Bass Inc.

SKIT FOR DIRECTIVE BEHAVIOUR

(**Setting:** Six first year cadets at a CSTC are getting ready for a barrack inspection to take place in one hour.)

Cadet Red: Okay we have a barrack inspection in an hour, we better get ready.

Cadet Orange: Do we have a uniform inspection at the same time or is it just the room?

Cadet Red: I don't know. Does anyone else?

Cadet Purple: Yes, I know, I asked the staff cadet. We're having a room and uniform inspection at the same time. We're supposed to wear our T-shirts, cadet trousers and parade boots.

Cadet Grey: Man, that's a lot of stuff in just an hour.

Cadet Yellow: No kidding.

Cadet Pink: I don't think I'll be ready.

Cadet Purple: We need to get stuff done fast, so here's what should happen. You two, Cadet Red and Cadet Orange will make the beds and sweep the room. That takes care of the room.

Cadet Grey: What about our uniforms?

Cadet Purple: You, Cadet Grey, take everyone's T-shirts and iron them.

Cadet Yellow: And trousers and boots?

Cadet Purple: You, Cadet Yellow, take everyone's trousers and iron them and Cadet Pink and I will do everyone's boots.

Cadet Red: That didn't take long to come up with a plan. I hope we get everything done.

Cadet Purple: We will, if everyone does their job and right now.

Cadet Red: I'm not great at making beds but I'll do what I'm told.

Cadet Orange: I'm okay at beds, we'll do fine.

Cadet Purple: Okay everyone give your T-shirt to Cadet Grey, your trousers to Cadet Yellow and give me your boots. Everyone, listen up: we a have a lot to do and not a lot of time… so get at it. Be back here in 40 minutes.

Cadet Pink: I'll get my polishing kit.

(ALL CADETS PRETEND TO DELIVER REQUIRED ITEMS TO THE CADET WHO HAS BEEN TASKED.)

(40 MINUTES PASS.)

(ALL CADETS RETURN TO THE ROOM.)

Cadet Red: As everyone can see, the beds are done and the room is swept.

Cadet Orange: The beds aren't great, but they'll pass inspection.

Cadet Purple: How did the ironing go?

Cadet Grey: Here are the T-shirts ready to go. I've never ironed that many in such a short time. I hope they pass the inspection.

Cadet Yellow: All the trousers have the right creases and I don't see any railroad tracks.

Cadet Pink: And we finished everyone's boots.

Cadet Purple: Let's get into our uniforms right now because we're running out of time.

(EVERYONE GETS READY FOR THE INSPECTION.)

Cadet Purple: We look okay. I'm pretty sure we will pass the inspection. Okay everyone stand at attention by your bed, because here comes the staff cadet.

SKIT FOR THE PERSUASIVE BEHAVIOUR

(**Setting:** Six second year cadets at CSTC getting ready for a barrack inspection to take place in one hour.)

Cadet Red: Okay we have a barrack inspection in an hour, we had better get ready.

Cadet Orange: Do we have a uniform inspection at the same time or is it just the room?

Cadet Purple: I asked the staff cadet. We're having a room and uniform inspection at the same time. We're supposed to wear our T-shirts, cadet trousers and parade boots.

Cadet Grey: Man, that's a lot of stuff in just an hour.

Cadet Yellow: No kidding.

Cadet Pink: I don't think I'll be ready.

Cadet Purple: We can be ready, we just need a plan. We need to get beds made, the room swept, T-shirts and trousers ironed and boots done.

Cadet Grey: That's a lot.

Cadet Purple: I have an idea to be able to everything done on time. Would you guys like to hear it?

(EVERYONE NODS IN AGREEMENT.)

Cadet Purple: I think we should divide the work that way we will be able to get things done fast. And if we get people to volunteer to do what they're good at… that should help too. Does that plan make sense to everyone?

(EVERYONE NODS IN AGREEMENT.)

Cadet Purple: I know if we work as a team, we can get everything finished on time and we will look great for the inspection. Okay, so which of us likes making beds?

Cadet Pink: I do. I want to make beds.

Cadet Purple: Anyone else?

Cadet Red: Not me, I like ironing T-shirts, I'll do that.

Cadet Purple: That sounds good. Anyone else want to volunteer?

Cadet Yellow: I like to polish boots. That's what I'll do.

Cadet Orange: Me too. I'll help Cadet Yellow.

Cadet Grey: I don't mind ironing. I'll press everyone's trousers.

Cadet Purple: That leaves me to help with making beds and sweeping the room. Now that everyone has a task, we need to give out our T-shirts, trousers and boots.

(ALL CADETS PRETEND TO DELIVER REQUIRED ITEMS TO THE CADET WHO HAS BEEN TASKED.)

Cadet Red: How long does everyone think this will take?

Cadet Purple: I think it should take about 40 minutes. Does that sound right?

(EVERYONE NODS IN AGREEMENT.)

Cadet Purple: Can everyone be back in 40 minutes?

Cadet Orange: No problem. Let's all be back in 40 minutes.

(EVERYONE NODS IN AGREEMENT.)

(40 MINUTES PASS.)

(ALL CADETS RETURN TO THE ROOM.)

Cadet Purple: As you can see the beds look really good. Thanks Cadet Pink. How did everyone else do?

Cadet Red: T-shirts are finished and look good.

Cadet Yellow: Boots are polished and very shiny. Thanks Cadet Orange.

Cadet Orange: Thanks, we make a good team.

Cadet Grey: Trousers are done too and if I do say so…they look good.

Cadet Purple: I think it's time to get into our uniforms 'cause I believe we're running out of time.

(EVERYONE GETS READY FOR THE INSPECTION.)

Cadet Purple: We look awesome, I know we will pass the inspection. Okay everyone, please stand at attention by your bed, because here comes the staff cadet.

SKIT FOR THE PARTICIPATIVE BEHAVIOUR

(**Setting:** Six senior cadets at CSTC getting ready for a barrack inspection to take place in one hour.)

Cadet Red: Okay we have a barrack inspection in an hour, we had better get ready.

Cadet Orange: Do we have a uniform inspection at the same time or is it just the room?

Cadet Purple: I asked the staff cadet. We're having a room and uniform inspection at the same time. We're supposed to wear our T-shirts, cadet trousers and parade boots.

Cadet Grey: Man, that's a lot of stuff in just an hour.

Cadet Yellow: It's not like we haven't done this before. We'll be okay.

Cadet Grey: We just need to get organized.

Cadet Purple: Let's make a plan. Any ideas?

Cadet Yellow: I know we are going to have to divide up the work, but how?

Cadet Red: What if we pick our jobs from a hat? That could work.

Cadet Grey: How about just doing what we want to do?

Cadet Yellow: I thought, maybe, we could do what we're good at.

Cadet Purple: I really like that idea.

Cadet Orange: Me too, I like doing what I'm good at.

Cadet Red: Okay, sounds good.

Cadet Pink: I'm on board.

Cadet Grey: Besides if we do what we're good at, everything should take less time.

Cadet Purple: Okay so who's good at what?

Cadet Pink: I'm really good at ironing T-shirts.

Cadet Purple: Okay, that's your job and the team is expecting good things.

Cadet Red: My speciality is polishing boots. That should be my task.

Cadet Purple: That's your assignment then. Go ahead.

Cadet Yellow: I am an expert boot polisher. I'll assist Cadet Red.

Cadet Orange: I make the best beds. I should do that.

Cadet Grey: I'm good at making beds too and I'll sweep the floor.

Cadet Purple: Go to it, both of you. I iron trousers very well. That's what I'll do, and I'll stay out of everyone else's business. Okay let's get at it.

(EVERYONE NODS IN AGREEMENT.)

Cadet Red: How long does everyone think this will take?

Cadet Grey: About 40 minutes?

Cadet Orange: Sound goods. Be back in 40 minutes then.

(ALL CADETS PRETEND TO DELIVER REQUIRED ITEMS TO THE CADET WHO HAS BEEN TASKED.)

(40 MINUTES PASS.)

(ALL CADETS RETURN TO THE ROOM.)

Cadet Purple: Wow, this room looks really good. Excellent job, Cadet Orange and Cadet Grey. How did everyone else do?

Cadet Pink: T-shirts are finished and look awesome.

Cadet Yellow: Boots are polished and very shiny. Thanks Cadet Red.

Cadet Red: Thanks, we make a good team.

Cadet Purple: Trousers are done too and if I do say so…they look really good. I think it's time to get into our uniforms because I believe we're running out of time.

(EVERYONE GETS READY FOR THE INSPECTION.)

Cadet Purple: We look excellent, I know this team will pass the inspection. Okay everyone, please stand at attention by your bed, because here comes the staff cadet.

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 6

EO M203.06 – EMPLOY PROBLEM SOLVING

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Copy handouts located at Annex A for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to problem solving.

An in-class activity was chosen for TP2 as an interactive way to provoke thought, stimulate an interest among cadets and present problem solving.

A group discussion was chosen for TP3 as it allows the cadets to interact with their peers and share their knowledge, experiences, and opinions about problem solving.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall employ problem solving.

IMPORTANCE

One of the qualities of leadership is problem solving. As cadets become leaders within a peer setting they will use this quality more often. By having some tools to solve problems cadets may have an easier time to resolve them.

Teaching Point 1	**Explain Problem Solving**
Time: 20 min	Method: Interactive Lecture

A Problem. This is a doubtful or difficult matter requiring a solution.

Proficiency Level Two cadets deal with varying problems daily. We all possess a natural ability to solve dilemmas that may take little effort or planning such as trying to decide with our friends what to do on a Saturday night or getting up to go to school. However, when faced with more complex matters like working with a group on a cadet or school project or finding more than one solution to a problem, a more efficient methodology than trial and error analysis may be required.

Trial and Error Analysis. This method used to solve problems if there is a great deal of time available and the possible outcomes are not serious.

A PROBLEM-SOLVING PROCESS

Logical Analysis. One of the processes to solve problems is logical analysis, if there is sufficient time available for consideration of all the options. Logical analysis helps reduce a complex thought process into a simple format. However, some problems are very simple so all the steps in the process may not be used. If the team follows these steps, they should be able to create a plan to implement a solution.

When a task is assigned to cadets in a peer setting, the cadets should follow all the steps in the logical analysis process. If a problem develops that cadets within a peer setting must solve, without being directed to do so, the cadets should begin the logical analysis at step 2.

STEPS IN LOGICAL ANALYSIS:

1. **Confirm the Task.** By understanding both the problem and the aim or intent of the person assigning the task, the team has the freedom to act within their initiative to lead the team to success, especially when factors or plans change.
2. **Identify the Problem(s).** Once a problem is understood, the team must consider the problem or challenges that may occur in the implementation. This usually requires breaking the problem down into its component parts ("do this, then this, then this…").
3. **Determine the "Critical Factor".** There is usually one overriding problem in which all other issues will depend. This is called the CRITICAL FACTOR. Once identified, a plan to solve the problem can be formed around solving the critical factor.
4. **Develop Alternate Solutions.** Create as many possible solutions as time allows, drawing from the experience, knowledge and initiative of the team.
5. **Compare Alternatives.** Each solution must then be compared by the team in order to decide on the best solution. To decide which solution is the best, some questions may be asked:
   (1) Which solution is the simplest?
   (2) Which solution is the safest? What is the worst possible outcome? What are the dangerous elements?
   (3) Which solution is the most flexible?
   (4) Which solution uses available resources in an economical manner?
   (5) Which solution will solve the critical factor and all other problems?
6. **Determine the Best Solution.** The team should choose the best solution to implement the plan of action.

7. **Implement the Solution.** The team should create a plan to implement the solution and get the problem solved. If a plan does not work like the team wanted, they may try another of the alternative solutions.

8. **Evaluate the Plan and the Implementation.** The team should evaluate performance once the problem is solved. The team should examine the implementation of the solution and the needs that may not have been anticipated. Questions may include:

   (1) Was the solution a good one?

   (2) Was the plan to implement the solution a success?

   (3) What can we do to improve the plan or the implementation for the next time?

   (4) What lessons were learned?

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is the definition of a problem?

Q2. List the steps in Logical Analysis.

Q3. List some questions that should be asked to evaluate the plan and implementation.

ANTICIPATED ANSWERS

A1. A problem is a doubtful or difficult matter requiring a solution.

A2. The steps in Logical Analysis are:

(1) confirm the task;

(2) identify the problem(s);

(3) determine the “Critical Factor”;

(4) develop alternate solutions;

(5) compare alternatives;

(6) determine the best solution;

(7) implement the solution; and

(8) evaluate the plan and the implementation.

A3. Questions may include:

(1) Was the solution a good one?

(2) Was the plan to implement the solution a success?

(3) What can we do to improve the plan or the implementation for the next time?

(4) What lessons were learned?

Teaching Point 2 — **Conduct a Writing Activity Where Cadets Solve Problems Using the Technique From TP1**

Time: 10 min — Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is for cadets to follow the problem solving steps in a written format.

RESOURCES

- 8.5 x 11 inch paper,
- Pen/pencil, and
- Scenario located at Annex A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Distribute the problem scenario located at Annex A to each cadet.

Instruct cadets to write down in point form how they would solve the problem. Cadets must list at least three possible solutions to solve the problem.

Ensure cadets follow all the steps in the process.

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 | **Conduct a Discussion Where Cadets Explain Their Choices From the Problem-solving Exercise**

Time: 20 min | Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

Ask for volunteers to share how they would solve the problem.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer.
- Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. What is the problem?

Q2. What is the critical factor?

Q3. What alternate solutions were developed?

Q4. List some comparisons for alternate solutions.

Q5. What solution was chosen?

Q6. Why was this choice made?

Q7. What was the plan to implement the solution?

Q8. What questions would be asked to evaluate the plan and the implementation?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

END OF LESSON CONFIRMATION

The cadets' participation in TP2 and TP3 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important to practice the skill of problem solving in a peer environment. Learning to solve problems is a quality of leadership. Knowing and using a technique to solve problems may help develop problem-solving skills.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A2-036 A-CR-CCP-121/PT-001 D Cdts 3. (2003). *Royal Canadian Army Cadet Reference Book.* Ottawa, ON: Department of National Defence.

C0-115 (ISBN 0-7879-4059-3) Van Linden, J. A. & Fertman, C. I. (1998). *Youth Leadership.* San Francisco, California: Jossey-Bass Inc.

C0-135 (ISBN 0-7645-5176-0) Loeb, M. & Kindel, S. (1999). *Leadership for Dummies.* Indianapolis, Indiana: Wiley Publishing, Inc.

PROBLEM SOLVING SCENARIO

In recently studying about the environment, cadets decide to initiate the creation of a recycling program at the squadron.

1. **Confirm the task** – (what must you do?)

2. **Identify the problem** – (what is the problem?)

3. **Determine the Critical Factor** – (what is the overriding problem?)

4. **Develop alternate solutions** – (different ways to solve the problem)

   1)

   2)

   3)

5. **Compare alternatives** – (simplest, safest, most flexible, best use of resources, best solution to the critical factor)

Solutions	Answer Questions

6. **Determine the best solution** – (make a choice)

7. **Implement the solution** – (develop a plan to get the problem solved)

8. **Evaluate the plan and the implementation** – (list some questions to ask for evaluation)

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 7

EO M203.07 – DISCUSS PERSONAL INTEGRITY AS A QUALITY OF LEADERSHIP

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-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to personal integrity as a quality of leadership.

An in-class activity was chosen for TP2 and TP3 as an interactive way to provoke thought, stimulate an interest among cadets and present personal integrity as a quality of leadership.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to discuss personal integrity as a quality of leadership.

IMPORTANCE

It is important for cadets to learn that personal integrity is a fundamental quality of leadership. Without personal integrity, a leader may never build the trust of his followers or his teammates. As listed in CATO 11-03, *Cadet Program Mandate*, leadership is one of the three aims of the Cadet Program.

Teaching Point 1 | **Explain Personal Integrity**

Time: 5 min | Method: Interactive Lecture

The most basic quality of leadership is personal integrity.

Ask cadets if they know what the word integrity means.

Integrity means moral uprightness; honesty. Personal integrity means doing the right thing, even if nobody is watching.

People struggle daily with situations that demand decisions between what they want to do and what they ought to do.

According to John C. Maxwell, the author of a number of best-selling books on leadership, if a leader uses personal integrity, a leader should be consistent. If what the leader says and what the leader does is the same, the results by the team will be consistent. For example,

The leader says to their team: "Be on time."	The leader arrives on time.	The team will be on time.
The leader says to their team: "Be positive."	The leader exhibits a positive attitude.	The team will be positive.
The leader says to their team: "Put others first."	The leader puts others first.	The team puts others first.

If what the leader says and what the leader does is not the same, the results by the team will be inconsistent.

The leader says to their team: "Be on time."	The leader arrives late regularly.	Some of the team will be on time, some will not.
The leader says to their team: "Be positive."	The leader exhibits a negative attitude regularly.	Some of the team will be positive, some will not.
The leader says to their team: "Put others first."	The leader puts themselves first.	Some of the team will put others first, some will not.

Aristotle, the Greek philosopher, once said, "We are what we repeatedly do. Excellence, then, is not an act but a habit."

Personal integrity builds trust. To earn the trust of others, a leader should lead by example. If the leader's words and actions match, teammates and followers should have trust and confidence in the group. Personal integrity usually results in a solid reputation, not just an image.

Personal integrity builds trust. Trust builds confidence. Confidence builds relationships. Relationships build leadership.

For the next series of questions, ensure cadets do NOT name the people they are thinking about. This is NOT a sharing activity.

Ask cadets to think of someone they know who has a good reputation. Is this person trustworthy? Ask cadets to think of someone they know who has poor reputation. Is this person trustworthy?

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What does integrity mean?

Q2. What is the most basic quality of leadership?

Q3. What does personal integrity build?

ANTICIPATED ANSWERS

A1. Integrity means moral uprightness; honesty.

A2. Personal integrity is the most basic quality of leadership.

A3. Personal integrity builds trust.

Teaching Point 2	**Conduct an Activity Where Cadets Brainstorm Where They Have Seen Integrity Displayed Within Their Peer Group**
Time: 5 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is for cadets to brainstorm where they have seen integrity displayed within their peer group. This reflective activity allows cadets to integrate their thoughts about leadership theory into their own experiences.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Have cadets brainstorm examples where they have seen integrity displayed within their peer group either during cadets, school, or other extra-curricular activities. Write in point form, the examples on a whiteboard/ flipchart/OHP.

Discuss instances where the cadets' peers have displayed:

- honesty
- honour,
- good character,
- decency,
- fairness,
- sincerity, and
- trustworthiness, etc.

> Ask cadets how they think the person in their example, who displayed personal integrity, would feel if they were in the class at that moment, after all the positive things have been said about them?

> If cadets mention someone in the class, be sure to praise the person mentioned. Positive reinforcement of correct behaviour is an excellent instructional technique.

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 | **Conduct an Activity Where Cadets Create a Poster That Shows an Example of Integrity**

Time: 15 min | Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is for the cadets to create a poster that shows an example of integrity. This activity allows cadets to reflect on personal integrity as a quality of leadership.

RESOURCES

- Pencil crayons/felt markers; and
- 8.5 x 14 inch paper.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

- Distribute pencil crayons/felt markers and the 8.5 x 14 inch paper to the cadets.
- Have the cadets draw and colour a poster to represent personal integrity as a quality of leadership. Cadets may create a picture, use a mind-map, use a saying, etc. Cadets may use the examples from TP2 or another instance of personal integrity.

Be sure to display posters in a place where they may be seen by as many squadron members as possible.

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' creation of posters displaying personal integrity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Brian Tracy, a leadership trainer, says, "The glue that holds all relationships together, including the relationship between the leader and the led is trust, and trust is based on integrity."

Personal integrity is the foundation of leadership. When cadets display this quality, it is the first step in their role as leaders within a peer setting.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-010 CATO 11-03 D Cdts 2. (2006). *Cadet Program Mandate.* Ottawa, ON: Department of National Defence.

C0-112 (ISBN 0-8407-6744-7) Maxwell, J. C. (1993). *Developing the Leader Within You.* Nashville, Tennessee: Thomas Nelson Inc. Publishers.

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 8

EO M203.08 – PARTICIPATE IN TEAM-BUILDING ACTIVITIES

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-802/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.

The time spent on each activity is at the discretion of the instructor. One activity may be conducted for the entire period or both activities may be conducted consecutively.

If the group is large, both activities may be conducted concurrently. When conducting activities concurrently, ensure additional supervision is provided.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for this lesson as it is a fun and challenging way to expand the cadets' experience participating in team-building activities and reinforce the cadets' appreciation of the fundamentals of leadership.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to participate in team-building activities.

IMPORTANCE

It is important for cadets to participate in team-building activities, including trust games, as it may improve their leadership abilities in a peer setting by allowing cadets to practice communication skills and positive group dynamics.

Teaching Point 1 — **Conduct Team-building Activities Through Trust Games**

Time: 25 min — Method: In-Class Activity

ACTIVITY 1

Time: 10 min

OBJECTIVE

The objective of this activity is to have the cadets develop trust within their peer group.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the group into pairs.
2. Cadets must assume a squatting position.
3. Cadets must face each other with their hands extended in front of their bodies, fingers pointing toward the ceiling and touching palms with their partner.
4. Cadets must attempt to knock their partner off balance by either pushing their palms, or withdrawing their palms using only slow motion movements. (Using slow motion movements should allow the two cadets to become cooperative partners.)
5. A player may lose the game if their feet move. (Most games conveniently end with both partners falling or moving their feet at the same time.)
6. Cadets may change partners as time allows.

SAFETY

The activity will be stopped if horseplay occurs.

ACTIVITY 2

Time: 15 min

OBJECTIVE

The objective of this activity is to have the cadets develop trust in their peer group.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the group into two lines facing each other, forming a corridor.

2. Have cadets put their arms straight in front of themselves. Arms should intersect, overlapping about a hand width apart from the person opposite them.

Wilderdom (2007). Index to Group Activities, Games, Exercises and Initiatives: Trust-Building Activities. Retrieved 26 April 2007, from http://wilderdom.com/games/descriptions/SliceNDice.html

Figure 1 Slice and Dice

3. The first cadet peels off and walks down the corridor. To let the cadet pass, have the other cadets raise and then lower their arms, creating a ripple effect in the corridor, through which the cadet is walking.

4. Once the cadet is finished walking down the corridor, the cadet joins the end of the corridor from which they have just emerged.

5. The next cadet, at the front of the line, peels off and walks down the corridor, and then joins the end of the line.

6. Each cadet takes a turn going down the corridor.

As cadets become more confident, invite them to walk fast, run and then sprint down the corridor. At some point, have the cadets chop their arms up and down, only pausing to allow the corridor runner through.

SAFETY

The activity will be stopped if horseplay occurs.

CONFIRMATION OF TEACHING POINT 1

The cadets' participation in the team-building activities will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' participation in the team-building activities will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Trust in others and trust in the leader are key leadership attributes and they may assist cadets in leading in a peer setting. When members of a team trust each other, accomplishing any task is usually easier. If cadets cultivate trust and protect the trust that others offer and share, cadets may increase the confidence others have in them and this should increase their own self-confidence.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-152 Wilderdom. (2007). *Index to Group Activities, Games, Exercises and Initiatives: Trust-Building Activities.* Retrieved 26 April 2007, from http://wilderdom.com/games/descriptions/SliceNDice.html.

C1-006 (ISBN 0-8403-5682-X) Ronhke, C. (1984). *Silver Bullets: A Guide to Initiative Problems, Adventures Games and Trust Activities.* Dubuque, Iowa: Kendall/Hunt Publishing Company.

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 9

EO C203.01 – RECORD ENTRIES IN A REFLECTIVE JOURNAL

Total Time:	3 x 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-802/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 one template of questions for reflection from the four located at Annex A and make a copy for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for this lesson to reinforce leadership principles and characteristics and to provoke thought. It also allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about a recent team-building or training activity.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall record entries in a reflective journal.

IMPORTANCE

Reflective thinking and evaluating past performance of tasks through journaling allows cadets to synthesize new knowledge and experiences to prior understanding. Cadets may develop self-awareness and/or recognize positive attributes of leadership that they may wish to integrate into their own personal leadership style.

Teaching Point 1 | **Conduct an Activity During Which Cadets Record Their Thoughts on Leadership**

Time: 25 min | Method: In-Class Activity

Recording in a reflective journal may encourage cadets to evaluate and analyze experiences they have undergone. It is an opportunity to think about, describe and communicate their impressions on peer interactions.

ACTIVITY

OBJECTIVE

The objective of this activity is for cadets to record their thoughts on leadership they displayed or the leadership they observed on a specific training activity.

RESOURCES

- Handouts of questions for reflection;
- 8.5 x 11 inch paper; and
- Pen/pencil.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Distribute a handout of the chosen template for reflection to each cadet.
2. Based on the last training activity in which the cadet participated (e.g. a field exercise, a community service exercise, a tour, etc.) the cadet must reflect on the leadership qualities and attributes they displayed or observed.
3. Instruct cadets to complete the template to the best of their ability.
4. Templates may be completed using sentences or point form. Mind mapping or drawing may be done on a separate piece of paper.

Cadets may share their journal or work with the class.

There are no right or wrong journal entries when cadets record their thoughts. Put as few restrictions as possible on the journal entries cadets may give during this activity.

If time permits, another template of questions for reflection may be completed.

SAFETY

N/A.

END OF LESSON CONFIRMATION

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

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Recording in a reflective journal, cadets have the opportunity to consider and/or evaluate experiences they have undergone. This may assist them in recognizing leadership qualities, principles and approaches the cadet wishes to incorporate into their own personal leadership style.

INSTRUCTOR NOTES/REMARKS

This EO should follow a significant practical activity such as a tour, a field exercise or EO M203.08 (Participate in Team-Building Activities).

REFERENCES

C0-113 (ISBN 1-882664-12-4) Karnes, F. A. & Bean S. M. (1995). *Leadership for Students: A Practical Guide for Ages 8-18.* Waco, Texas: Prufrock Press.

THIS PAGE INTENTIONALLY LEFT BLANK

TEMPLATES

TEMPLATE No. 1

Leadership Characteristics

Based on the last training activity, list and or describe the leadership characteristics you observed or displayed.

Leadership Characteristics

TEMPLATE No. 2

Defining Leadership

Based on the last training activity, my definition of leadership is:

Based on the last training activity, my leader's definition of leadership is (what you think your leader would say):

Based on the last training activity, I observed positive leadership when:

TEMPLATE No. 3

Positive Aspects of Leadership

Based on the last training activity, some positive aspects of leadership I displayed or observed are:

TEMPLATE No. 4

Leadership Looks Like/Sounds Like/Feels Like

Based on the last training activity, positive leadership that I observed looked like:

Based on the last training activity, positive leadership that I observed sounded like:

Based on the last training activity, positive leadership that I observed felt like:

Based on the last training activity, attributes I observed and wish to incorporate into my own personal leadership style are:

Based on the last training activity, attributes I wish to avoid incorporating into my own personal leadership style are:

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 10

EO C203.02 – EMPLOY PROBLEM SOLVING

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Photocopy scenarios located at Annex A.

Cut up scenarios located at Annex A.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 as an interactive way to provoke thought and stimulate an interest among cadets.

A group discussion was chosen for TP2 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about problem solving.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall employ problem solving.

IMPORTANCE

One of the qualities of leadership is problem solving. As cadets become leaders within a peer setting they will use this quality more often. It is important to practice this quality. Knowing and using a technique to solve problems may give the cadet increased confidence in their leadership ability.

Teaching Point 1 | **Conduct an Activity Where Cadets Solve Problems Using Logical Analysis**

Time: 25 min | Method: In-Class Activity

STEPS TO LOGICAL ANALYSIS

1. **Confirm the Task.** The team must understand both the problem and the aim or intent of the person assigning the task.
2. **Identify the Problem.** The team must consider the problem and the challenges that may occur in the implementation.
3. **Determine the Critical Factor.** The critical factor is usually the one overriding problem, on which all other issues depend. The critical factor should be determined by the team.
4. **Develop Alternate Solutions.** The team should create as many possible solutions to solve the critical factor and other issues as time allows.
5. **Compare Alternate Solutions.** Each solution must be compared by the team in order to decide on the best solution.
6. **Determine the Best Solution.** The team should choose the best solution to implement a plan of action.
7. **Implement the Solution.** The team should create a plan to implement the solution and get the problem solved.
8. **Evaluate the Plan and Implementation.** The team should evaluate their performance once the problem is solved.

ACTIVITY

Time: 15 min

OBJECTIVE

The objective of this activity is for cadets to solve problems within a peer setting.

RESOURCES

- Flipchart paper,
- Markers,
- Paper bag, and
- Scenarios of problems.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the class into small groups of no more than four cadets.
2. Distribute flipchart paper and markers to each group.

3. Have one representative from each group come to the front of the class and pick one or two scenarios at random from a paper bag or a wedge.
4. Instruct the cadets that the problem-solving steps must be used to solve the scenario.
5. Cadets must list at least three solutions to each problem.
6. Cadets must record the steps they would use to solve each scenario on the flipchart paper.

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	**Conduct a Group Discussion Where Cadets Explain Their Choices From the Problem-solving Exercise**
Time: 25 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

Have one representative from each group present their problem scenario and the steps the group used to solve the problem.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g., everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. What is the problem?

Q2. What is the critical factor?

Q3. What alternate solutions were developed?

Q4. What are some comparisons for alternate solutions?

Q5. What solution was chosen?

Q6. Why was this choice made?

Q7. What was the plan to implement the solution?

Q8. What questions would be asked to evaluate the plan and the implementation?

Q9. Are there different problems, other solutions, etc.?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. List the steps in Logical Analysis.

Q2. What is the critical factor?

Q3. Who should determine the best solution?

ANTICIPATED ANSWERS

A1. The steps in Logical Analysis are:

(1) confirm the task;

(2) identify the problem;

(3) determine the critical factor;

(4) develop alternate solutions;

(5) compare alternate solutions;

(6) determine the best solution;

(7) implement the solution; and

(8) evaluate the plan and implementation.

A2. The critical factor is usually the one overriding problem on which all other issues depend.

A3. The team should determine the best solution.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Applying the steps in logical analysis to a given problem enables the cadet to determine and implement a solution. With practice, this problem-solving skill will develop. Knowing and using logical analysis to solve problems may give the cadet increased confidence in their ability to lead in a peer setting.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A2-036 A-CR-CCP-121/PT-001 D Cdts 3. (2003). *Royal Canadian Army Cadet Reference Book.* Ottawa, ON: Department of National Defence.

C0-115 (ISBN 0-7879-4059-3) Van Linden, J. A. & Fertman, C. I. (1998). *Youth Leadership.* San Francisco, California: Jossey-Bass Inc.

C0-135 (ISBN 0-7645-5176-0) Loeb, M. & Kindel, S. (1999). *Leadership for Dummies.* Indianapolis, Indiana: Wiley Publishing, Inc.

SCENARIOS

Scenario No. 1

You and five other Proficiency Level Two cadets are tasked to set up a classroom for a class that will begin in ten minutes. You arrive to find the door to your classroom locked. The officer who is supposed to have the key is nowhere to be found.

Scenario No. 2

Your Training Officer is preparing for a weekend exercise and asks you to inventory and restock the three field first aid kits with the help of five cadets.

Scenario No. 3

While on a canteen break, you and other cadets see your best friend take some money that belongs to another cadet.

Scenario No. 4

You enter your squadron building with four other cadets to find two male Leading Air Cadets (LAC) in a verbal and physical altercation.

Scenario No. 5

You are told by the Warrant Officer Second Class (WO2) that the large classroom was not set up properly for the guest speaker who is arriving in 10 minutes. You and three other cadets are told to make sure the classroom is ready on time.

Scenario No. 6

Your squadron is holding a mandatory training exercise on the same day as your soccer team is scheduled to play in the regional playoffs. You and three other cadets from your squadron play on the same team. Your soccer coach is counting on you to be at the game.

Scenario No. 7

Your Flight Sergeant (FSgt) and Flight Commander are both absent from the parade night. You and one other cadet are tasked by the Administration Officer to verify the attendance and have your flight members sign the attendance sheet.

Scenario No. 8

You and five of your friends notice that the parade square needs to be cleaned. Your team accepts this small challenge and have decided to ensure that the parade square is clean for the parade practice for the next period.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 11

EO C203.03 – DISCUSS CHARACTERISTICS OF A LEADER

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Copy the handouts located at Annex A and distribute to each cadet prior to the lesson.

PRE-LESSON ASSIGNMENT

Using the research information sheet provided, the cadets will research a leader of their choice (a military person, political leader, pastor, teacher, etc.) prior to the lesson.

Cadets will bring to the class presentation materials (if needed) and information about the leader they researched.

APPROACH

An in-class activity was chosen for TP1 to reinforce leadership principles to provoke thought.

A group discussion was chosen for TP2 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about characteristics of a leader.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall discuss the characteristics of a leader.

IMPORTANCE

In discussing the characteristics of various leaders, cadets may be able to discern different leadership qualities, principles and approaches. After reflection, cadets may wish to incorporate these qualities, principles and approaches into their own leadership style.

Teaching Point 1	**Discuss the Study of Specific Leaders**
Time: 30 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets discuss, in a group of no more than four, their studies of specific leaders.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the class into groups of no more than four.
2. In a group of four, the first cadet will present their study of a specific leader.
3. The other three cadets will be given three minutes to ask questions.

Questions from cadets to the presenter should be created using the research template located at Annex A.

4. Another cadet will present their study of a specific leader.
5. The other three cadets will be given three minutes to ask questions.
6. The rest of the cadets will present their specific leader in turn.

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 — **Conduct a Group Discussion Where Cadets Volunteer to Share Their Study of a Specific Leader With the Entire Group**

Time: 20 min — Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

Use the completed handouts from the cadets as the material for the group discussion.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

Ask cadets if they wish to volunteer to share their study of a specific leader with the class.

SUGGESTED QUESTIONS

Q1. Where did the leader use their influence?

Q2. Was the leader's influence positive or negative?

Q3. How was it positive or negative?

Q4. How did their leadership style create opportunities in the leader's life?

Q5. What kind of leadership approach did the leader use?

Q6. Was the leader able to solve problems?

Q7. How did the leader solve problems?

Q8. When did the leader display personal integrity?

Q9. How did the leader display personal integrity?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

The cadets' participation in the in-class activity and group discussion will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Learning about different leaders and being able to describe their attributes may help cadets understand that leaders come from all walks of life with different leadership qualities, principles and approaches. Deciding whether to incorporate those attributes into the cadet's leadership style may assist the cadet in becoming a more effective leader.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-113 (ISBN 1-882664-12-4) Karnes, F. A. & Bean S. M. (1995). *Leadership for Students: A Practical Guide for Ages 8-18.* Waco, Texas: Prufrock Press.

THIS PAGE INTENTIONALLY LEFT BLANK

INFORMATION TO RESEARCH

Name (in Full): ______________________________

Date of Birth: ______________________________

Place of Birth: ______________________________

Date of Death (if Deceased): ______________________________

If Deceased, How Did They Die? ______________________________

____

Information on Their Childhood: ______________________________

____

____

Positions of Responsability (if Applicable): ______________________________

____

____

____

Incidents Where Influence Was Displayed: ______________________________

____

____

____

____

____

____

____

Other Interesting Facts or Information: ______________________________

____

____

____

____

____

____

____

____

Why Did You Pick This Person? ______________________________

____

____

____

____

____

Where Did You Get Your Information? ______________________________

____

____

____

____

____

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 12

EO C203.05 – PARTICIPATE IN TRUST-BUILDING ACTIVITIES

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-802/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.

The time spent on each activity is at the discretion of the instructor. If time permits, activities may be conducted consecutively. If the group is large, activities may be conducted concurrently. When conducting activities concurrently, ensure enough resources and supervision are available.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An experiential approach was chosen for this lesson as it allows the cadets to acquire new skills through a direct experience. This approach allows cadets to experience trust-building activities and define that experience on a personal level. They will be given the opportunity to reflect on and examine what they saw, felt and thought while they were having the experience, and consider how this will relate to future experiences.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to participate in trust-building activities.

IMPORTANCE

It is important for cadets to participate in trust-building activities as it may improve their leadership abilities in a peer setting by allowing cadets to practice communication skills and positive group dynamics.

BACKGROUND KNOWLEDGE

Trust is a powerful and essential leadership attribute because it is a key to personal involvement. A cadet will seldom take a physical or emotional chance if they perceive callousness or an unreasonable risk. A group surrounded with positive experiences and successes will undergo growth in trust and personal confidence. Trust, within the framework of leadership, is gained with patience, thoughtfulness and care over a period of time. Trust can also be lost in a second by carelessness or inconsiderate behaviour. Cultivating and protecting the trust that another individual offers should be a fundamental leadership quality to be acquired.

ACTIVITY

Time: 20 min | Method: Experiential

OBJECTIVE

The objective of this activity is to have cadets develop trust in their peer group.

RESOURCES

- A large empty space with four walls; and
- A blindfold.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Brief the cadets on any safety rules or any other guidelines pertaining to the activity.

1. Have one cadet stand with their back to one wall of a large four-walled room. This cadet becomes the jogger.
2. The jogger must hold their hands up in front of their body, palms out, to protect themselves.
3. Blindfold the jogger.
4. Place three-quarters of the group in a line with their backs to the wall that the jogger will be approaching. They will act as spotters. The spotter’s job is to prevent the jogger from running into the wall.
5. Place the remaining quarter of the group three-quarters of the way down the room to prevent wildly disoriented joggers from running into the side walls.
6. Ask the jogger to jog toward the far wall at a steady, unchanging pace.
7. Have cadets take turns being the jogger.

SAFETY

The spotters must be as quiet as possible to increase the resolve of the jogger.

The spotters must concentrate on the jogger at all times. If the jogger hits a wall the trust of the group may be broken.

ACTIVITY

Time: 20 min

OBJECTIVE

The objective of this activity is to have cadets develop trust in their peer group.

RESOURCES

A blindfold.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Brief the cadets on any safety rules or any other guidelines pertaining to the activity.

1. Divide the group into pairs.
2. Blindfold one cadet. This cadet becomes the walker. The walker must hold their hands up in front of their body, palms out, to protect themselves.
3. The second cadet becomes the talker.
4. The talker must lead the walker on a tour through a pre-determined location in the cadet squadron facility.
5. The talker must give directions as simply as possible. (e.g. take two steps forward, turn to your left, take four steps to the right, etc.).
6. The talker is not allowed to touch the walker, unless the walker is about to fall.
7. Have cadets change positions and repeat the activity.

SAFETY

If there are stairs at the cadet squadron facility, ensure extra supervision.

REFLECTION

Time: 5 min

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. How did it feel to trust others in your group? Why?

Q2. How did it feel to have others trust you? Why?

Q3. How does it feel when someone does not trust you?

Q4. Why is trust an important part of leadership?

Other questions and answers will develop throughout the discussion stage. The discussion should not be limited to only those suggested.

CONCLUSION

REVIEW

Upon completion of the group discussion the instructor will conclude by summarizing the discussion to ensure that all teaching points have been covered. The instructor must also take this opportunity to explain how the cadet will apply this knowledge and/or skill in the future.

TEACHING POINTS

TP1. Trust is a powerful and essential leadership attribute because it is a key to personal involvement.

TP2. A group surrounded with positive experiences and successes will undergo growth in trust and personal confidence.

TP3. Trust can also be lost in a second by carelessness or inconsiderate behaviour.

TP4. Cultivating and protecting the trust that another individual offers should be a fundamental leadership quality to be acquired.

Reinforce those answers given and comments made during reflection, but ensure that the teaching points have been covered. Any teaching point not brought out during the group discussion shall be covered during review.

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Trust is a key leadership attribute that may assist cadets in leading in a peer setting. Participating in trust-building activities may assist cadets by increasing the confidence others have in them and this should increase their own self-confidence.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C1-006 (ISBN 0-8403-5682-X) Ronhke, C. (1984). Silver Bullets: A Guide to Initiative Problems, Adventures Games and Trust Activities. Dubuque, Iowa: Kendall/Hunt Publishing Company.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 13

EO C203.06 – PARTICIPATE IN PROBLEM-SOLVING ACTIVITIES

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-802/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.

The time spent on each activity is at the discretion of the instructor. If time permits, activities may be conducted consecutively. If the group is large, activities may be conducted concurrently. When conducting activities concurrently, ensure enough supervision is available.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An experiential approach was chosen for this lesson as it allows the cadets to acquire new skills through a direct experience. This approach allows cadets to experience problem-solving activities and define that experience on a personal level. They will be given the opportunity to reflect on and examine what they saw, felt and thought while they were having the experience, and consider how this will relate to future experiences.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to participate in problem-solving activities.

IMPORTANCE

It is important for cadets to participate in problem-solving activities as it may improve their leadership abilities in a peer setting by allowing cadets to practice communication skills, positive group dynamics and problem-solving techniques.

BACKGROUND KNOWLEDGE

Problem-solving activities offer a clearly defined opportunity to practice the skill of problem-solving. Each task is designed so that the group must employ communication skills, positive group dynamics and problem-solving techniques. This problem-solving approach to learning can be useful in developing each individual's awareness of their decision making, responsibilities and cooperation with others. Groups engage the problem by taking advantage of the combined physical and mental strengths of each of its members. Problem solving is an unrivalled way to build morale and a sense of camaraderie.

ACTIVITY

Time: 20 min Method: Experiential

OBJECTIVE

The objective of this activity is to have cadets solve a problem within a peer setting.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Brief the cadets on any safety rules or any other guidelines pertaining to the activity.

1. Divide the cadets into groups of 8 (preferably 4 males and 4 females).

If there is not an even number of males and females, any alternative to identify the two groups may be used (e.g. hats on/hats off, tunics on/tunics off, etc.)

2. The group must solve the problem in the least number of moves. The object of the game is to have all the males end up on one end of the line and all the females on the other end of the line.
3. Have males and females alternate in line.
4. All moves must be made in pairs. Any two cadets standing side by side (without a space between them) may be considered a pair. Pairs may change with each move.
5. As a pair moves, an empty space is created in the line.
6. The empty space may be filled by another pair.
7. Pairs may not pivot or turn around.
8. The final line must have no spaces or gaps.

There are many ways to solve this problem. Have cadets attempt to solve this problem a number of times, trying to minimize the number of moves on each attempt.

The following sequence illustrates the minimum 4 move solution.

1. Move 1 – Pair 2/3 move to the end of the line past 8.

M	F	M	F	M	F	M	F		
1	(2	3)	4	5	6	7	8		

M			F	M	F	M	F	F	M
1			4	5	6	7	8	(2	3)

2. Move 2 – Pair 5/6 move into the slot vacated by the previous pair.

M			F	M	F	M	F	F	M
1			4	(5	6)	7	8	2	3

M	M	F	F			M	F	F	M
1	(5	6)	4			7	8	2	3

3. Move 3 – Pair 8/2 move into the slot vacated by the previous pair.

M	M	F	F			M	F	F	M
1	5	6	4			7	(8	2)	3

M	M	F	F	F	F	M			M
1	5	6	4	(8	2)	7			3

4. Move 4 – Pair 1/5 move into the slot vacated by the previous pair.

M	M	F	F	F	F	M			M
(1	5)	6	4	8	2	7			3

		F	F	F	F	M	M	M	M
		6	4	8	2	7	1	5	3

SAFETY

N/A.

ACTIVITY

Time: 20 min

OBJECTIVE

The objective of this activity is to have the cadets solve a problem within a peer setting.

RESOURCES

- Masking tape, and
- A stopwatch.

ACTIVITY LAYOUT

Using masking tape make a rectangle shape on the floor, 5 m long and 30 cm wide.

ACTIVITY INSTRUCTIONS

Brief the cadets on any safety rules or any other guidelines pertaining to the activity.

1. Divide the cadets into two groups.
2. Each group forms a line inside the rectangle, one behind the other, facing into the centre of the rectangle.

D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure 1 Cadet Shuffle

3. Each group must exchange places with the other group without touching the floor outside the rectangle.

D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure 2 Cadet Shuffle

4. Time each attempt.
5. For each person that steps outside the rectangle, add 10 seconds to the time.
6. Have cadets attempt this game a number of times, trying to minimize their time on each attempt.

SAFETY

Remind cadets that there is to be no horseplay or pushing other cadets outside the rectangle.

REFLECTION

Time: 5 min

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. How did it feel to solve the problem?

Q2. How could your group have improved on its performance?

Q3. Did the group follow a problem-solving technique? Why or why not?

Q4. Did your group members use positive group dynamics when discussing how to solve the problem? Why or why not?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

CONCLUSION

REVIEW

Upon completion of the group discussion the instructor will conclude by summarizing the discussion to ensure that all teaching points have been covered. The instructor must also take this opportunity to explain how the cadet will apply this knowledge and/or skill in the future.

TEACHING POINTS

TP1. The group must employ communication skills, positive group dynamics and problem-solving techniques.

TP2. Problem solving develops each individual's awareness of their decision making, responsibilities and cooperation with others.

TP3. Groups engage the problem by taking advantage of the combined physical and mental strengths of each of its members.

TP4. Problem solving is an unrivalled way to build morale and a sense of camaraderie.

Reinforce those answers given and comments made during reflection, but ensure that the teaching points have been covered. Any teaching point not brought out during the group discussion shall be covered during review.

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Problem solving is a key leadership quality. Practicing the skills of problem-solving should assist cadets in leading in a peer setting by increasing their self-confidence. Problem-solving activities allow cadets to practice communication skills, positive group dynamics and problem-solving techniques.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C1-006 (ISBN 0-8403-5682-X) Ronhke, C. (1984). *Silver Bullets: A Guide to Initiative Problems, Adventures Games and Trust Activities.* Dubuque, Iowa: Kendall/Hunt Publishing Company.

CHAPTER 4

PO X04 – TRACK PARTICIPATION IN PHYSICAL ACTIVITIES

COMMON TRAINING

ALL TRAINING LEVELS

INSTRUCTIONAL GUIDE

**PERSONAL FITNESS
AND HEALTHY LIVING**

PO X04 – TRACK PARTICIPATION IN PHYSICAL ACTIVITIES

Total Time:

For the following EOs, refer to the lesson specifications located in A-CR-CCP-801/PG-001, *Royal Canadian Air Cadets Proficiency Level One Qualification Standard and Plan*:

- CX04.01 – Participate in the Cadet Fitness Assessment and Identify Strategies for Improving Personal Physical Fitness,
- CX04.03 – Participate in a Cooking Class,
- CX04.04 – Attend a Personal Fitness and Healthy Living Presentation, and
- CX04.05 – Attend a Local Amateur Sporting Event.

For the following EOs, refer to the instructional guides located in A-CR-CCP-801/PF-001, *Royal Canadian Air Cadets Proficiency Level One Instructional Guides*:

- MX04.01 – Participate in 60 Minutes of Moderate- to Vigorous-Intensity Physical Activity (MVPA) and Track Participation in Physical Activities,
- MX04.02 – Identify Strategies to Improve Participation in Physical Activities and Participate in the Cadet Fitness Assessment,
- MX04.03 – Participate in the Cadet Fitness Assessment and Identify Strategies for Improving Personal Physical Fitness, and
- CX04.02 – Participate in Activities that Reinforce the Three Components of Physical Fitness.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 5

PO X05 – PARTICIPATE IN PHYSICAL ACTIVITIES

COMMON TRAINING

ALL TRAINING LEVELS

INSTRUCTIONAL GUIDE

PHYSICAL ACTIVITIES

PO X05 – PARTICIPATE IN PHYSICAL ACTIVITIES

Total Time:

For the following EOs, refer to the instructional guides located in A-CR-CCP-801/PF-001, *Royal Canadian Air Cadets Proficiency Level One Instructional Guides*:

- MX05.01 – Participate in Physical Activities,
- CX05.01 – Participate in Physical Activities, and
- CX05.02 – Participate in a Tournament.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 6

PO 206 – FIRE THE CADET AIR RIFLE DURING RECREATIONAL MARKSMANSHIP

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 1

EO M206.01 – PARTICIPATE IN A RECREATIONAL MARKSMANSHIP ACTIVITY USING THE CADET AIR RIFLE

Total Time: 90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 delivery of the lesson. Set up air rifle range in accordance with Annex A.

Review Unit Standing Range Orders (see sample at Annex B).

Review and photocopy required targets and diagrams found in Annexes C to L.

Review the Cadet Air Rifle Handling Test in A-CR-CCP-811/PG-001, Chapter 3, Annex C.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

This interactive lecture was chosen for TP1 and TP2 to provide direction on procedures and to illustrate application of rules, principle and concepts.

The practical activity was selected for TP3 as an interactive setting to provide the cadets the experience of a recreational marksmanship air rifle activity in a safe and controlled environment. This recreational activity will contribute to creating and maintaining an interest the marksmanship program.

INTRODUCTION

REVIEW

The review for this lesson will be from EO M106.02 (Cadet Air Rifle Handling Test). Ensure all cadets have completed the Cadet Air Rifle Handling Test.

SUGGESTED QUESTIONS

Q1. Why do we follow safety regulations?

Q2. How would you verify the safety catch is ON?

Q3. What are the four “ACTS” of firearm safety?

ANTICIPATED ANSWERS

A1. To help prevent accidents with the cadet air rifle.

A2. No red can be seen.

A3. The mnemonic “ACTS” stands for:

- Assume every firearm is loaded;
- Control the muzzle direction at all times;
- Trigger finger must be kept off the trigger and out of the trigger guard; and
- See that the firearm is unloaded (prove it safe).

OBJECTIVES

By the end of this lesson, the cadets shall have participated in a recreational marksmanship activity using the cadet air rifle.

IMPORTANCE

It is important for cadets to practice the skills learned in PO 106. CA (Participate in a Familiarization Marksmanship Activity). This activity is essential for creating, developing and maintaining an interest in the cadet marksmanship program.

Teaching Point 1	**Conduct a Range Briefing**
Time: 10 min	Method: Interactive Lecture

Review the following information with the cadets.

REMOVING A RIFLE FROM THE CASE

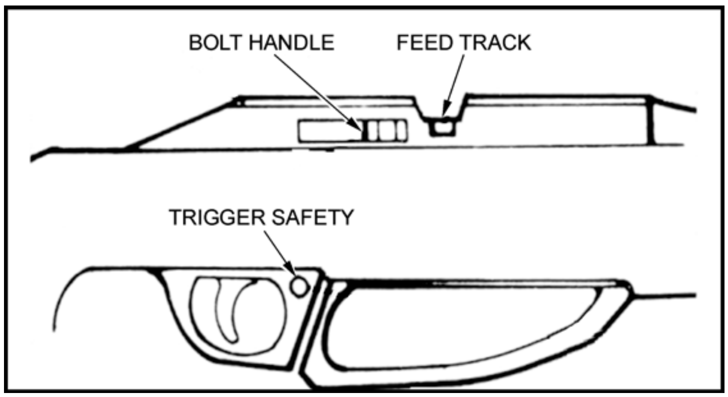
The rifle case should be clearly marked on the outside with an arrow, indicating the direction the rifle inside is pointing. This will ensure that, when the case is opened, the rifle is pointing in a safe direction. The following steps must be followed when removing a rifle from its case:

1. Place the rifle case on a flat surface and ensure the arrow is pointing in a safe direction.
2. Open the case.
3. Cock the action (leave the bolt to the rear).
4. Confirm that the safety catch is ON.

5. Confirm that the pumping lever is partially open.
6. Slide the safety rod in the barrel towards the bolt until it can be seen in the feed track.
7. Remove the rifle from the case.
8. Remove the safety rod when you are on the firing line.

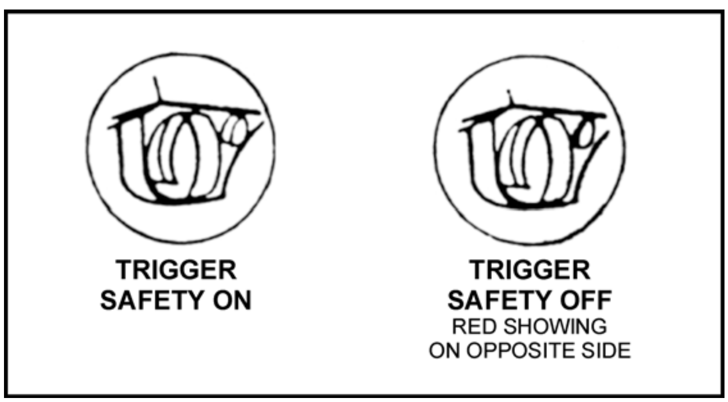
SAFETY CATCH AND SECURITY MEASURES

The safety catch is a mechanism that, once engaged, prevents a rifle from firing by locking its trigger in place. It is located just in front of the trigger, on the trigger guard. To engage the safety catch it must be pushed towards the right so no red can be seen. To fire, the safety catch must be pushed towards the left in the OFF position and a red mark must be seen on it. For maximum security, it is recommended that the safety catch be kept engaged until the rifle is ready for firing.



Daisy Outdoor Products, Operational Manual – Avanti Legend SX Model 853C, Daisy Outdoor Products

Figure 1 Safety Catch

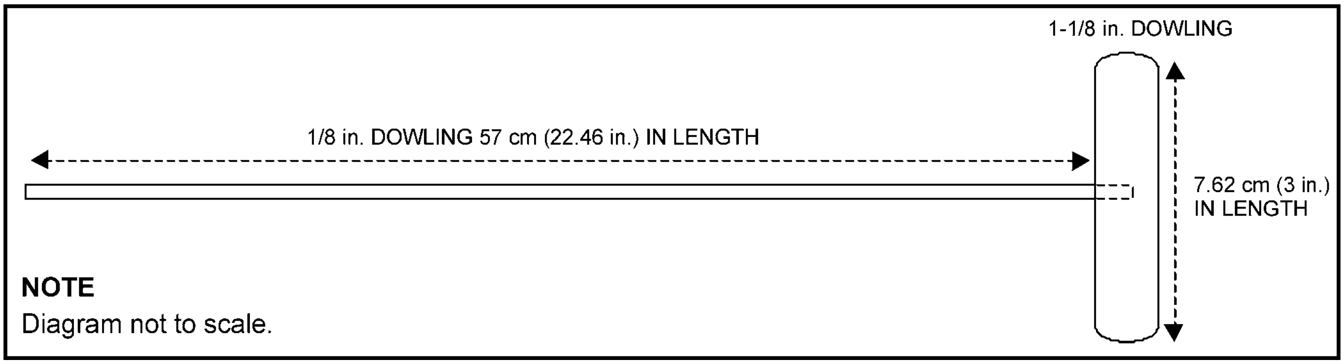


Daisy Outdoor Products, Operational Manual – Avanti Legend SX Model 853C, Daisy Outdoor Products

Figure 2 Safety Catch

SAFETY ROD

To ensure that air rifles are not removed from the firing point or stored with a pellet in the chamber or barrel, a safety rod is to be inserted in the barrel from the muzzle end. It consists of two (2) sections of doweling joined together in a "T" shape, and may be made of varying materials. Dimensions are detailed in the diagram below. The tip of the safety rod is to be coloured red so that it is visible in the feed track with the bolt fully to the rear.



A-CR-CCP-177/PT-001, Canadian Cadet Movement: Cadet Marksmanship Program Reference Manual (p.1-3-1)

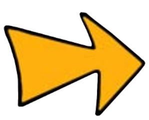
Figure 3 Safety Rod

INDIVIDUAL SAFETY PRECAUTIONS

Provide an explanation and demonstration proving the rifle safe.

Upon receiving a rifle, or when the "safe rifle status" is uncertain, individual safety precautions shall be done to confirm that the rifle is safe. An individual must ensure that:

- the bolt is open fully to the rear;
- the safety catch is in the ON position;
- the pump lever is left partially open; and
- a safety rod is placed in the barrel.



Have the cadets imitate the demonstration.

SAFETY

Maintain complete control at all times and ensure that all cadets treat the cadet air rifles as though it was loaded at all times.

Ensure that the demonstration is conducted in a safe manner, in a safe direction and away from others.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Why is it important to leave your fingers off the trigger until ready to fire?

Q2. When storing the rifle in its case, is the bolt left forward (opened) or back (closed)?

Q3. Where is the safety catch located on the cadet air rifle?

ANTICIPATED ANSWERS

A1. To prevent accidental discharge of a pellet.

A2. When the rifle is being stored in its case, the bolt is always left foreword.

A3. Within the trigger guard, forward of the trigger.

Teaching Point 2	**Explain Rules and Range Commands**
Time: 15 min	Method: Interactive Lecture

Review range commands with an explanation and demonstration for each command.

All loading/firing is to be simulated. No pellets are to be fired.

RANGE COMMANDS CADETS MUST FOLLOW

Command	Action To Be Taken
Cover off your firing point	Stand up, move behind the firing point and await further commands.
Place your equipment down and stand back	Lay the equipment down on the mat and stand back when finished.
Adopt the prone position	Adopt the prone position, pick up the rifle, ready the equipment and put on hearing and eye protection.
Type of firing – "G.R.I.T."	"G.R.I.T" is the acronym for: • Group (relay); • Range (distance); • Indication (number of rounds); and • Type (grouping, scored).
Relay, load, commence firing	1. Pick up and hold the rifle with the left hand. 2. Ensure the safety catch is in the ON position. 3. Pump the rifle, observing a 3 second pause. 4. Load a pellet (flat end forward). 5. Close the bolt.

Command	Action To Be Taken
Relay, fire	1. Place the safety catch in the OFF position. 2. Aim the rifle at the target. 3. Squeeze the trigger. 4. Open the bolt. 5. Repeat the sequence for each shot. 6. Place the safety in the ON position. 7. Partially open the pump lever. 8. Lay down the rifle.

ACTIVITY LAYOUT

As illustrated in Figure A-1 for Range Layout Diagram.

ACTIVITY INSTRUCTIONS

Conduct a recreational marksmanship activity according to the instructions in Annexes C to L.

SAFETY

All standard range safety procedures will apply in accordance with Local Range Standing Orders.

CONFIRMATION OF TEACHING POINT 2

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

Teaching Point 3 — **Participate in a Recreational Marksmanship Activity**

Time: 60 min — Method: Performance

ACTIVITY

OBJECTIVE

The objective of this recreational marksmanship activity is to stimulate an interest in marksmanship in the Canadian Cadet Movement (CCM).

RESOURCES

- Cadet air rifles,
- Cadet air rifle safety rods,
- Safety glasses/goggles,
- Targets,
- Pellets (70 per cadet),
- Cleaning Pellets (11 per cadet),
- Pellet receptacle,
- Shooting mats (one per firing lane),

- Marking devices to record names on targets,
- Grouping template,
- Scoring template,
- Scoring Magnifier (e.g. Eagle Eye),
- Spotting scope with tripod,
- Thumb tacks/tape,
- Target frames/back stops,
- Red and green range flags, and
- Hand washing facilities.

ACTIVITY LAYOUT

As illustrated in Figure A-1 for Range Layout Diagram.

For detailed specifications refer to A-CR-CCP-177/PT-001.

ACTIVITY INSTRUCTIONS

Conduct a recreational marksmanship activity according to the instructions located at Annex C.

SAFETY

All standard range safety procedures will apply in accordance with Local Range Standing Orders.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

Confirmation of this lesson is inherent in the cadets' participation in the recreational marksmanship activity.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

In order to become more familiar with the cadet air rifle, and participate in a recreational marksmanship activity, cadets are provided a fun and safe way to practice their marksmanship skills.

INSTRUCTOR NOTES/REMARKS

Cadets are allowed to view their targets after they have been scored; the RSO will then select the targets that may qualify for marksmanship qualification levels, if applicable.

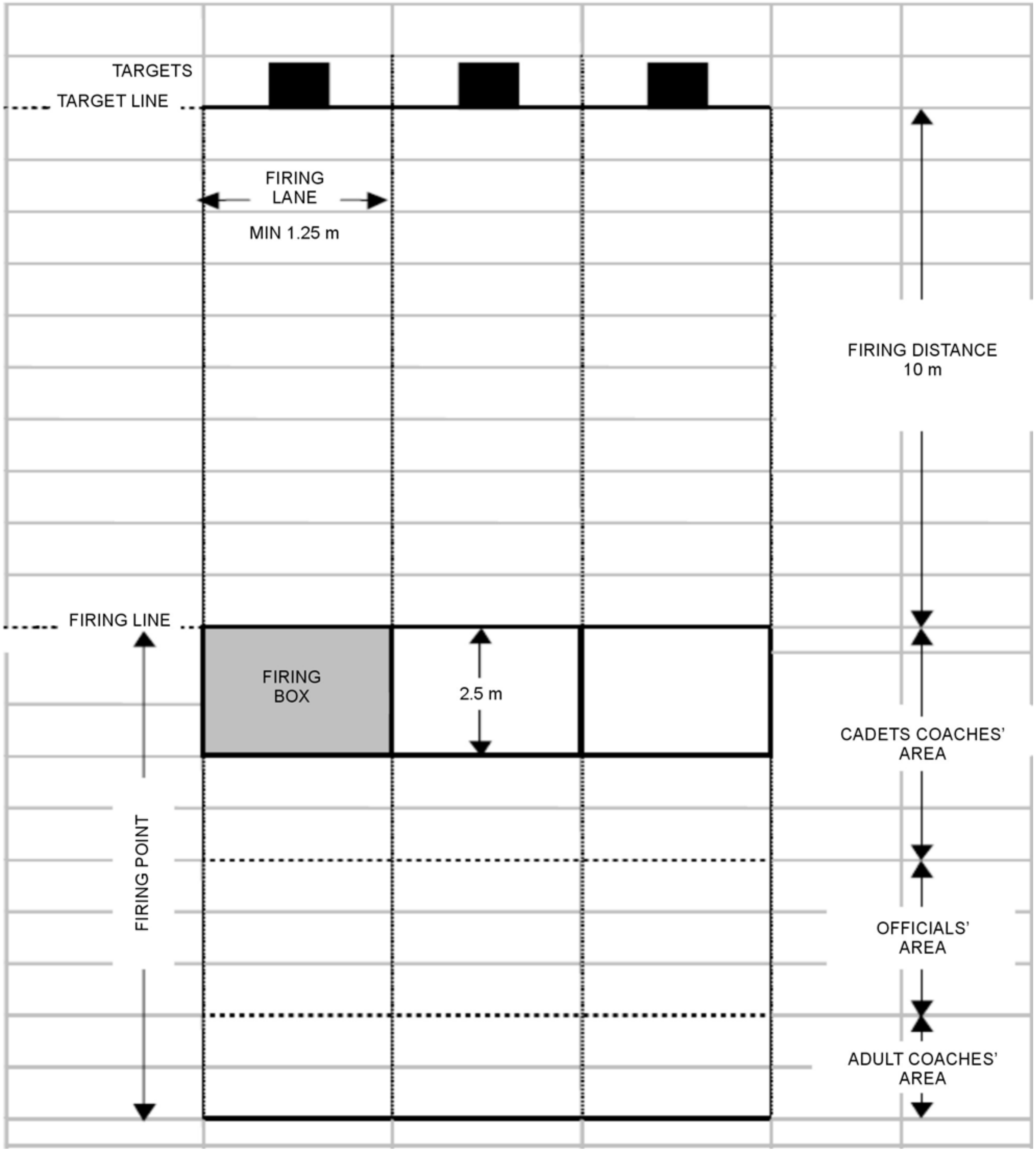
REFERENCES

A0-027 A-CR-CCP-177/PT-001 D Cdts (2001). *Canadian Cadet Movement: Cadet Marksmanship Program Reference Manual.* Ottawa ON: Department of National Defence.

A0-028 CATO 14-41 D Cdts (2005). *Annex E Appendix 1 Marksmanship, Rifles, and Ammunitions.* (Vol 1, 8 pages). Ottawa ON: Department of National Defence.

C0-085 Daisy Outdoor Products (2006). *Operational Manual – Avanti Legend EX Model 853C.* Rogers, AR: Daisy Outdoor Products.

RANGE LAYOUT DIAGRAM



A-CR-CCP-177/PT-001 (p. 4-4-16)

Figure A-1 Air Rifle Range Layout

THIS PAGE INTENTIONALLY LEFT BLANK

SAMPLE RANGE STANDING ORDERS

GENERAL

These Range Standing Orders shall apply to all personnel participating in any air rifle firing conducted on a 10-metre indoor **“Portable Indoor Air Rifle Range”**.

LOCATION

The 10-metre “Portable Indoor Air Rifle Range” is to be set up IAW A-CR-CCP-177/PT-001.

DESCRIPTION OF AN INDOOR RANGE

- The portable air rifle range is set-up and then dismantled once the activity is completed.
- Target stands used will be those provided by DND. Once the range practice is finished, they shall be neatly stored.
- Shooting mats/gym mats will be used on the firing line.
- A table and chairs may be set up behind the firing point to be used by range staff, ammunition, scoring, etc.
- The set-up of the range will be as illustrated in Figure A-1.
- In all cases, the firing distance will be 10 metres.
- Backstops (Hesin curtain/blankets) will be used to protect the back of the range. They will be set up so as to minimize damage to the walls and doors.
- The sides of the range will be indicated and access to those areas should be limited. There is no requirement for physical barriers in those areas.

DESCRIPTION OF BACKSTOPS (TARGET FRAMES)

Target frames for the prone position may be constructed of either wood frame with steel backer plates or wood frame with a ballistic nylon curtain (Herculite or other brand name) to catch the pellets. The size of the frames shall be large enough to accommodate two 10-metre air rifle targets (CCT2001AR853) horizontally or vertically. The target stands provided by RCSU and/or other authorized DND sources shall be the only ones used.

Biathlon air rifle falling plate targets (BT 100) may be attached to the target frame by fixing a piece of wooden material (1” by 6”) to the frame and providing two screws to hang the BT 100 falling plate target.

Target frames for the standing position may be the frames described in part “a” provided that the frames are elevated to a height of 1.4 m to the centre of the target. Should a mechanical target retrievable pulley system be used, the system may be attached to the frame by fixing a piece of wooden material 1” by 6” to the frame to attach the pulley system. A means of counter balance must be used to prevent the frames from being pulled over due to the tension and strain of the pulley system. The frames should be clamped to a table or stand and weight in the form of concrete blocks be hung from the table to give the system stability.

Moving targets are prohibited.

When conducting air rifle training in any other position (kneeling and standing) the RSO shall ensure that the backstops provide adequate surface area to accommodate the target being used and stop stray pellets.

AIR RIFLES/PELLETS

Notwithstanding the limitations set out in CATO 14-41, *Marksmanship, Rifles and Ammunitions*, regarding the types of air rifles that may be used for approved cadet activities:

- **Air Rifles:**

  - Daisy 853-C Air Rifle
  - Avanti 853-C Air Rifle
- **Pellets:** 4.56 mm (.177 cal) air rifle pellets as provided by DND.

RESTRICTIONS

When the air rifle range is in use, doors leading directly into the active range area shall be locked and a sign shall be posted indicating: **"Live air rifle range is in progress – DO NOT ENTER"**. The following are areas of concern:

- Main access doors should be secured from the inside. The RSO is to verify that the doors are locked and cannot be opened from the outside.
- All pellets fired must be directed towards the stop butts (target frames).

COMMUNICATIONS

All communication on this range shall be made verbally or with range signal flags. Depending on the size of the range a megaphone (loud hailer) may be necessary.

SUPERVISION AND RANGE SAFETY OFFICERS

A qualified Range Safety Officer (RSO) shall be appointed to conduct the range practice by the cadet squadron Commanding Officer. Furthermore, only those individuals who have a valid Air Rifle RSO certificate are authorized to supervise the range.

The RSO is responsible for all aspects of the range exercise.

The RSO is to ensure the range area is strictly controlled.

The RSO is to ensure that all personnel have been instructed in the safe use and operation of the air rifle being used prior to firing.

The RSO will carry out an inspection of the range area and equipment to ensure serviceability.

Adult coaches and cadet coaches are permitted on the range; however, they shall be under the control of the RSO and follow all range rules and etiquette.

RANGE CONTROL FLAGS/LIGHTS/SIGNS

To indicate the range is in use:

- Range Control Flags at the entrance to the range area. The flag will be **red** when firing practice is being conducted and **green** when no firing is taking place
- Warning signs to all entrances to the range area will be posted so that they are visible to anyone attempting to enter.

FIRING POSITIONS

These range standing orders apply to the prone position only.

MEDICAL REQUIREMENTS

During all range exercises a suitable first aid kit shall be available and if possible, a qualified first aid person present. All range users are to be familiar with the location and contents of the First Aid Kit.

All personnel on the range shall wear safety goggles, or their own prescription safety glasses IAW A-CR-CCP-177/PT-001.

EMERGENCY CEASE FIRE

The RSO will ensure that all personnel understand the method of signalling a “CEASE FIRE”.

Once a “CEASE FIRE” has been ordered, the rifle’s safety catch is to be applied and the finger is to be removed from the trigger. The rifle is to be placed down and cadets are to wait for further instructions.

EMERGENCY PROCEDURES

1. In the case of serious injury to personnel:
2. The OIC/RSO of the range exercise shall immediately order a “CEASE FIRE” and shut down the range. The appointed first aid person will administer first aid.
3. Contact by phone will be made to emergency services or 911, depending on your local area provider.
4. The cadet squadrons’ Commanding Officer and applicable SO2 shall be notified immediately in the event of any range related accident. If the Commanding Officer is not available, the RSO shall notify the next person in the cadet corps chain of command, including the escort officer.
5. An incident or accident report (CF98/CF 2299 as applicable) shall be completed and forwarded to the cadet squadrons ‘Commanding Officer.
6. Safety personnel (fire, ambulance, police) are to be notified prior to entering the building that a range exercise was in progress at the time of the emergency and evacuation of the building.

RANGE LIGHTING

If overhead lights are not adequate, additional lighting may be provided by means of halogen lamps. These lamps shall be protected from the impact and deflection of pellets and as well as positioned on both sides of each firing lane as not to be in the direct line of fire of the pellets.

TARGETS

Only 10 metre approved air rifle targets will be used. These include grouping or application targets.

Cadets are authorized to fire on any to the following targets:

- Geometric shapes or silhouettes,
- CCT2001AR853 Competition Targets,
- CCT2000GRTD Air Rifle Grouping Target, and
- BT110’s.

SAFETY PRECAUTIONS

Rifles will be proved when picked up, handed to or received from another person.

Rifles are never to be pointed at another person.

Horseplay is forbidden on or near the range.

Rifles, whether loaded or not, will always be pointed down range.

The RSO and the range staff have the authority to remove rifles from the firing line and conduct inspections, adjustments or repairs as required. Any rifles handled off the range must be unloaded and proved prior to handling.

Smoking is not permitted in the building.

Eating is not permitted on or near the range or around pellets.

All personnel shall either read or be briefed on the contents of the Unit Range Standing Orders.

All persons having come into contact with lead pellets shall wash their hand thoroughly when finished firing.

The RSO's directions and orders are to be obeyed at all times.

ARCS OF FIRE AND ELEVATION

Rifles shall not be elevated above 30 degrees to eliminate arcs of fire.

RANGE CLEARANCE

All rifles are to be unloaded and proved by the RSO. The RSO may delegate this task to firing point assistants, but the overall responsibility for clearing rifles remains with the RSO.

A verbal declaration is to be made by all personnel who fired or worked during the exercise to confirm that no personnel have any pellets in their possession. The phrase to use is "I have no pellets in my possession, Sir/Ma'am".

All remaining unfired pellets are to be returned to the RSO or range assistants responsible for ammunition accounting.

The range area will be cleaned and returned to its proper setting.

CHANGE TO REGULATIONS

Should there be a change in DND, CF, GGFG or CCM regulations concerning any aspect of these orders, changes shall be made in accordance with established procedures.

These orders may be reviewed and subject to change with the approval of the squadron Commanding Officer, in accordance with references stated above.

AUTHORITY

The Range Standing Orders for the "Indoor Air Rifle Range" located at local squadron of the squadron Commanding Officer.

________________________________ Date: ________________

Commanding Officer
(Include full signature block)

ACTIVITY

STAR

Time: 60 min

OBJECTIVE

The objective of this activity is to generate and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Photocopies of star diagram.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Distribute one (1) photocopy of star diagram to each cadet.
2. Have each cadet write their name and rank on the star diagram.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will fire one pellet into each point of the star.
5. Give cadets five (5) minutes to fire the pellets.
6. On completion of activity or as time allows, place star diagrams out for all the cadets to review.
7. After viewing, all star diagrams they will be collected by the RSO to record results then return to the cadets.

SAFETY

In accordance with Unit Range Standing Orders.

STAR TARGET

D Cdts 3, 2006, Ottawa, ON: Department of National Defence

ACTIVITY

BEACH BALL

Time: 60 min

OBJECTIVE

The objective of the activity is to generate and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Photocopies of beach ball diagram.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Distribute one photocopy of beach ball diagram to each cadet.
2. Have each cadet write their name and rank on the beach ball diagram.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will be given ten pellets, to fire at the black circle.
5. Give cadets ten minutes to fire the pellets.
6. On completion of activity or as time allows, place beach ball diagram out for all the cadets to review.
7. After viewing, all beach ball diagrams, they will be collected by the RSO to record results. Return all beach ball diagrams to the cadets.

SAFETY

In accordance with Unit Range Standing Orders.

BEACH BALL TARGET

D Cdts 3, 2006, Ottawa, ON: Department of National Defence

ACTIVITY

NUMBER BLOCK

Time: 60 min

OBJECTIVE

The objective of this activity is to generate and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Photocopies of number block diagram.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Distribute one photocopy of number block diagram to each cadet.
2. Have each cadet write their name and rank on the number block diagram.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will be given six pellets to fire at the number(s) called by the RSO into the appropriate numerical Number Block.
5. Give cadets six minutes to fire pellets.
6. Cadets are only to fire once at each number and only when the RSO calls the number block.
7. On completion of activity or as time allows place number block diagrams out for all the cadets to review.
8. After viewing, all number block diagrams, they will be collected by the RSO to record results. Return all number block diagrams to the cadets.

SAFETY

In accordance with Unit Range Standing Orders.

NUMBER BLOCK TARGET

4		7		5
8		3		1
6		9		2

D Cdts 3, 2006, Ottawa, ON: Department of National Defence

ACTIVITY

CCT2001AR853

Time: 60 min

OBJECTIVE

The objective of this activity is to generate and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Use the CCT2001AR853 target.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Distribute one CCT2001AR853 target.
2. Have each cadet write their name and rank on the front CCT2001AR853 target.
3. When placing the target on the backstop the target will be placed so the diagrams can not be seen by the cadet. (This is a memory sighting drill.)
4. Cadets will fire in relays following the Range Commands by the RSO.
5. Cadets will be given twenty pellets to fire at their own time at the reverse target.
6. Only two pellets per diagram will be counted.
7. Give cadets fifteen minutes to fire pellets.
8. After viewing, all CCT2001AR853 targets, they will be collected by the RSO to record results. Return all CCT2001AR853 targets to the cadets.

SAFETY

In accordance with Unit Range Standing Orders.

THIS PAGE INTENTIONALLY LEFT BLANK

ACTIVITY

UNO CARDS

Time: 60 min

OBJECTIVE

The objective of this activity is to generate and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Six decks of uno cards.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Distribute ten uno cards to each cadet.
2. Have cadets write their name and rank on the back of the uno cards.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets are given twenty pellets to fire at the uno cards.
5. Cadets may only fire at the colour and number of card called by the RSO once. If they do not have the card, they do not fire a pellet. (RSO to ensure you call all numbers/colours of cards distributed.
6. Give cadets five minutes to fire pellets.
7. On completion of activity or as time allows place all uno cards out for all the cadets to review.
8. After viewing, all uno cards, they will be collected by the RSO to record results. Return the uno cards to the cadets.

SAFETY

In accordance with Unit Range Standing Orders.

THIS PAGE INTENTIONALLY LEFT BLANK

ACTIVITY

PYRAMID (TRIANGLE)

Time: 60 min

OBJECTIVE

The objective of this activity is to generate and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Photocopies of pyramid (triangle) target.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Distribute one pyramid target to each cadet.
2. Have each cadet write their name and rank on the pyramid target.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will be given three pellets to fire one (1) pellet into each point of the pyramid.
5. Give cadets three (3) minutes to fire pellets.
6. On completion of activity or as time allows place all pyramid targets out for the cadets to review.
7. After viewing, all pyramid targets, will be collected by the RSO to record results. Return all pyramid diagrams to cadets.

SAFETY

In accordance with Unit Range Standing Orders.

PYRAMID TARGET

D Cdts 3, 2006, Ottawa, ON: Department of National Defence

ACTIVITY

BALLOON

Time: 60 min

OBJECTIVE

The objective of this activity is to increase and maintain interest in the Cadet Marksmanship Program.

RESOURCES

- Photocopies of balloon diagram targets, or
- Purchase twenty packages of various shaped balloons for target shapes. When using real balloons blow them up prior to recreational marksmanship activity.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

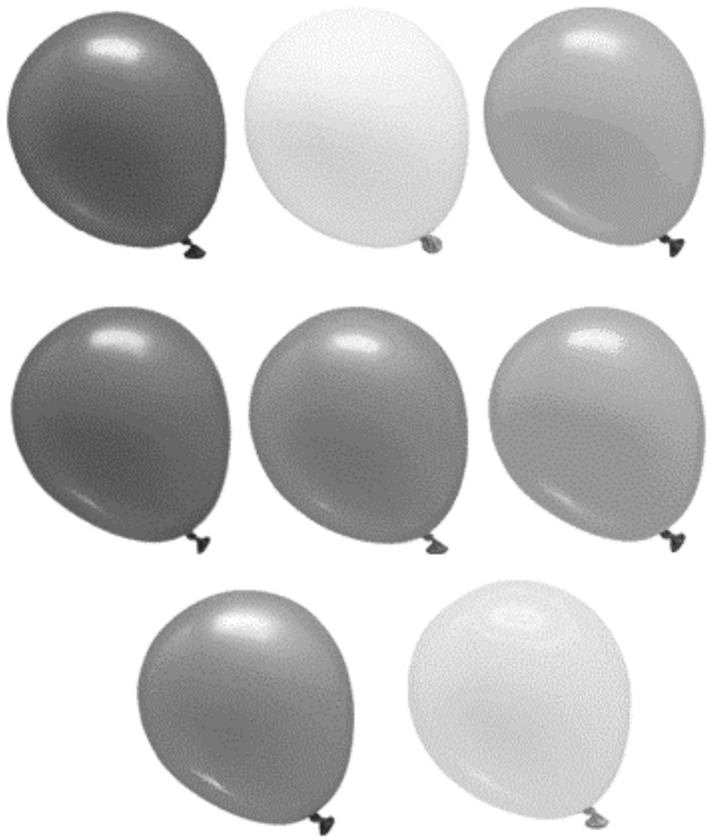
ACTIVITY GUIDELINES

1. Distribute five balloons or one balloon paper targets to each cadet.
2. Have each cadet write their name and rank on blank paper (score sheets to record number of hits) or balloon paper targets.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will be given ten pellets to fire on their on time at the balloon targets.
5. Give cadets five (5) minutes to fire pellets.
6. On completion of activity or as time allows place score sheets or balloon targets out for review for all cadets.
7. After viewing, all score sheets or paper targets, will be collected by the RSO to record results. Return score sheets or paper targets to cadet.

SAFETY

In accordance with Unit Range Standing Orders.

BALLOON TARGET



ACTIVITY

BT 100's

Time: 60 min

OBJECTIVE

The objective of this activity is to generate and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Position the required number of BT 100's for each lane on the range.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Designate firing lanes for each cadet.
2. Have cadets write their name and rank on the blank paper (score sheets) to record number of hits.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will be given an unlimited supply of pellets.
5. Give cadets ten (10) minutes to make all the plates fall on the BT 100.
6. On completion of activity or as time allows place all score sheets out for the cadets to review.
7. After viewing, all score sheets will be collected by the RSO to record results. Return score sheets to the cadets.

SAFETY

In accordance with Unit Range Standing Orders.

THIS PAGE INTENTIONALLY LEFT BLANK

ACTIVITY

BEAT THE CLOCK

Time: 60 min

OBJECTIVE

The objective of this activity is to increase and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Photocopies beat the clock diagram.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

ACTIVITY GUIDELINES

1. Distribute one photocopy of beat the clock diagram to each cadet.
2. Have each cadet write their name and rank on the beat the clock diagram.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will only fire at the hour number called by the RSO.
5. Cadets will be given six pellets, one pellet at each hour number designation called by the RSO. (Example if 1300 was called the cadets fires only at the 1 on the clock face.)
6. Give cadets six minutes to fire pellets.
7. On completion of activity or as time allows place all beat the clock diagrams out for cadets to review.
8. After viewing, all beat the clock diagram will be collected by the RSO to record results. Return all beat the clock diagrams to the cadets.

SAFETY

In accordance with Unit Range Standing Orders.

BEAT THE CLOCK TARGET

ACTIVITY

TIN CAN

Time: 60 min

OBJECTIVE

The objective of this activity is to increase and maintain interest in the Cadet Marksmanship Program.

RESOURCES

Photocopies of tin can diagram.

ACTIVITY LAYOUT

Air Rifle Range in accordance with Unit Range Standing Orders.

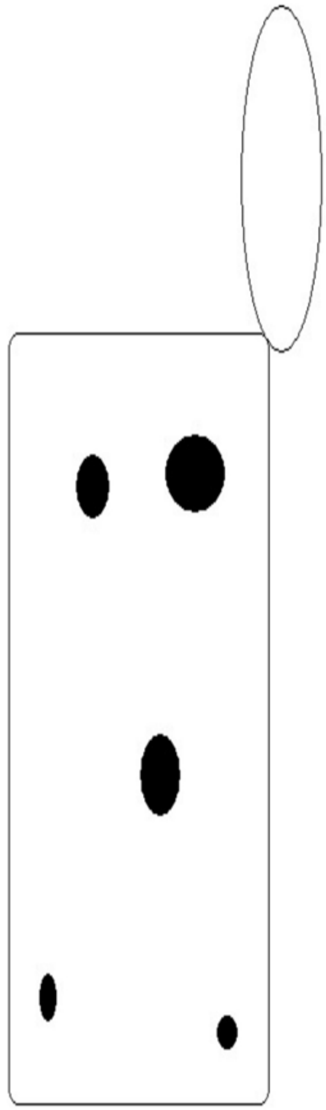
ACTIVITY GUIDELINES

1. Distribute one photocopy of tin can diagram to each cadet.
2. Have cadets write their name and rank on the tin can target.
3. Cadets will fire in relays following the range commands by the RSO.
4. Cadets will be given eight pellets to fire pellets into black circles on tin can.
5. Give cadet eight minutes to complete this diagram.
6. On completion of activity or as time allows place tin can targets out for all the cadets to review.
7. After viewing, all tin can targets will be collected by the RSO to record results. Return all tin can diagrams.

SAFETY

In accordance with Unit Range Standing Orders.

TIN CAN TARGET



Cdts 3, 2006, Ottawa, ON: Department of National Defence

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 2

EO C206.01 – PRACTICE HOLDING TECHNIQUES

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-802/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.

For comfort during this class, it is recommended that cadets be dressed in PT gear.

Ensure all cadet air rifle slings are properly assembled (except one for demonstration).

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration was chosen for TP1 and TP2 as it allows the instructor to explain and demonstrate the holding techniques that the cadet is expected to acquire.

Performance was chosen for TP3 as it provides an opportunity for the cadets to practice holding techniques under supervision.

INTRODUCTION

REVIEW

The review for this lesson is from EO M106.03 (Apply Basic Marksmanship Techniques), specifically adopting the prone position.

> Have an assistant instructor lie down on a mat and assume the prone position without the cadet air rifle sling. Allow the cadets two minutes to identify and/or correct aspects of the position.

OBJECTIVES

By the end of this lesson the cadet shall have practiced holding techniques.

IMPORTANCE

It is important for cadets to practice holding techniques using the cadet air rifle sling, as it will enhance the cadets' marksmanship skills through added stability of the firing position.

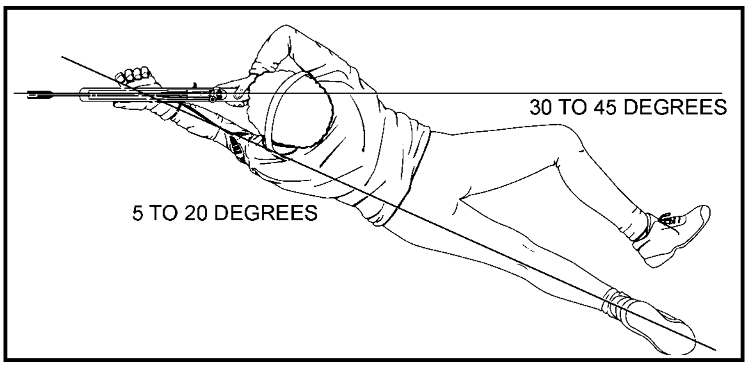
Teaching Point 1 — **Explain and Demonstrate Adopting the Prone Position**

Time: 5 min — Method: Demonstration

An assistant instructor may be used to demonstrate as the instructor explains the prone position.

THE PRONE POSITION

The first principle of marksmanship is to find a comfortable firing position. The prone position is the most stable firing position in which the cadet air rifle is supported by the body structure. The prone position requires little movement and muscular tension while holding the cadet air rifle, so that:



A-CR-CCP-177/PT-001 (p. 1-5-3)

Figure 1 Prone Position

- the bodyweight is equally distributed;
- the position is consistent throughout the relay;
- the body forms a 5 to 20 degree angle to the line of sight with the target;
- the body and spine are straight;
- the left leg is parallel with the spine;
- the right foot is straight out or turned to the right;
- the left foot is straight behind on the toe or pointed to the right; and
- the right knee is brought up so the thigh forms a 30 to 45 degree angle with the left leg.

By bending the right knee, stability is improved. This causes the body to roll slightly, raising the chest off the ground to improve breathing and to minimize body movement caused by a normal heartbeat.

CONFIRMATION OF TEACHING POINT 1

The cadets' participation in the holding technique activity in TP3 will serve as the confirmation of this TP.

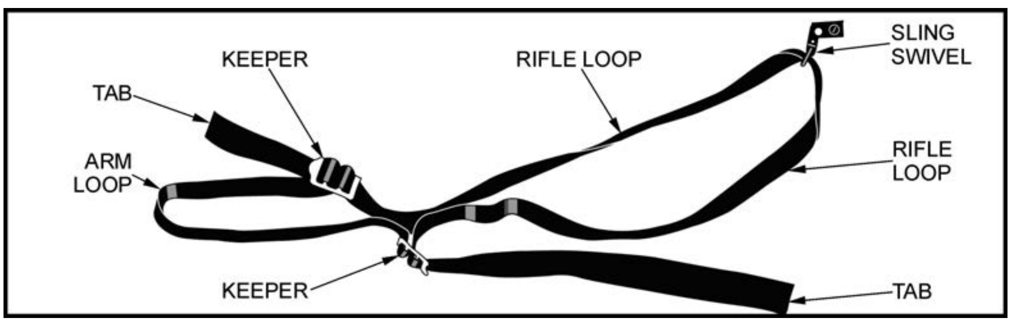
Teaching Point 2 — **Explain and Demonstrate Holding Techniques Using the Cadet Air Rifle Sling**

Time: 10 min — Method: Demonstration

The cadet air rifle sling helps the cadet maintain a comfortable and stable position, improving the ability to hold the cadet air rifle. It also allows the right hand to be free to load the air rifle while the rifle remains in position.

Arrange the cadets so they can all hear the explanation and see the demonstration.

ASSEMBLING THE SLING



A-CR-CCP-121/PT-001, Royal Canadian Army Cadet Reference Book (p. 6-17)

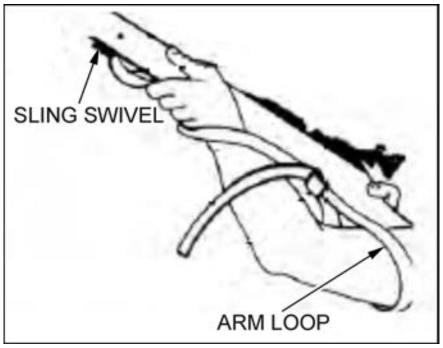
Figure 2 Cadet Air Rifle Sling

The cadet air rifle sling is assembled in the following sequence:

1. Hold the sling parallel to the ground with the short section in the left hand, ensuring the rounded tip of the keeper is pointing to the left.
2. Take the tab of the short section, loop it through the middle slot of the keeper and then back down through the front slot nearest to the rounded tip. The short section will now form the arm loop.
3. Turn the sling over and slide the sling swivel onto the long section. Ensure the sling swivel hangs downwards, as it will later attach to the rifle.
4. Loop the tab of the long section up through the middle slot of the keeper and then back through the rear slot nearest to the rounded tip. The long section will now form the rifle loop.

An assistant instructor can be used to demonstrate as the instructor explains wearing, adjusting and attaching the cadet air rifle sling.

POSITIONING THE SLING ON THE ARM

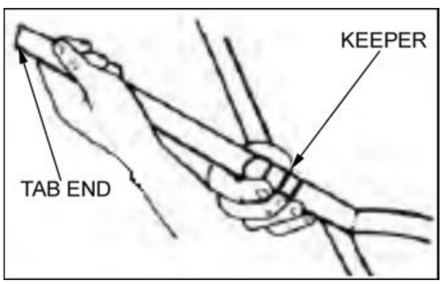


Daisy Outdoor Products, Operational Manual – Avanti Legend EX Model 853C, Daisy Outdoor Products (p. 7)

Figure 3 Positioning Sling

The sling arm loop should be positioned on the upper part of the arm, above the bicep muscle near the shoulder. The sling can be held in place by the rubber pad on a shooting jacket. When a shooting jacket is not worn, the sling can be kept in place using a safety pin. This will prevent the sling from slipping down the arm while in the prone position.

ADJUSTING THE ARM LOOP

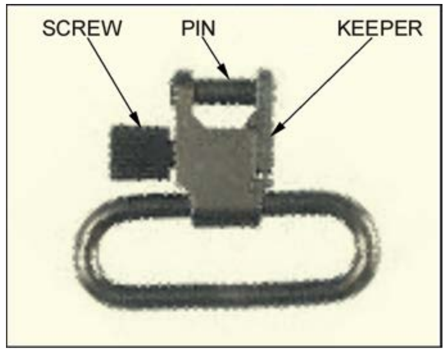


Daisy Outdoor Products, Operational Manual – Avanti Legend EX Model 853C, Daisy Outdoor Products (p. 8)

Figure 4 Adjusting Arm Loop

To adjust the arm loop, pull the tab away from the keeper. If the sling is too loose, it will not fully support the cadet air rifle and it will have to be kept in place using muscles. If the sling is too tight, it will restrict the blood flow to the arm and can cause discomfort, numbness, or a more pronounced feel of the body's pulse. Therefore, the sling must be comfortable without pinching the arm, while providing maximum support of the cadet air rifle.

ATTACHING THE SLING TO THE CADET AIR RIFLE



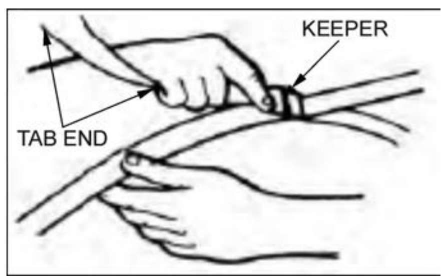
D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure 5 Sling Swivel

To attach the sling to the cadet air rifle, simply:

1. open the keeper on the sling swivel by pressing on the screw;
2. insert the swivel pin into the hole of the sling swivel on the fore end of the rifle; and
3. screw the keeper over the pin to lock the swivel in place.

ADJUSTING THE RIFLE LOOP



Daisy Outdoor Products, Operational Manual – Avanti Legend EX Model 853C, Daisy Outdoor Products (p. 8)

Figure 6 Adjusting Rifle Loop

To adjust the rifle loop, pull the tab away from the keeper. The tension of the sling should allow the forearm to be in its proper position. If the sling is too loose, it will not provide maximum support of the cadet air rifle. If the sling is too tight, it could cause discomfort and affect the cadet's position.

CONFIRMATION OF TEACHING POINT 2

The cadets' participation in the holding technique activity in TP3 will serve as the confirmation of this TP.

Teaching Point 3 | **Conduct a Holding Technique Activity**

Time: 10 min | Method: Performance

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets adopt the prone position, positioning the sling on the arm, adjusting the arm loop, attaching the sling to the air rifle, and adjusting the rifle loop.

RESOURCES

- Cadet air rifle (one per firing lane).
- Cadet air rifle sling (one per air rifle).
- Shooting mat (one per firing lane).

ACTIVITY LAYOUT

An air rifle range constructed IAW A-CR-CCP-177/PT-001, Chapter 1, Section 8. If a range is not available, set up the training area to have a defined mock firing point. The assistant instructor shall be used to confirm the cadet's position.

ACTIVITY INSTRUCTIONS

1. Divide cadets into equal groups according to the number of cadet air rifles.
2. Have each group of cadets take turns lying down on mats and assume the prone position.
3. With assistance, allow the cadets to practice the prone position as taught.
4. Have cadets position the sling on the arm and adjust the arm loop.
5. Have cadets attach the sling to the air rifle and put the cadet air rifle into the shoulder.
6. Have cadets adjust the rifle loop of the sling.
7. Have cadets adjust their prone position.
8. Inspect each cadet for proper placement of the sling on the arm and tension of the sling loops.
9. Repeat steps as required, within the allotted time.

SAFETY

Ensure that the cadet air rifles are pointed in a safe direction at all times. Cadets will treat air rifles as though they are loaded.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

The cadets' participation in the holding technique activity in TP3 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The prone position and the cadet air rifle sling are essential to improving marksmanship techniques. With practice using the sling in the prone position, cadets can improve their technique and their marksmanship score.

INSTRUCTOR NOTES/REMARKS

Instructions may be modified for left-handed cadets (e.g. switching left hand/foot when instructions call for right hand/foot).

This EO is intended to enhance and further develop techniques taught in EO M106.03 (Apply Basic Marksmanship Techniques).

REFERENCES

A0-027 A-CR-CCP-177/PT-001 D Cdts 3. (2001). *Canadian Cadet Movement: Cadet Marksmanship Program Reference Manual.* Ottawa, ON: Department of National Defence.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 3

EO C206.02 – PRACTICE AIMING TECHNIQUES

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration and performance was chosen for TP1 and TP3 as it allows the instructor to explain and demonstrate aiming techniques while providing an opportunity for the cadets to practice these skills under supervision.

An interactive lecture was chosen for TP2 to introduce the aspects of aiming.

INTRODUCTION

REVIEW

Review the following points from EO M106.03 (Apply Basic Marksmanship Techniques).

- The aiming process is achieved by adopting a comfortable prone position and ensuring body alignment with the target.
- Sight alignment is the alignment of the eye, the rear sight, and the front sight.
- The sight picture is obtained by keeping the bull's-eye centred with the circles of the front sight and rear sight.

OBJECTIVES

By the end of this lesson the cadet shall have practiced aiming techniques.

IMPORTANCE

It is important for cadets to practice aiming techniques while wearing the cadet air rifle sling as it will enhance the cadets' marksmanship skills through added stability of the firing position.

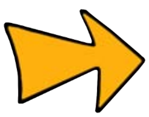
Teaching Point 1 | **Explain, Demonstrate and Have Cadets Practice Proper Eye Usage**

Time: 15 min | Method: Demonstration and Performance

Before completing a manual task, it must first be determined which hand or foot to use. Is one left or right-handed? The same is true for sight; it must first be determined the proper eye to use when aiming the cadet air rifle. To do this cadets' must determine their master eye, learn to fire with both eyes open and avoid fixed vision.

DETERMINING THE MASTER EYE

Everyone has a master eye, which is the brain's main source for the visual image of what we see. The non-master eye is used by the brain for depth perception or sense of direction. The master eye is the eye to be used when aiming the cadet air rifle.



The master eye is usually on the same side of the body as the dominate hand. If your master eye is opposite from your dominate hand, you should try firing on the side of your master eye.

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets determine their master eye.

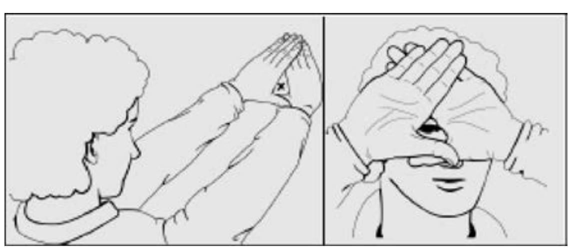
RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS



A-CR-CCP-177/PT-001 (p. 1-5-2)

Figure 1 Determining the Master Eye

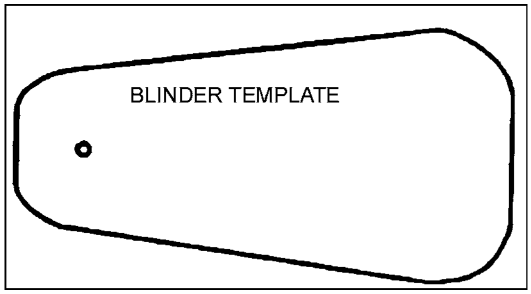
1. Have cadets stand and face away from each other.
2. Select a small object preferably at least 5 m away.

3. Face the object and extend both arms in front of the face.
4. Form a small triangle opening around the object with both hands.
5. Look through the opening at the object, and draw the hands back towards the face.
6. Ensure the object remains centred through the opening of the hands.
7. Cadets should be looking at the object through the opening with one single eye (the stronger of the two). This is their master eye.

SAFETY

N/A.

FIRING WITH BOTH EYES OPEN



A-CR-CCP-177/PT-001 (p. 1-5-2)

Figure 2 Blinder Template

The human eyes are always working together. If one eye is closed, the opposite eye will strain and affect focusing of the open eye.

Some cadets will have difficulty focusing, so a blinder should be used in front of the non-aiming eye to help prevent squinting and fatigue. The blinder allows the cadets to see a focused sight picture while having both eyes open.

A good blinder should be translucent (plastic or paper) so that images are blocked, but light can still penetrate it. It should be easily attachable to the rear sight or to the cadet's glasses.

Have cadets look at a spot on the wall with both eyes open, then have cadets hold a blank piece of white paper in front of their non-aiming eye. The object should come into a clear focus.

AVOIDING FIXED VISION

When anyone's vision is fixed on one object for more than a few seconds, such as a target bulls-eye, the image can be burned in their mind and a "ghost" image can be seen when glancing to the side. It is important for cadets to avoid this fixed vision during marksmanship training, as it may result in a loss of visual perception and can greatly hinder performance. To avoid fixed vision, cadets need only to blink or slightly shift their vision every four to five seconds.

CONFIRMATION OF TEACHING POINT 1

The cadets' participation in determining the master eye will serve as the confirmation of this TP.

Teaching Point 2 | **Identify and Explain Aspects of Aiming**

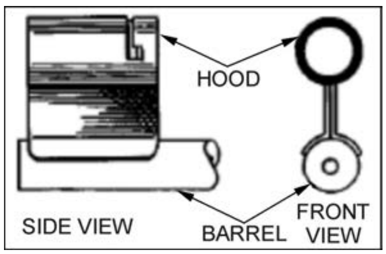
Time: 25 min | Method: Interactive Lecture

Before cadets can aim the cadet air rifle with accuracy, they must first identify aspects of aiming. To do this cadets must understand that the sight system of the cadet air rifle, natural head position, and eye relief all work together when aiming.

SIGHT SYSTEM OF THE CADET AIR RIFLE

The sight system of the cadet air rifle is made up of two main components – the front sight and the rear sight.

Explain to the cadets that the front and rear sights of the cadet air rifle must be used together when acquiring a sight picture.

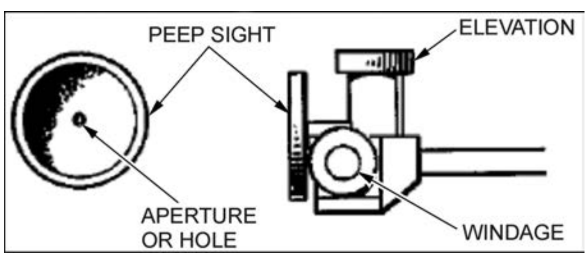


A-CR-CCP-177/PT-001 (p. 1-5-5)

Figure 3 Front Sight

Front Sight. The front sight of the cadet air rifle is made of a short tube, which is called a hood. The hood is designed to shield the front sight from overhead and side light. The most common front sights used for the cadet air rifle is the aperture or circle sight. The aperture is inserted in the hood through a slit on the top.

The adjusting of the sights on the cadet air rifle will be covered in Year Three. Instruct the cadets that they are not to make any adjustments to the sights.



A-CR-CCP-177/PT-001 (p. 1-5-5)

Figure 4 Rear Sight

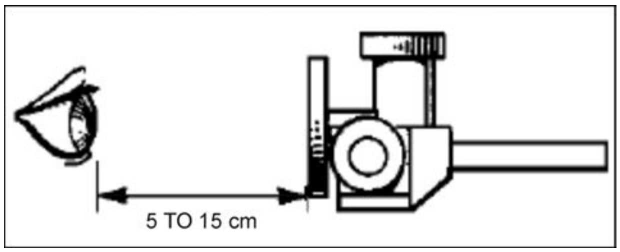
Rear Sight. The adjustable rear sight of the cadet air rifle has three main parts; peep sight, elevation knob, and windage knob.

- **Peep Sight.** The peep sight is the penny-sized dish-shaped part at the rear of the sight. It has a small hole in the centre to look through.
- **Elevation Knob.** The elevation knob is on the top of the sight and moves the point of impact on the target up or down.
- **Windage Knob.** The windage knob is on the side of the sight and moves the point of impact on the target left or right.

NATURAL HEAD POSITION

The head should be kept as close as possible to a natural position, allowing the eyes to look straight forward from the eye socket. It is perfectly normal to tilt the head forward slightly, but cadets must resist allowing it to tilt to the left or right as this may affect their sense of balance.

EYE RELIEF



A-CR-CCP-177/PT-001 (p. 1-5-6)

Figure 5 Eye Relief

Eye relief is the distance between the eye and the peep sight on the rear sight. Depending on an individual's build and position, the distance is usually 5 to 15 cm. Eye relief should be comfortable, natural and allow the head to be as erect as possible during the firing process. It is important to maintain the same eye relief from shot to shot and to find an eye relief that allows a circle of light to be seen around the front sight while looking through the rear sight. If the eye relief is less than 5 cm, the line of white around the front sight becomes larger, making the sight picture more difficult to keep aligned.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What are the two main components of the cadet air rifle sight system?

Q2. What are the three parts of the rear sight?

Q3. What is the usual distance for eye relief?

ANTICIPATED ANSWERS

A1. The front and rear sights.

A2. The peep sight, elevation knob and windage knob.

A3. 5 to 15 cm.

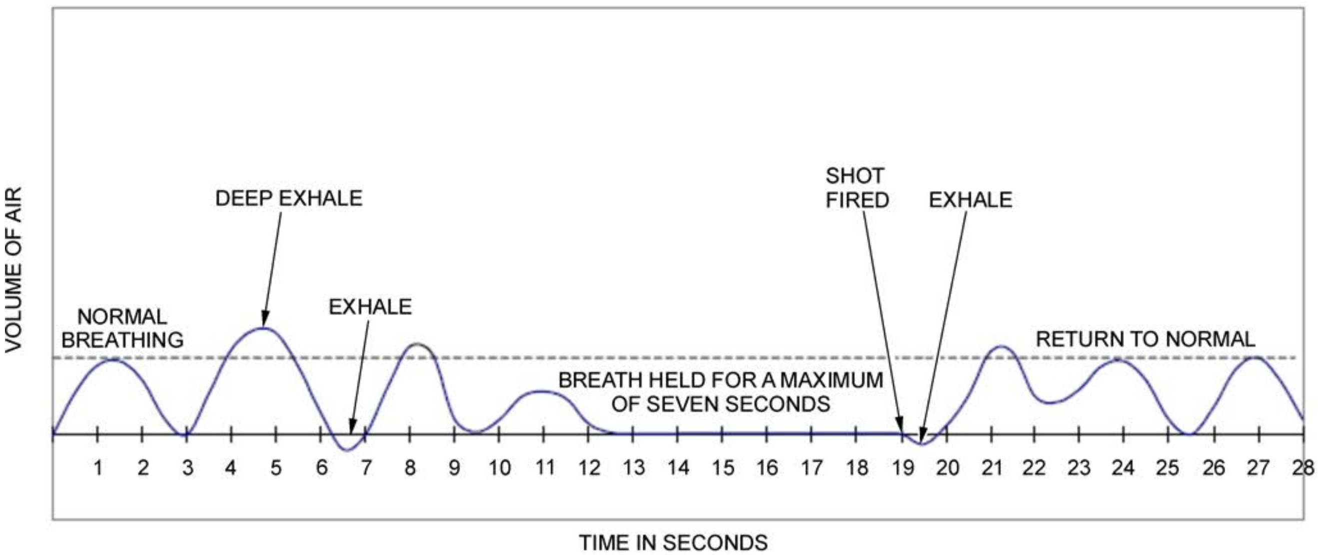
Teaching Point 3 | **Explain, Demonstrate and Have Cadets Practice Marksmanship-related Breathing**

Time: 15 min | Method: Demonstration and Performance

Breathing supplies the blood stream with oxygen and eliminates waste elements (such as carbon dioxide) from the blood. While breathing, the oxygen inhaled is used to supply muscles with energy, ensuring optimal potential of the muscles. Just like in sports, controlled breathing can affect marksmanship outcomes.

CONTROLLED BREATHING

Once a stable prone position is established, cadets must integrate the principles of controlled breathing. For maximum stability when firing, cadets will have to hold their breath for five to seven seconds. It is very important that they do not hold their breath for more than seven seconds, as tension will increase in the chest, muscles will lack oxygen and stability will be reduced. When the body lacks oxygen, muscles will quiver and eyesight will be negatively affected.



A-CR-CCP-177/PT-001 (p. 1-5-9)

Figure 6 Breathing Cycle

ACHIEVING A CONTROLLED BREATHING SEQUENCE

During the breathing sequence, cadets should confirm that the cadet air rifle is moving up and down and it is not canted. Also, when breathing in and out, cadets can visually confirm that they are aiming on the proper diagram.

ACTIVITY

Time: 10 min

OBJECTIVE

The objective of this activity is to have cadets practice a controlled breathing sequence.

RESOURCES

- Cadet air rifles (one per firing lane).
- Cadet air rifle slings (one per air rifle).
- Cadet air rifle safety rods (one per air rifle).
- Suitable targets (one per firing lane).

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into groups based on the number of air rifles available.
2. Have cadets adopt the prone position using the cadet air rifle sling.
3. Have the cadets relax and breathe normally.
4. Have the cadets obtain a sight picture.
5. Have the cadets inhale and exhale deeply.
6. Have the cadets inhale deeply and exhale normally.
7. Have the cadets relax the chest muscles, hold a breath for 5 to 7 seconds and squeeze the trigger.
8. Have the cadets exhale completely and resume normal breathing.

It is important for cadets not to fire if they feel they want to take another breath. Their shot will not be perfect and their end result will be affected. Relaxed breathing decreases “vibrations” caused by tension.

SAFETY

Ensure control at all times. Cadets will treat air rifles as though they are loaded.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What is the master eye used for in marksmanship?

Q2. How much eye relief is between the eye and the rear sight?

Q3. During a controlled breathing sequence, what direction should the cadet air rifle move?

ANTICIPATED ANSWERS

A1. To aim the cadet air rifle.

A2. 5 to 15 cm.

A3. Up and down.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Breathing is essential to marksmanship as it supplies the muscles with oxygen and helps the cadet to maintain the prone position. With practice using the controlled breathing sequence, cadets can improve their aiming of the cadet air rifle and marksmanship scores can improve.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-027 A-CR-CCP-177/PT-001 D Cdts 3. (2001). *Canadian Cadet Movement: Cadet Marksmanship Program Reference Manual.* Ottawa, ON: Department of National Defence.

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 4

EO C206.03 – PRACTICE FIRING TECHNIQUES

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-802/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.

For comfort during this class, it is recommended that cadets be dressed in PT gear.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration and performance was chosen for TP1 as it allows the instructor to explain and demonstrate firing techniques while providing an opportunity for the cadets to practice these skills under supervision.

Demonstration was chosen for TP2 as it allows the instructor to explain and demonstrate trigger control.

An interactive lecture was chosen for TP3 to present basic material on follow-through.

INTRODUCTION

REVIEW

The review for this lesson is from EO M106.03 (Apply Basic Marksmanship Techniques). The sequence required to fire the cadet air rifle when the RSO gives the command "Fire", will include:

1. place safety catch in the OFF position;
2. aim the cadet air rifle at the target;
3. squeeze the trigger;
4. open the bolt, pump the rifle, reload, aim and fire;
5. repeat the last step until firing is complete;

6. upon completion, place the safety catch in the ON position and partially open the pump lever; and
7. lay down the cadet air rifle.

OBJECTIVES

By the end of this lesson the cadet shall have practiced firing techniques.

IMPORTANCE

It is important for cadets to practice natural alignment, trigger control and follow-through when firing the cadet air rifle, as it helps cadets achieve a stable prone position and sight picture.

Teaching Point 1	**Explain, Demonstrate and Have the Cadets Practice Natural Alignment**
Time: 15 min	Method: Demonstration and Performance

NATURAL ALIGNMENT

With the use of an assistant instructor, demonstrate and explain natural alignment as listed below, prior to cadets practicing this procedure.

Natural alignment describes the direction that the cadet air rifle is aimed when the marksman is in the prone position with the cadet air rifle at the ready. In a comfortable position, the cadet air rifle should not be forced to point at the target. Even with a perfect prone position and sight alignment, forcing the air rifle can cause muscle tension and will affect the accuracy of each shot.

Natural alignment is obtained by:

1. adopting a comfortable prone position;
2. acquiring a sight picture;
3. closing both eyes;
4. taking several normal breaths to relax the muscles;
5. looking through sights when comfortable;
6. adjusting body position until a proper sight picture is achieved; and
7. proceeding with firing.

ACTIVITY

Time: 10 min

OBJECTIVE

The objective of this activity is to have cadets practice natural alignment.

RESOURCES

- Cadet air rifle (one per firing lane).
- Cadet air rifle safety rod (one per rifle).
- Shooting mat (one per firing lane).
- Suitable target (one per firing lane).

ACTIVITY LAYOUT

Construct an air rifle range IAW A-CR-CCP-177/PT-001, Chapter 1, Section 8. If a range is not available, set up the training area to have a defined mock firing point. Ensure that the air rifles are pointed in a safe direction at all times.

ACTIVITY INSTRUCTIONS

1. Divide cadets into equal groups according to the number of cadet air rifles available.
2. Have cadets lie on the mats and assume the prone position using the cadet air rifle and sling.
3. Cadets will acquire a sight picture by aligning the eye, rear sight, front sight, and the target bull's eye.
4. When cadets have a sight picture, have them close their eyes.
5. Have cadets relax by taking 3 to 4 normal breaths.
6. After approximately 10 seconds, have cadets open their eyes and inspect their sight picture.
7. Cadets shall adjust their bodies to re-acquire an accurate sight picture.
8. Repeat steps 4 to 9, as required, within the allotted time.

SAFETY

Ensure control at all times. Cadets will treat cadet air rifles as though they are loaded.

CONFIRMATION OF TEACHING POINT 1

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

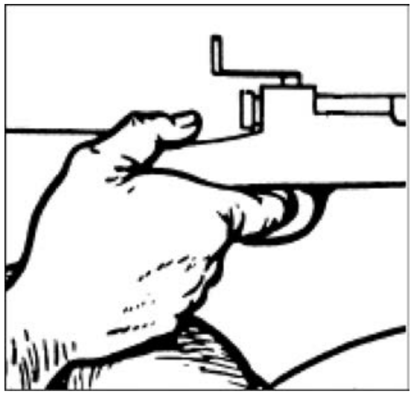
Teaching Point 2	**Demonstrate and Explain Trigger Control**
Time: 5 min	Method: Demonstration

TRIGGER CONTROL

With the use of an assistant instructor, allow the cadets to observe the demonstration and hear the explanation for each aspect of trigger control as listed below.

Trigger control is the handling of the trigger in such a way that there is no disturbance. It must be constant, controlled, slow and deliberate.

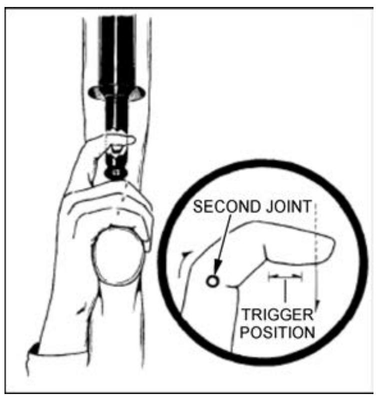
Position of the Hand on the Rifle. Cadets should have a relatively firm grip so the three lower fingers wrap around the small of the butt. The thumb is pointed forward in a relaxed position behind the rear sight along the rifle stock, or wrapped around the small of the butt.



D Cdts 5, Royal Canadian Army Cadets Visual Aids Rifle Shooting Figures, Department of National Defence (p. 11)

Figure 1 Position of the Hand on the Rifle

Trigger Finger Position. The index finger is placed on the trigger halfway between the tip of the finger and the first joint. The index finger never touches the stock of the rifle and must be vertically centred on the trigger.



A-CR-CCP-177/PT-001 (p. 1-5-9)

Figure 2 Trigger Finger Position

Squeezing the Trigger. Squeezing the trigger is simply applying pressure to the trigger, by bending the second joint of the index finger straight to the rear. While the breath is being held, apply constant pressure and slowly squeeze the trigger. Trigger pressure is to be applied only when ready to fire.

CONFIRMATION OF TEACHING POINT 2

The cadets' observation of the trigger control demonstration will serve as the confirmation of this TP.

Teaching Point 3 | **Define Follow-through**

Time: 5 min | Method: Interactive Lecture

FOLLOW-THROUGH

Since no pellets will be fired, position the cadets so they may observe an assistant instructor perform a simulation and hear the explanation of follow-through.

Follow-through is defined as the act of remaining in a stable prone position for two seconds and reacquiring the sight picture after firing the air rifle. Follow-through is critical to ensuring there is no movement as the cadet air rifle is being fired. If the cadet moves the cadet air rifle during firing, the pellet will not hit the target in the spot that it was aimed. Ensuring proper follow-through allows cadets to improve their skills, and their score.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. How long must a stable position be held after firing the cadet air rifle?

Q2. What will happen to a pellet during follow-through?

Q3. If the rifle moves before the pellet leaves the muzzle, how will it affect the target?

ANTICIPATED ANSWERS

A1. A stable position must be held for two seconds.

A2. It will leave the muzzle.

A3. The pellet will not hit the target in the spot that it was aimed.

END OF LESSON CONFIRMATION

The cadets' participation in marksmanship activities using natural alignment, trigger control and follow-through, will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Natural alignment, trigger control and follow-through are essential to developing marksmanship skills. They help cadets maintain a stable position and sight picture when firing the cadet air rifle. With practice using these firing techniques, cadets can improve their skills and their score.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-027 A-CR-CCP-177/PT-001 D Cdts 3. (2001). *Canadian Cadet Movement: Cadet Marksmanship Program Reference Manual.* Ottawa, ON: Department of National Defence.

CHAPTER 7

PO 207 – SERVE IN AN AIR CADET SQUADRON

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M207.01 – IDENTIFY PROFICIENCY LEVEL TWO TRAINING OPPORTUNITIES

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-802/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. Set up stations around the classroom with information from each PO. Place the PO name and number at each of the various stations.

Photocopy the handout located at Annex A for each cadet. Photocopy Annexes B, C and D.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 and TP3 as it is an interactive way to provoke thought and to stimulate interest among cadets.

An interactive lecture was chosen for TP2 to introduce Proficiency Level Two training to the cadets and to generate interest in the topics.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify the training they will receive in Proficiency Level Two.

IMPORTANCE

It is important for cadets to know what training will be conducted during Proficiency Level Two to give them an overview of what the training year will entail. This lesson will prepare the cadets for the training year and help generate interest in the topics.

Teaching Point 1 **Identify Proficiency Level Two Mandatory Training**

Time: 15 min Method: In-Class Activity

OVERVIEW

The training program is broken into Performance Objectives (POs), which are the overall subjects, and Enabling Objectives (EOs), which are the topics within each PO. Training is conducted as mandatory and complementary components.

MANDATORY TRAINING

Mandatory training encompasses the EOs that all squadrons must complete throughout the training year.

ACTIVITY

OBJECTIVE

The objective of this activity is for the cadets to participate in a gallery walk of information for each PO.

RESOURCES

Resources will be IAW with each PO as listed below.

ACTIVITY LAYOUT

Classroom will be set up with a station for each PO with information, pictures, videos, and other training aids at each station that will exemplify what the cadet will learn in each PO.

PO 201 – Citizenship

Citizenship provides the cadets an opportunity to identify the role of an environmentally conscious Canadian citizen. The cadets will identify the rights and responsibilities of a Canadian citizen and the Government of Canada's *Code of Environmental Stewardship*.

Examples of information/training aids that could be set up at this station include:

- a Pollution Prevention Activity Poster;
- a poster of the rights and responsibilities of Canadian citizens;
- posters of various symbols of Canada (Royal Arms of Canada, National Flag, etc.);
- a poster of the *Code of Environmental Stewardship* (located at Annex D);
- a spill kit; and
- pictures from various citizenship activities in which the squadron has participated.

Note:

1. Pollution Prevention Activity Posters can be ordered by contacting Lori.Fryzuk@ec.gc.ca.
2. Posters of various symbols of Canada (The Proclamation of the National Flag of Canada, The Declaration of National Flag of Canada Day, The Royal Arms of Canada, and a poster of the National Flag of Canada) can be ordered by calling 1-866-811-0055.
3. If posters can not be obtained, samples are located at Annex C.

PO 202 – Community Service

Community Service provides the cadets an opportunity to perform community service. The community service should provide a direct benefit to the community and promote good citizenship.

Examples of information/training aids that could be set up at this station include:

- Pictures from various community service activities in which the squadron has participated; and
- Cadets Caring for Canada posters.

PO 203 – Leadership

Leadership provides the cadets an opportunity to demonstrate leadership attributes within a peer setting by positively contributing to a group, displaying a positive attitude toward learning, and being accountable for personal actions and choices.

Examples of information/training aids that could be set up at this station include:

- pictures of various famous leaders;
- leadership quotes; and
- pictures of cadets from the squadron participating in leadership activities/taskings.

PO 204 – Personal Fitness and Healthy Living

Personal Fitness and Healthy Living provides the cadets an opportunity to update their personal physical activity plans (from Proficiency Level One) for the training year. Cadets will participate in the Progressive Aerobic Cardiovascular Endurance Run (PACER) and will set new short-term and long-term goals for the training year.

This PO gives the cadets some of the tools required to make more informed choices in order to follow a healthy lifestyle. This is important as physical fitness is one of the aims of the Cadet Program.

Examples of information/training aids that could be set up at this station include:

- target heart rate charts;
- a CD/tape player with the audio recording of the PACER beeps playing; and
- copies of the PACER Individual Score Sheet.

PO 205 – Recreational Sports

Recreational Sports provides the cadets the opportunity to participate in organized recreational team sports. This is important as physical fitness is one of the aims of the Cadet Program.

Examples of information/training aids that could be set up at this station include:

- soccer ball,
- volleyball,
- floor hockey ball,
- hockey sticks,
- frisbees, and
- pictures of cadets at the squadron participating in recreational sports.

PO 206 – Air Rifle Marksmanship

Air Rifle Marksmanship provides the cadets an opportunity to participate in recreational marksmanship activities.

A miniature range could be set up at this station, to include:

- a mat,
- a cadet air rifle,
- sample targets,
- a scope,
- a sling, and
- safety goggles/glasses.

PO 207 – General Cadet Knowledge

General Cadet Knowledge provide the cadets with the information required to serve as a member of an Air Cadet squadron. Cadets will identify the training opportunities available in Proficiency Level Two, recognize historical aspects related to Air Cadets, recognize the role of the local sponsor, and identify year two summer training opportunities.

Examples of information/training aids that could be set up at this station include:

- a poster of the history of Air Cadets (sample located at Annex D); and
- information sheets/poster on year two summer training opportunities.

PO 208 – Drill

Drill provides the cadets an opportunity to execute drill as a member of a squad. The cadets will execute left and right turns on the march, form single file from the halt as a squad in threes, and form single file from the halt as a squad in line.

Examples of information/training aids that could be set up at this station include:

- a copy of A-PD-201-000/PT-000, *The Canadian Forces Manual of Drill and Ceremonial*;
- pictures of the cadets in the squadron participating in drill; and
- a video of cadets participating in drill.

PO 230 – Aviation History

Aviation History provides the cadets an opportunity to discuss Canadian aviation history. Cadets will discuss the Battle of Britain, Remembrance Day, the Battle of the Atlantic and D-Day.

Examples of information/training aids that could be set up at this station include:

- pictures of planes that were flown during these events; and
- pictures/video of the squadron participating in these parades.

PO 231 – Principles of Flight

Principles of Flight provides the cadets an opportunity to explain the principles of flight by identifying the four forces that act upon an aircraft, describing the production of lift, describing the types of drag, describing the aircraft axis movement and describing aircraft control surfaces.

Examples of information/training aids that could be set up at this station include:

- an example of a wind tunnel;
- models of the Colditz paper glider;
- pictures of aircraft affected by the four forces that act upon an aircraft; and
- a picture of a cross-section of an airfoil.

PO 232 – Propulsion

Propulsion provides the cadets an opportunity to identify the characteristics of piston-powered aircraft. Cadets will identify types of engines, the components of an internal combustion engine, the four-stroke cycle and the functions of oil.

Examples of information/training aids that could be set up at this station include:

- pictures of the various types of engines; and
- pictures of the various types of planes that use these engines.

PO 240 – Aerospace

Aerospace provides the cadets an opportunity to participate in aerospace activities by simulating communicating in space, surviving in space and inventing a space technology item.

Examples of information/training aids that could be set up at this station include:

- past examples of space technology items created by cadets;
- past examples of ideas from cadets about communicating in space; and
- current pictures and/or information about space technology.

PO 260 – Aerodrome Operations

Aerodrome Operations provides the cadets an opportunity to participate in aerodrome operations activities. Cadets will identify aspects of basic airport operations and air traffic control.

Examples of information/training aids that could be set up at this station include:

- a mock-up of a model aerodrome; and
- lighted wands with instructions about performing marshalling.

PO 270 – Aircraft Manufacturing and Maintenance

Aircraft Manufacturing and Maintenance provides the cadets an opportunity to discuss aircraft fabrication and maintenance. Cadets will discuss avionics, aircraft systems, airframes and employment opportunities.

Examples of information/training aids that could be set up at this station include:

- pictures and/or written information about aircraft systems;
- current employment opportunities in the field;
- a set-up of the online CAMC Interactive Multimedia Learning Tool; and
- a video of the *World’s Biggest Airliner: The Airbus A380 – Coming Together*.

PO 290 – Aircrew Survival

Aircrew Survival provides the cadets an opportunity to participate in a field exercise. Cadets will construct, light, maintain and extinguish a signal fire, construct a lean-to-style shelter, construct a simple snare, construct ground-to-air signals, identify hiking techniques and operate a hand-held radio.

Examples of information/training aids that could be set up at this station include:

- pictures of cadets on a field exercise;
- examples of proper footwear;
- a mock-up of a signal fire; and
- a mock-up of ground-to-air signals.

ACTIVITY INSTRUCTIONS

Explain that cadets will have approximately 10 minutes to walk around the classroom, visiting each station.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

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

Teaching Point 2	**Identify Proficiency Level Two Complementary Training Opportunities**
Time: 5 min	Method: Interactive Lecture

Complementary training provides squadron staff with a variety of EOs they can choose to instruct. These lessons are used to complement the mandatory training that must be conducted.

PO 201 – Citizenship

Complementary training for Citizenship provides the cadets an opportunity to discuss environmental issues relative to Canada; tour a local municipal, provincial, or national political institution; tour a local municipal, provincial, or national environmental facility; participate in a presentation given by an environmental guest speaker; and participate in a presentation given by a government representative.

PO 202 – Community Service

Complementary training for Community Service provides the cadets an opportunity to participate in a ceremonial parade and an additional opportunity to perform community service.

PO 203 – Leadership

Complementary training for Leadership provides the cadets an opportunity to record entries in a reflective journal, employ problem solving, participate in team-building activities, discuss characteristics of a leader, and participate in a presentation by a leader.

PO 204 – Personal Fitness and Healthy Living

Complementary training for Personal Fitness and Healthy Living provides the cadets an opportunity to perform the PACER at the mid-point of the training year and to develop a personal nutrition plan.

PO 205 – Recreational Sports

Complementary training for Recreational Sports provides the cadets an opportunity to participate in an organized sports tabloid, participate in an organized intramural sports event, and participate in an orienteering event.

PO 206 – Air Rifle Marksmanship

Complementary training for Air Rifle Marksmanship provides the cadets an opportunity to practice holding techniques, to practice aiming techniques, and to practice firing techniques.

PO 207 – General Cadet Knowledge

Complementary training for General Cadet Knowledge provides the cadets an opportunity to identify the rank structures of the Royal Canadian Sea and Army Cadets and to visit a local cadet corps or squadron.

PO 208 – Drill

Complementary training for Drill provides the cadets an opportunity to practice ceremonial drill as a review and to execute drill with arms.

PO 211 – Summer Biathlon

Summer Biathlon provides the cadets an opportunity to participate in summer biathlon activities including running on alternate terrain, firing the cadet sir rifle while using a sling and a competitive activity.

PO 230 – Aviation History

Complementary training for Aviation History provides the cadets an opportunity discuss Canadian aviation history by participating in a presentation given by a member of the Memory Project Speakers Bureau, discussing significant Canadian historical events relative to aviation and touring a local aviation museum.

PO 231 – Principles of Flight

Complementary training for Principles of Flight provides the cadets an opportunity to explain the principles of flight and operate an experimental wing, fly a paper Colditz glider and tour a flight school.

PO 232 – Propulsion

Complementary training for Propulsion provides the cadets an opportunity to identify the characteristics of piston-powered aircraft and discuss the characteristics of gas turbine engines, rocket engines and helicopter engines.

PO 240 – Aerospace

Complementary training for Aerospace provides the cadets an opportunity to participate in aerospace activities, participate in a non-verbal communication activity, invent a communication system for space, identify parts of a rocket, navigate with a global positioning system (GPS), simulate survival in space and determine direction using constellations during a field exercise.

PO 260 – Aerodrome Operations

Complementary training for Aerodrome Operations provides the cadets an opportunity to participate in aerodrome operations activities and tour an aerodrome security facility, an air traffic control (ATC) tower, an aerodrome and perform marshalling.

PO 270 – Aircraft Manufacturing and Maintenance

Complementary training for Aircraft Manufacturing and Maintenance provides the cadets an opportunity to discuss aircraft fabrication and maintenance, participate in a presentation given by an employee in the aircraft manufacturing or maintenance industry, identify Canadian Aviation Maintenance Council (CAMC) Interactive Multimedia Learning Tool (IMLT) activities, tour an aircraft manufacturing or maintenance facility and discuss aircraft assembly.

PO 290 – Aircrew Survival

Complementary training for Aircrew Survival provides the cadets an opportunity to participate in a field exercise, participate in a presentation given by a member of a survival organization, discuss skinning and cooking a small animal, construct a snow cave, collect drinking water using a solar still and participate in a hike.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. As part of the Citizenship PO, what are the EOs (topics) that may be taught?

Q2. What EOs are encompassed under complementary training for Personal Fitness and Healthy Living?

Q3. In Air Rifle Marksmanship, what EOs may be taught?

ANTICIPATED ANSWERS

A1. Complementary EOs for Citizenship include:

- Discuss Environmental Issues Relative to Canada;
- Tour a Local Municipal, Provincial, or National Political Institution;
- Tour a Local Municipal, Provincial, or National Environmental Facility;
- Participate in a Presentation Given by an Environmental Guest Speaker; and
- Participate in a Presentation Given by a Government Representative.

A2. Complementary EOs for Personal Fitness and Healthy Living include:

- Perform the PACER; and
- Develop a Personal Nutrition Plan.

A3. Complementary EOs for Air Rifle Marksmanship include:

- Practice Holding Techniques;
- Practice Aiming Techniques; and
- Practice Firing Techniques.

Teaching Point 3	**Conduct an Activity on Proficiency Level Two Training Opportunities**
Time: 5 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to familiarize the cadets with the POs conducted in Proficiency Level Two training.

RESOURCES

- Labels of POs located at Annex B,
- Labels of PO statements located at Annex B, and
- Tape.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

- Place the labels face down on desks throughout the classroom.
- Have a cadet stand up and read out their label.
- The cadet who thinks they have the corresponding PO or PO statement should stand up.
- The remainder of the cadets will confirm if it is correct.
- Corresponding POs and PO statements will be taped to a flipchart/whiteboard/wall.
- Continue until all POs are complete.

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 the activity in TP3 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Being aware of the topics to be covered during Proficiency Level Two training will help generate interest in the training year. Being aware of the opportunities available throughout the training year may help motivate you in you specific areas of interest.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-010 D Cdts 2. (2006). CATO 11-03: *Cadet Program Mandate*. Vol. 1, Administration (pp. 1/5 to 5/5). Ottawa, ON: Department of National Defence.

A0-045 Cadets Canada. (2007). *About Cadets – History*. Retrieved 19 February 2007, from http://www.cadets.ca/about-nous/histo_e.asp.

C0-081 Citizenship and Immigration Canada. *Rights and Responsibilities of Canadian Citizenship.* Retrieved 4 April 2007, from http://www.cic.gc.ca/english/citizen/rights-fs.html.

THIS PAGE INTENTIONALLY LEFT BLANK

PROFICIENCY LEVEL TWO POS AND EOS

PO 201 – Citizenship Identify the Role of an Environmentally Conscious Canadian Citizen	
M201.01	Discuss the Rights and Responsibilities of a Canadian Citizen
M201.02	Discuss the Principles of Environmental Stewardship
C201.01	Discuss Environmental Issues Relative to Canada
C201.02	Tour a Local Municipal, Provincial, or National Political Institution
C201.03	Tour a Local Municipal, Provincial, or National Environmental Facility
C201.04	Participate in a Presentation Given by an Environmental Guest Speaker
C201.05	Participate in a Presentation Given by a Government Representative
PO 202 – Community Service Perform Community Service	
M202.01	Perform Community Service
C102.01	Participate in a Ceremonial Parade
C102.02	Perform Community Service
PO 203 – Leadership Demonstrate Leadership Attributes within a Peer Setting	
M203.01	Discuss Leadership within a Peer Setting
M203.02	Discuss Principles of Leadership
M203.03	Discuss Effective Communication in a Peer Setting
M203.04	Demonstrate Positive Group Dynamics
M203.05	Discuss Influence Behaviours
M203.06	Employ Problem Solving
M203.07	Discuss Personal Integrity as a Quality of Leadership
M203.08	Participate in Team-Building Activities
C203.01	Record Entries in a Reflective Journal
C203.02	Employ Problem Solving
C203.03	Discuss Characteristics of a Leader
C203.04	Participate in a Presentation Given by a Leader
C203.05	Participate in Trust-Building Activities

C203.06	Participate in Problem-Solving Activities
PO 204 – Personal Fitness and Healthy Living Update Personal Activity Plan	
M204.01	Perform the PACER
M204.02	Identify Healthy Food Choices
M204.03	Identify Benefits of a Healthy Lifestyle
M204.04	Update Personal Activity Plan
M204.05	Perform the PACER
C204.01	Perform the PACER
C204.02	Develop a Personal Nutrition Plan
PO 205 – Recreational Sports Participate in Recreational Sports	
M205.01	Participate in Organized Recreational Team Sports
C105.01	Participate in a Sports Tabloid
C105.02	Participate in an Organized Intra-mural Sports Event
C105.03	Participate in an Orienteering Event
PO 206 – Air Rifle Marksmanship Participate in Recreational Air Rifle Marksmanship	
M206.01	Participate in Recreational Air Rifle Marksmanship
C206.01	Practice Holding Techniques
C206.02	Practice Aiming Techniques
C206.03	Practice Firing Techniques
PO 207 – General Cadet Knowledge Serve in an Air Cadet Squadron	
M207.01	Identify Proficiency Level Two Training Opportunities
M207.02	Recognize Historical Aspects of the RCAC
M207.03	Recognize the Role and Responsibilities of the Local Sponsor
M207.04	Identify Year Two CSTC Training Opportunities
C207.01	Identify the Rank Structure of the Royal Canadian Sea and Army Cadets
C207.02	Visit a Local Cadet Corps or Squadron
C207.03	Describe the Affiliated Unit

C207.04	Tour the Affiliated Unit
PO 208 – Drill Execute Drill as a Member of a Squad	
M208.01	Execute Left and Right Turns on the March
M208.02	Form Single File from the Halt
C208.01	Practice Ceremonial Drill as a Review
C208.02	Execute Drill With Arms
PO 211 – Summer Biathlon Participate in Recreational Summer Biathlon Activities	
C211.01	Identify Civilian Biathlon Opportunities
C211.02	Run on Alternating Terrain
C211.03	Fire the Cadet Air Rifle Using a Sling Following Physical Activity
C211.04	Participate in a Competitive Summer Biathlon Activity
PO 230 – Aviation History Participate in a Discussion on Canadian Aviation History	
M230.01	Discuss Aircraft Flown During WWI and WWII
M230.02	Discuss Significant Events in 20th Century Canadian Military History
C230.01	Participate in a Presentation Given by a Member of the Memory Project Speakers Bureau
C230.02	Tour a Local Aviation Museum
C230.03	Discuss Significant Canadian Historical Events Relative to Aviation
PO 231 – Principles of Flight Explain Principles of Flight	
M231.01	Identify the Four Forces That Act Upon an Aircraft
M231.02	Describe the Production of Lift by an Aircraft Wing
M231.03	Describe the Types of Drag That Act Upon an Aircraft
M231.04	Describe the Axial Movements of an Aircraft
M231.05	Describe Aircraft Control Surfaces
C231.01	Operate an Experimental Wing
C231.02	Fly a Paper Colditz Glider
C231.03	Tour a Flight School

C231.04	Participate in a Presentation Given by a Guest Speaker from the Local Aviation Community
C231.05	Tour a Flight Simulator
C231.06	Tour a Local Air Show
PO 232 – Propulsion Identify Characteristics of Piston-Powered Aircraft	
M232.01	Identify Types of Aircraft Engines
M232.02	Identify Components of Internal Combustion Engines
M232.03	Explain the Cycles of a Four-Stroke Piston-Powered Engine
M232.04	Recognize the Functions of Oil in a Four-Stroke Piston-Powered Engine
C232.01	Identify Characteristics of Gas Turbine Engines
C232.02	Identify Characteristics of Rocket Engines
C232.03	Identify Characteristics of Helicopter Engines
PO 240 – Aerospace Participate in Aerospace Activities	
M240.01	Explore Current Advancements in Aerospace Technology
M240.02	Invent a Space Technology Item
M240.03	Participate in a Space Survival Scenario
C240.01	Participate in a Non-verbal Communication Activity
C240.02	Invent a Communication System for Space
C240.03	Identify Parts of a Rocket
C240.04	Navigate with a Global Positioning System (GPS)
C240.05	Simulate Survival in Space
C240.06	Determine Direction Using Constellations on a Field Exercise
PO – 260 Aerodrome Operations Participate in Aerodrome Operations Activities	
M260.01	Explain Aspects of Air Traffic Control (ATC)
M260.02	Identify Aspects of Basic Aerodrome Operations
C260.01	Tour an Aerodrome Security Facility
C260.02	Tour an Air Traffic Control (ATC) Tower
C260.03	Participate in a Presentation Given by an Employee of an Aerodrome

C260.04	Perform Marshalling
C260.05	Tour an Aerodrome
PO – 270 Aircraft Manufacturing and Maintenance Participate in a Discussion on Aircraft Fabrication and Maintenance	
M270.01	Identify Aspects of Aircraft Manufacturing
M270.02	Identify Requirements for Aircraft Maintenance
M270.03	Discuss Education and Employment Opportunities in Aircraft Manufacturing and Maintenance
C270.01	Participate in a Presentation Given by an Employee in the Aircraft Manufacturing or Maintenance Industry
C270.02	Identify Canadian Aviation Maintenance Council (CAMC) Interactive Multimedia Learning Tool (IMLT) Activities
C270.03	Tour an Aircraft Manufacturing or Maintenance Facility
C270.04	Watch World’s Biggest Airliner: The Airbus A380 - Coming Together
PO – 290 Aircrew Survival Participate in a Field Exercise	
M290.01	Construct, Light, Maintain, and Extinguish a Signal Fire
M290.02	Construct a Lean-to-Style Shelter
M290.03	Construct a Simple Snare
M290.04	Construct Ground-to-Air Signals
M290.05	Identify Hiking Techniques
M290.06	Operate a Hand-Held Radio
C290.01	Participate in a Presentation Given by a Member of a Survival Organization
C290.02	Participate in a Discussion on Skinning and Cooking a Small Animal
C290.03	Construct a Snow Cave
C290.04	Collect Drinking Water Using a Solar Still
C290.05	Participate in a Hike

THIS PAGE INTENTIONALLY LEFT BLANK

LABELS OF POS

PO 201 Citizenship	PO 206 Air Rifle Marksmanship	PO 231 Principles of Flight
PO 202 Community Service	PO 207 General Cadet Knowledge	PO 232 Propulsion
PO 203 Leadership	PO 208 Drill	PO 240 Aerospace
PO 204 Personal Fitness and Healthy Living	PO 211 Summer Biathlon	PO 260 Aerodrome Operations
PO 205 Recreational Sports	PO 230 Aviation History	PO 270 Aircraft Manufacturing and Maintenance

PO 290 Aircrew Survival		

Identify the Role of an Environmentally Conscious Canadian Citizen	Participate in Recreational Air Rifle Marksmanship	Explain Principles of Flight
Perform Community Service	Serve in an Air Cadet Squadron	Identify Characteristics of Piston-Powered Aircraft
Demonstrate Leadership Attributes within a Peer Setting	Execute Drill as a Member of a Squad	Participate in Aerospace Activities
Update Personal Activity Plan	Participate in Recreational Summer Biathlon Activities	Participate in Aerodrome Operations Activities
Participate in Recreational Sports	Participate in a Discussion on Canadian Aviation	Participate in a Discussion on Aircraft Fabrication and Maintenance

Participate in a Field Exercise		

POSTERS OF VARIOUS SYMBOLS OF CANADA

CANADIAN CITIZENSHIP

RIGHTS AND FREEDOMS	RESPONSIBILITIES
Legal Rights	Understand and Obey Canada's Laws
Equality Rights	Express Opinions Freely While Respecting the Rights and Freedoms of Others
Mobility Rights	Help Others in the Community
Aboriginal Peoples' Rights	Care for and Protect our Heritage and Environment
Freedom of Thought	Eliminate Discrimination and Injustice
Freedom of Speech	Vote in Elections (municipal, provincial and federal)
Freedom of Religion	Support Canada's Ideals in Building the Country
The Right to Peaceful Assembly	
The Right to Legal Rights	
The Right to Apply for a Passport	
The Right to Run in Elections	
The Right to Vote in Elections	

THE ROYAL ARMS OF CANADA

Canadian Heritage – Ceremonial and Canadian Symbols and Promotion. Retrieved 4 April 2007, from http://www.pch.gc.ca/progs/cpsc-ccsp/sc-cs/arm2_e.cfm

Figure C-1 The Royal Arms of Canada

THE NATIONAL FLAG

Canadian Heritage – Ceremonial and Canadian Symbols and Promotion.
Retrieved 4 April 2007, from http://www.pch.gc.ca/progs/cpsc-ccsp/sc-cs/dfl_e.cfm

Figure C-2 The National Flag

CODE OF ENVIRONMENTAL STEWARDSHIP

The Government of Canada fully supports the principle of sustainable development.

To reflect this commitment in all aspects of its operation and activities, from facilities and real property management to procurement and waste management, the Government commits:

- to integrate environmental concerns with operational, financial, safety, health, economic development and other relevant concerns in decision-making;
- to meet or exceed the letter and spirit of federal environmental laws and, where appropriate, to be compatible with provincial and international standards;
- to improve the level of awareness throughout the public service of the environmental and health benefits and risks of operational decisions and to encourage and recognize employee actions;
- to apply environmentally responsible management practices to hazardous substances used in operations, including biological products, specifically with regard to the acquisition, handling, storage, safety in use, transportation and disposal of such substances;
- to ensure that environmental considerations are integrated into government purchasing policies and practices; and
- to seek cost-effective ways of reducing the input of raw materials, toxic substances, energy, water and other resources, and of reducing the generation of waste and noise.

HISTORY OF THE ROYAL CANADIAN AIR CADETS

- The Air Cadet League of Canada was formed in 1940, and raised its first squadrons in 1941.
- In 1942, in recognition of the significant contribution of former cadets to the war effort, His majesty King George VI conferred the title royal to the Cadet Program, creating the Royal Canadian Air Cadets.
- In 1968, the Army, Navy and Air Force were unified into the Canadian Armed Forces. At that time the Canadian Forces and the cadet movement adopted a single green uniform. The first issue of the green Air Cadet uniform was worn in 1976. This uniform remained in use for almost 20 years. In 1994, the Air Cadet uniform changed back to the traditional Air Force blue style, which is still worn today.
- Following the unification of the Canadian Forces (CF) in 1968, a directorate of cadets was established in Ottawa to set policy and coordinate activities between the three elements of the Cadet Program, and Air Cadet officers became commissioned members of the CF.
- On July 30, 1975, parliament amended the relevant legislation by changing the word boys to persons, therefore permitting girls to become members of the Royal Canadian Air Cadets.
- The “Air Force Blue” represents the sky above. It is a uniform richly endowed with history and tradition. Wearing the uniform bestows recognition of the individual as a representative of Canada’s honoured forces. More than just a means of identification, it is recognized as a badge of courage and bravery. The “Air Force Blue” was proudly worn by Canadians during the wars of the 20th century and their exploits are honoured by all who serve.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M207.02 – RECOGNIZE HISTORICAL ASPECTS OF THE ROYAL CANADIAN AIR CADETS (RCAC)

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-802/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.

Photocopy the information sheets located at Annexes A, B and C ensuring there is one copy per cadet at each learning station.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 as it is an interactive way to present the content and stimulate interest among cadets.

A group discussion was chosen for TP2 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about the history of the Air Cadet Program.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have participated in a discussion on the history of the Royal Canadian Air Cadets including significant events in the Air Cadet Program and the Air Cadet League and changes in the Air Cadet uniform.

IMPORTANCE

It is important for cadets to know the rich history of the Royal Canadian Air Cadets. By recognizing historical events, cadets may develop an appreciation for history and for the organizations involved in shaping the Air Cadet Program into what it is today.

Teaching Point 1 — **Introduce Historical Aspects of the Air Cadet Program**

Time: 15 min — Method: In-Class Activity

Information about the historical aspects of the Air Cadet Program needed for this activity are located at Annexes A, B and C.

ACTIVITY

Time: 15 min

OBJECTIVE

The objective of this activity is to gain knowledge of some of the historical aspects of the Air Cadet Program.

RESOURCES

- Significant events in the Air Cadet Program located at Annex A,
- Changes to the Air Cadet uniform located at Annex B, and
- Significant dates in the Air Cadet League located at Annex C.

ACTIVITY LAYOUT

Three learning stations will be set up and clearly marked for each of the historical aspects and will include:

- significant events in the Air Cadet Program,
- changes to the Air Cadet uniform,
- significant dates in the Air Cadet League,
- pens/pencils, and
- paper.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into three groups and place each group at one of the learning stations.
2. Cadets will have 5 minutes at each station to take notes from the information provided.
3. After five minutes, the groups will rotate clockwise to the next station, where they will take notes.
4. Rotate the groups through the remaining stations.

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	**Discuss Historical Aspects of the RCAC**
Time: 10 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the historical aspects of the Air Cadet Program from the group using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don’t interrupt; only one person speaks at a time; no one’s ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. What interesting things did you learn that you did not know before the lesson?

Q2. Why did you find this information interesting?

Q3. Why do you think it is important to know information on the history of the Air Cadet Program?

Q4. Why do you think it is important to know information on the history of the Air Cadet League?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

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

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

As members of the Royal Canadian Air Cadets, this basic knowledge of the rich history of the Air Cadet Program will forever be a part of the cadet's experience. Understanding this history may lead to increased enthusiasm and greater esprit de corps for the cadets.

INSTRUCTOR NOTES/REMARKS

After the introduction, the class shall be divided into three groups. Each group will begin at a separate learning station. Each group will rotate to a new learning station after approximately five minutes.

REFERENCES

A0-045 Cadets Canada. (2007). *About Cadets – History.* Retrieved 19 February 2007, from http://www.cadets.ca/about-nous/histo_e.asp.

A3-032 *Today's Air Force, General Information, Traditions (2006).* Retrieved 11 October 2006, from http://www.airforce.forces.gc.ca/today4_e.asp.

C3-077 Air Cadet League. (2007). *General – History.* Retrieved 19 February 2007, from http://www.aircadetleague.com/General/history_e.html.

SIGNIFICANT EVENTS IN THE AIR CADET PROGRAM

World War II

The beginning of World War II brought a renewed public interest in cadet training across the nation. Cadet squadrons were formed in many high schools. The Air Cadet League of Canada was formed in 1940, and raised its first squadrons in 1941. From the outset, the Air Cadet League enjoyed a partnership with the Royal Canadian Air Force, which enrolled Air Cadet instructors as commissioned officers. By the end of World War II, they had raised 374 squadrons with an enrolment of 29 000 Air Cadets.

The Post-War Period

In recognition of the significant contribution of former cadets to the war effort, His Majesty King George VI conferred the title royal on the Cadet Program, creating the Royal Canadian Sea Cadets, the Royal Canadian Army Cadets, and the Royal Canadian Air Cadets. It is estimated that nearly 230 000 former Sea, Army and Air Cadets served in His Majesty's forces during World War II.

After World War II, quotas were imposed reducing Canada's total cadet force to about 75 000 members. Many of the corps and squadrons closed or were disbanded. The Korean War stimulated growth among squadrons in the early 1950s. After 1954, Korean veterans staffed the Area Cadet Offices that began to manage these squadrons and the summer camps that trained them.

Unification of the Canadian Forces

Following the unification of the Canadian Forces in 1968, a number of changes occurred in the cadet world:

- Sea and Air Cadets came more fully under the control of the Canadian Forces in order to standardize the three Cadet organizations.
- A directorate of cadets was established in Ottawa to set policy and co-ordinate the activities of the Sea, Army and Air Cadets.
- The Cadet Services of Canada was superseded by the Cadet Instructor List (CIL), which was later redesignated the Cadet Instructor Cadre (CIC).

Girls in the Cadet Program

Girls have participated unofficially in cadet training almost from the beginning. Shortly after the formation of the Highland Cadet Corps at the Guelph Grammar School in 1882, a female cadet company was also formed, called the Daughters of the Regiment.

During and after World War II, you could find cadet corps and squadrons that paraded a female platoon or flight. But these unofficial female cadets could never lawfully be trained, kitted, fed or transported and were not allowed to attend summer camp.

On July 30, 1975, parliament amended the relevant legislation by changing the word boys to persons, therefore permitting girls to become members of the Royal Canadian Sea, Army, and Air Cadets.

THIS PAGE INTENTIONALLY LEFT BLANK

CHANGES TO THE AIR CADET UNIFORM

The Origin of the Air Force Uniform

At one time, England was a major supplier of uniforms and cloth to other countries. At the time of the October Revolution in Russia, there was a large quantity of cloth in England that had originally been ordered for the Russian Army. This blue cloth remained unused until the end of World War I, when the Royal Air Force (RAF) came into existence and required uniforms. The unused cloth was made into uniforms and as a result, the RAF and original Royal Canadian Air Force (RCAF) uniforms were the same colour as the old Tsarist Russian uniform.

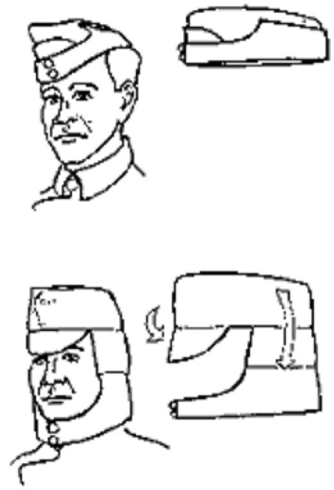
The “Air Force Blue” represents the sky above. It is a uniform richly endowed with history and tradition. Wearing the uniform bestows recognition of the individual as a representative of Canada’s honoured forces. More than just a means of identification, it is recognized as a badge of courage and bravery. The “Air Force Blue” was proudly worn by Canadians during the wars of the 20th century and their exploits are honoured by all who serve. It is worn with pride.

Against The Odds - Bomber Command At IWM North. News. Kay Carson. (2006). Retrieved 2 November 2006, from http://www.24hourmuseum.org.uk/content/images/2006_2529.JPG

Figure B-1 RCAF Uniforms WWII

The Wedge Cap

Current dress regulations of the Canadian Forces include the “Cap, wedge (optional) centred and worn on the right side of the head, one inch above the right eyebrow". The wedge cap is a good example of how a tradition was born some 60 years ago and thrives to this day. The Air Force affinity for this type of headdress is well known. It all began when the Royal Flying Corps was established just before World War I. The field service cap, as it was then called, was adopted by the RFC along with a tunic with a high, stand-up collar secured by buttons at the far right side of the chest. With the cap cocked well over to the right, this uniform, with its jaunty air, became synonymous with the daring new fighting Air Force. This headdress, designated the wedge cap in 1941, continued to be worn throughout the life of the RCAF (1924-68) and continues to be the preference of many personnel today in spite of the availability of the peaked forage cap and the beret. There is little doubt that in the days when goggles and leather helmets were worn in open cockpits, the wedge cap lent itself to handy storage in a pocket, ready for use on return to base. When inclement weather was encountered, the sides could be unhooked and pulled down to cover the ears and the forward flap tucked under the chin. Today's version of the "wedge" is sewn in a slightly different manner, but it continues to provide the officer, the NCM and the Air Cadet their distinctive Air Force identity.



Department of National Defence. (2006). Air Force Traditions. Retrieved 2 November 2006, from http://www.airforce.forces.gc.ca/traddocs/traddocs/tradq_e.asp

Figure B-2 The Wedge

The Original Air Cadet Uniform

The original Air Cadet uniform was also blue. They were usually older, out-of-use RCAF uniforms. In 1968, the Army, Navy and Air Force were unified into the Canadian Armed Forces. At that time the Canadian Forces and the cadet movement adopted a single green uniform. The first issue of the green Air Cadet uniform was worn in 1976. This uniform remained in use for almost 20 years. In 1994, the Air Cadet uniform changed back to the traditional Air Force blue style, which is still worn today.

D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure B-3 Air Cadet Uniforms

THIS PAGE INTENTIONALLY LEFT BLANK

SIGNIFICANT DATES IN THE AIR CADET LEAGUE

The Early Days

To understand why and how the Air Cadet League of Canada came into being, it is necessary to recall the early days of World War II. The critical need was for planes and more planes and for trained young men to fly them in defence of freedom. There grew, in Canada, the idea of a select set of teenaged youths who would devote some of their spare time to prepare for the day when they would take their places as aircrew in the ranks of the Royal Canadian Air Force (RCAF).

The Inauguration

On April 9, 1941, the Air Cadet League of Canada was granted a Dominion Charter authorizing it to operate as a charitable, non-profit corporation. This charter officially established the Air Cadet League in partnership with the RCAF. An administrative headquarters was established in Ottawa, and the stage was set for a concentrated appeal for sponsors and volunteers throughout the provinces.

In September of 1944, the movement reached the peak war strength of 374 squadrons, over 29 000 cadets, 1750 officers and instructors and another 2000 civilians who supplied financial and other support. It has been established that during one brief period, between October 1943 and June 1944, over 3000 Air Cadets graduated into the wartime RCAF.

The Post-War Period 1946 to 1968

Immediately following the close of the war, there was a natural lessening of interest in all cadet activities throughout Canada. Many squadrons that had been set up “for the duration” were disbanded and the movement settled down to a low point of approximately 11 000 cadets in 155 squadrons.

In 1946, the RCAF introduced Flying Scholarship courses for senior cadets, a development which gave added importance to the movement. In 1961, as the League celebrated its 20th anniversary, more than 150 000 Air Cadets had received training in the squadrons now numbering 332.

The Post-Unification Years 1968 to 2000

On February 1, 1968, the Air Cadet League lost its original partner, the Royal Canadian Air Force, and unification brought about a new partnership with the Canadian Armed Forces. In view of a strong demand for new units at the time and to provide for gradual expansion, authority was granted in 1972 for an increase by stages to the present entitlement of 28 000 Air Cadets.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO M207.03 – RECOGNIZE THE ROLE AND RESPONSIBILITIES OF THE LOCAL SPONSOR

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-802/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.

Become familiar with the cadet squadron sponsor and sponsoring committee. Be prepared to give examples of what the sponsor does for the cadet squadron.

Contact members of the local sponsor and invite them to participate in this EO.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to the role and responsibilities of the local sponsor and to present basic material.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to recognize the role and responsibilities of the local sponsor.

IMPORTANCE

It is important for cadets to know the support structure of their squadron. Every cadet squadron across Canada has a local sponsor, who provides assistance and aid to help complete training. For a cadet squadron to run effectively, it needs a variety of support structures. A dependable and reliable sponsor is a key to the success of a cadet squadron and each cadet should be aware of their importance.

Teaching Point 1	**Define Sponsor and Sponsoring Committee**
Time: 5 min	Method: Interactive Lecture

Provincial/territorial branches of the Air Cadet League may refer to the sponsoring committee as a different term (e.g. support committee). Discuss the difference between a sponsor and sponsoring committee.

SPONSOR VS. SPONSORING COMMITTEE

Sponsor. With respect to a cadet squadron, the organization or persons accepted by or on behalf of the Chief of Defence Staff (CDS) to undertake jointly with the Canadian Forces (CF) and the supervisory sponsor, responsibility for the organization and administration of the cadet squadron.

Sponsoring Committee/Branch. A working support committee that is a member of and supervised by the league and is compromised of persons who are approved, registered and screened in accordance with league policy to complete the functions required to support the squadron.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is a sponsor?

Q2. What is the sponsoring committee/branch?

Q3. Who normally comprises a sponsoring committee?

ANTICIPATED ANSWERS

A1. With respect to a cadet squadron, the organization or persons accepted by or on behalf of the Chief of Defence Staff to undertake jointly with the CF and the supervisory sponsor, responsibility for the organization and administration of the cadet squadron.

A2. A working support committee that is a member of and supervised by the league and is compromised of persons who are approved, registered and screened in accordance with league policy to complete the functions required to support the squadron.

A3. Sponsoring committees are normally comprised of representative(s) of the sponsor, parents, and other civilians from the community.

Teaching Point 2	**Describe the Local Sponsoring Body**
Time: 10 min	Method: Interactive Lecture

Name the sponsoring body for the squadron. Identify positions and members of the sponsoring body.

LOCAL SPONSORING BODY

Air Cadet squadron sponsors are usually community organizations or social clubs. In some cases, more than one organization sponsors a squadron. A sponsoring committee is formed to represent the sponsor(s) on a day-to-day basis.

Sponsoring committees are normally comprised of representative(s) of the sponsor, parents, and other civilians from the community. They are sometimes called parents' committees or civilian committees; however, not every parents' committee is a sponsoring committee.

Some examples of a local sponsoring body may include:

The Royal Canadian Legion (RCL). The RCL is the largest veterans-based community service organization in the country and contributes millions of dollars and voluntary hours to help Canadians, particularly veterans, seniors, and youth.

The Air Force Association of Canada (AFAC). The AFAC is a national not-for-profit aerospace and community service organization composed of aviation-minded citizens. Individual wings of the AFAC actively sponsor and support cadets and other community activities.

Lions Clubs. The Lions Clubs are internationally based and are the world's largest service club organization.

A Rotary Club. A rotary club's main objective is to encourage and foster the ideal of service as a basis of worthy enterprise.

A Parents' Committee. An Air Cadet squadron may also have a separate parents' committee to assist the sponsoring committee. A parents committee is usually made up of parents of current or former cadets from the squadron. These parents join to raise extra funds for the squadrons' activities.

POSITIONS IN THE LOCAL SPONSORING BODY

The following is a list of positions within the sponsoring committee and the basic responsibilities corresponding to these positions. These positions may vary or terms may change from sponsor to sponsor.

Chairperson. The chairperson is the senior official in the sponsoring body and is responsible for all activities/functions. All members must keep the chairperson informed of their activities and the chairperson in turn must keep the squadron informed of activities within the sponsor.

Secretary. The secretary is responsible for maintaining all of the records and correspondence. During committee and general meetings, the secretary is responsible for recording the minutes.

Treasurer. The treasurer is responsible for maintaining all financial records and transactions. All expenditures should be recorded for purposes of budgeting and financial reporting.

SECONDARY SPONSORS

Some corps have a secondary sponsor that may assist in duties such as fundraising for the corps. Secondary sponsors usually consist of organizations such as, but not limited to: a parents' committee, a RCL, a Lions Club, or a Rotary Club.

A parents' committee is usually made up of parents of current or former cadets from the squadron. These parents join to raise extra funds for the squadrons' activities.

The RCL is the largest veterans-based community service organization in the country and contributes millions of dollars and voluntary hours to help Canadians, particularly veterans, seniors, and youth.

Lions Clubs are internationally based and are the world's largest service club organization.

A rotary club's main objective is to encourage and foster the ideal of service as a basis of worthy enterprise.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. Name the sponsoring body of the Air Cadet squadron.

Q2. Identify three positions within the sponsoring body.

Q3. What is the primary role of the Chairperson?

ANTICIPATED ANSWERS

A1. Answers will vary.

A2. Three positions within the sponsoring body are:

- chairperson,
- secretary, and
- treasurer.

A3. The chairperson is the senior official in the sponsoring body and is responsible for all activities/functions.

Teaching Point 3	Explain the Role and Responsibilities of the Sponsoring Committee
Time: 10 min	Method: Interactive Lecture

Discuss the role and responsibilities using squadron-specific examples.

ROLE OF THE SPONSOR

It is the role of the sponsor to ensure responsibilities are met in accordance with the *Memorandum of Understanding*, for the proper and efficient delivery of the Cadet Program within Canada.

RESPONSIBILITIES OF THE SPONSOR

Fundraising

It is the responsibility of the sponsor to organize fundraising activities in consultation with the squadron commanding officer (CO). Annual reports are to be produced by the sponsor when required by law.

Recruiting Cadets

It is the responsibility of the sponsor to organize local community campaigns to attract cadets to become members of the squadron.

Attracting Officers to the Squadron

It is the responsibility of the sponsor to conduct local campaigns to attract potential candidates within the community to become members of the Cadet Instructors Cadre (CIC) and civilian instructors (CIs). This is based on the needs confirmed by the CO of the squadron.

Screening Volunteers

It is the responsibility of the sponsor to identify and conduct the screening process of potential volunteers. The sponsor is responsible for completing the process and providing these results to the league.

Providing Adequate Office and Training Facilities

The sponsor is responsible for providing adequate office and training facilities, where they are not provided by DND. This is to include insurance requirements, as necessary.

Participating in Senior Cadet Rank Appointments

The sponsor is responsible to assist with the selection process for senior cadets.

Participating in Selections for CSTC/Exchanges

The sponsor is responsible for cooperating with the squadron CO to promote summer courses and exchanges and to participate in the selection process accordingly, in accordance with the league and DND agreements and responsibilities.

Participating in Selections for Honours and Awards

The sponsor is responsible for participating in the joint selection process for honours and awards from the league and in initiating the selection process for league-specific awards.

The sponsor plays an important role in developing and maintaining positive community relationships with businesses, municipal government, local service clubs, and the affiliated unit.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What role does the sponsor play in fundraising?

Q2. Who is responsible for recruiting CIC officers, CIs and cadets to the squadron?

Q3. Who is responsible for providing office and training facilities?

ANTICIPATED ANSWERS

A1. It is the responsibility of the sponsor to organize fundraising activities in consultation with the squadron CO.

A2. The sponsor.

A3. The sponsor.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What is a sponsor?

Q2. What positions constitute the sponsoring committee?

Q3. Who is responsible for screening volunteers?

ANTICIPATED ANSWERS

A1. With respect to a cadet squadron, a sponsor is the organization or persons accepted by or on behalf of the CDS to undertake jointly with the CF and the supervisory sponsor, responsibility for the organization and administration of that cadet squadron.

A2. Three positions within the sponsoring body are:

- chairperson,
- secretary, and
- treasurer.

A3. The sponsor.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The Air Cadet League and the local sponsor works collaboratively with the DND to ensure that Air Cadet squadrons have what they require to run the program efficiently. The sponsor of a cadet squadron has a role and responsibilities to fulfill, most importantly support and financial aid. Though they are not always seen, a dependable and reliable sponsor is key to the success of a cadet squadron and each cadet should recognize their importance.

INSTRUCTOR NOTES/REMARKS

This EO may be delivered by a member of the local sponsoring body.

The guest speaker shall be briefed on the TPs prior to the lesson.

REFERENCES

A0-040 2005-113124 *Memorandum of Understanding Between the DND and the Leagues (2005).* Ottawa, ON. Department of National Defence.

A0-046 Scott, M. (Ed.). (2003). Clarifying Civilian Roles in Cadet Corps and Squadrons. *Cadence: The Leadership Magazine of the Canadian Cadet Movement,* Issue 11, pp. 30-32.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO M207.04 – IDENTIFY YEAR TWO CSTC TRAINING OPPORTUNITIES

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-802/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.

Read CATO 54-20, *Summer Training Directive – Royal Canadian Air Cadets* and its annexes.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

A group discussion was chosen for TP1 as it allows the cadets to interact with their peers and share their experiences, opinions, and feelings about year two CSTC training opportunities.

An interactive lecture was chosen for TP2 to orient the cadets to year two CSTC training opportunities and to generate interest.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify year two CSTC training opportunities.

IMPORTANCE

It is important for cadets to identify the year two CSTC training opportunities available to them because they must decide if and for which course they would like to apply.

Teaching Point 1 **Discuss the Speciality Areas for Year Two CSTC Training**

Time: 10 min Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

FITNESS AND SPORTS

Cadets will improve individual fitness and sport knowledge and skills. Activities include:

- rules and regulations of sports, and
- personal fitness.

MUSIC

Military Musician

Cadets will develop music knowledge and skills. Activities include:

- music theory;
- playing an instrument as part of an ensemble;
- playing an instrument as part of a military band; and
- developing individual music skills.

Pipe and Drum Musician

Cadets will develop music knowledge and skills. Activities include:

- music theory;
- playing an instrument as part of an ensemble;
- playing an instrument as part of a pipe and drum band; and
- developing individual music skills.

MARKSMANSHIP

Cadets will develop the knowledge and skills required to improve marksmanship and coaching abilities. Activities include:

- acting as a range assistant, and
- carrying our basic marksmanship coaching duties.

LEADERSHIP

Cadets will develop the knowledge and skills required to improve leadership abilities in a peer and small group setting. Activities include:

- leadership,
- public speaking,
- problem solving, and
- ceremonial drill.

AVIATION

Cadets will develop the knowledge and skills required to improve their understanding of the fundamentals of aviation. Activities will include aspects of:

- meteorology,
- aero engines,
- air navigation, and
- airmanship.

AVIATION TECHNOLOGY

Cadets will develop knowledge and skills required to improve their understanding of the fundamentals of aviation technology. Activities will include aspects of aircraft:

- fabrication,
- construction, and
- maintenance.

AEROSPACE

Cadets will develop knowledge and skills required to improve their understanding of the fundamentals of aerospace science. Activities will include aspects of:

- theoretical and practical principles of space science, and
- principles of project management.

AIRCREW SURVIVAL

Cadets will develop the knowledge and skills required to improve aircrew survival abilities. Activities include:

- fire construction,
- shelter construction,
- signal construction, and
- food and water collection.

Write the specialty areas on a whiteboard/flipchart. Explain the activities that are conducted within each area.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet.
- This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. Which summer training activities interest you?

Q2. Who is interested in applying for summer training this year? Why?

Q3. What specialty area are you interested in pursuing? Why?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 1

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

Teaching Point 2	**Describe Year Two CSTC Courses**
Time: 15 min	Method: Interactive Lecture

A cadet who has attended one of these courses could be asked to speak about their experience during this TP.

COMMON COURSES

Basic Fitness and Sports. The aim of this course is to improve the cadets' knowledge and skills in individual fitness and sports.

Military Band – Basic Musician. The aim of this course is to introduce fundamental music knowledge and skills, and for the cadets to achieve a basic music level.

Pipe and Drum Musician – Basic Pipe and Drum. The aim of this course is to introduce fundamental music knowledge and skills, and for the cadets to achieve a basic music level.

ELEMENTAL COURSES

Basic Leadership. The aim of this course is to build on the knowledge and skills required for an emerging leader to complete a leadership assignment in a peer and small group setting. This course also allows cadets to develop knowledge and skills in drill and ceremonial.

Basic Aviation. The aim of the Basic Aviation course is to provide the cadets with the fundamentals of aviation including civilian, military and Air Cadet aviation opportunities, aviation history and basic airmanship.

Basic Aerospace. The aim of the Basic Aerospace course is to provide the cadets with the fundamentals of aerospace to include theoretical and practical principles of aerospace science and the principles of project management.

Basic Aviation Technology. The aim of the Basic Aviation Technology course is to provide the cadets with the fundamentals of aviation technologies to include aircraft fabrication, construction and maintenance. Cadets are given ample opportunity for the practical application of theoretical and practical skills.

Basic Survival. The aim of the Basic Survival course is to allow cadets to apply the basic survival pattern including fire construction, shelter construction, signal construction and food and water collection. Cadets are given ample opportunity for the practical application of theoretical and practical skills.

PREREQUISITES FOR ATTENDING A YEAR TWO CSTC COURSE

The cadet must:

- be undergoing Proficiency Level Two training by the application deadline;
- successfully complete Proficiency Level Two by June 30 of the year the cadet wishes to attend the CSTC;
- be physically fit;
- complete a CF 51 including the medical portion;
- have parental consent; and
- be recommended by the squadron Commanding Officer.

Cadets do NOT have to complete General Training (GT) to apply for their first three-week course.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. How many three-week courses can cadets choose from in year two?

Q2. What are the two music courses available in year two?

Q3. What are the prerequisites to attend a year two CSTC course?

ANTICIPATED ANSWERS

A1. Eight.

A2. Basic Military Band Musician and Basic Pipe and Drum Musician.

A3. The prerequisites for attending a year two CSTC course are:
The cadet must:

- be undergoing Proficiency Level Two training by the application deadline;
- successfully complete Proficiency Level Two by June 30 of the year you wish to attend the CSTC;
- be physically fit;
- complete a CF-51 including the medical portion;
- have parental consent; and
- be recommended by the squadron Commanding Officer.

END OF LESSON CONFIRMATION

The cadets' participation in the group discussion will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Summer training is a fun and exciting aspect of the Cadet Program. Summer training centres are also a place to meet cadets and make new friends from different squadrons across Canada. It is important to be familiar with the summer training courses offered so cadets may apply for the course that interests them most.

INSTRUCTOR NOTES/REMARKS

This EO should be conducted prior to the summer training application deadline of the applicable cadet detachment/region.

It is strongly recommended that the summer training application forms (CF 51) be completed during a training session after this EO has been conducted.

Squadrons may choose to devote two additional complementary training periods to expand this to a session that includes a parent information seminar.

REFERENCES

A0-010 CATO 11-03 D Cdts 2. (2006). *Cadet Program Mandate.* Ottawa, ON: Department of National Defence.

A0-033 CATO 14-21 D Cdts 3. (2004). *Music Training and Education With the Canadian Cadet Organizations.* Ottawa, ON: Department of National Defence.

A3-003 CATO 54-20 D Cdts 3. (2000). *Summer Training Directive – Royal Canadian Air Cadets.* Ottawa, ON: Department of National Defence.

A3-029 CATO 51-01 D Cdts 3. (2006). *Air Cadet Program Outline.* Ottawa, ON: Department of National Defence.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 5

EO C207.01 – IDENTIFY THE RANK STRUCTURE OF THE ROYAL CANADIAN SEA AND ARMY CADETS

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-802/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.

Photocopy the handout of ranks located at Annex A for each cadet.

Photocopy annexes for chosen activities.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to the Sea and Army Cadet rank structure, to generate interest and to present basic material.

A game was chosen for TP2 as it is an interactive way to provoke thought and stimulate interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson cadets shall identify the rank structure of the Royal Canadian Sea and Army Cadets.

IMPORTANCE

It is important for cadets to identify the rank structure of the Sea and Army Cadets to better understand the structure of other elements. Knowing the rank structure and insignia will help cadets address other cadets and gain an appreciation for the differences and similarities between Sea, Army and Air Cadets.

Teaching Point 1 | **Identify Sea and Army Cadet Rank Structure**

Time: 10 min | Method: Interactive Lecture

Both Sea and Army Cadet ranks have chevrons and crowns, just like Air Cadets. Sea cadets also have an anchor and Army Cadets have a maple leaf on some of their insignia.

Distribute handouts of the cadet rank insignia located at Annex A and briefly introduce the cadets to Sea and Army Cadet ranks.

CADET RANK INSIGNIA

SEA CADET RANKS	ARMY CADET RANKS	AIR CADET RANKS
ORDINARY SEAMAN (OS) (NO BADGE)	CADET (NO BADGE)	AIR CADET (AC) (NO BADGE)
ABLE SEAMAN (AB) 	PRIVATE (Pte) 	LEADING AIR CADET (LAC) 
LEADING SEAMAN (LS) 	CORPORAL (Cpl) 	CORPORAL (Cpl) 
MASTER SEAMAN (MS) 	MASTER CORPORAL (MCpl) 	FLIGHT CORPORAL (FCpl) 
PETTY OFFICER SECOND CLASS (PO2) 	SERGENT (Sgt) 	SERGEANT (Sgt) 
PETTY OFFICER FIRST CLASS (PO1) 	WARRANT OFFICER (WO) 	FLIGHT SERGEANT (FSgt) 
CHIEF PETTY OFFICER SECOND CLASS (CPO2) 	MASTER WARRANT OFFICER (MWO) 	WARRANT OFFICER SECOND CLASS (WO2) 
CHIEF PETTY OFFICER FIRST CLASS (CPO1) 	CHIEF WARRANT OFFICER (CWO) 	WARRANT OFFICER FIRST CLASS (WO1) 

D Cdts 3, 2007, Ottawa ON: Department of National Defence

Figure 1 Cadet Ranks

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What does the rank insignia for a leading seaman look like?

Q2. What rank has two chevrons, an anchor and a crown?

Q3. What does the rank insignia for a petty officer first class look like?

Q4. What does the rank insignia for sergeant look like?

Q5. What is the highest rank an Army Cadet can obtain?

ANTICIPATED ANSWERS

A1. Two chevrons and an anchor.

A2. Master Seaman.

A3. A crown.

A4. Three chevrons.

A5. Chief Warrant Officer (CWO).

Teaching Point 2 — **Conduct an Activity to Familiarize Cadets With the Sea and Army Cadet Rank Structure**

Time: 15 min — Method: In-Class Activity

Conduct only one of the following activities.

ACTIVITY

OBJECTIVE

The objective of this twister activity is to become familiar with Sea and Army Cadet ranks.

RESOURCES

- Sea and Army Cadet rank insignia located at Annex B,
- Actions located at Annex C,
- Tape, and
- Two bags, hats or containers.

ACTIVITY LAYOUT

The floor of ranks must be set up and the bag of actions for the cadets to take must be ready.

To set up the floor of ranks for this twister activity:

1. make two copies of the insignia located at Annex B; and
2. tape the ranks on the floor in a four by seven rectangle, ensuring that the same ranks are not placed together.

To make the bags of actions:

1. make a copy of the actions located at Annex C;
2. cut out the actions;
3. divide the actions into two groups – body parts and ranks;
4. fold the pieces of paper; and
5. place the names of body parts in one bag and the ranks in the other.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into groups of 3 to 6 cadets.
2. Decide the amount of time each group may have to complete the activity. For example, if there are two groups, each group will have approximately five minutes. If there are three groups, each group will have approximately three to four minutes.
3. If possible, assign two or three cadets to assist in judging.
4. Have the first group place themselves around the floor of ranks.
5. Pick a body part and a rank (action) out of each bag, hat or container and read them aloud (e.g. left hand – able seaman).
6. Have the cadets carry out the action (e.g. put their left hand on an able seaman rank).
7. Replace the paper into the appropriate bag, hat or container.
8. Pick another action, read aloud and have the cadets complete it.
9. If any portion of the cadet's body touches the floor or if they do not complete the proper movement, they are eliminated and must leave the rank floor.
10. Once all the cadets have been eliminated from the first group, start the second group, following the same steps.
11. Continue until all cadets have had a chance to participate in the activity.

If any cadet does not want to participate in this activity, he or she can be a judge. Have extra tape available in case the ranks slip around on the floor.

SAFETY

- Cadets shall remove their shoes prior to completing this activity.
- This activity shall be stopped immediately if there is any horseplay.

ACTIVITY

OBJECTIVE

The objective of this activity is to become familiar with Sea and Army Cadet ranks.

RESOURCES

- Paper copies of each rank insignia (use as many ranks as the number of cadets in the class. If there are more than fourteen cadets, there can be more than one cadet with the same rank). Ranks are located at Annex B, and
- Tape.

ACTIVITY LAYOUT

Cut out ranks, ensuring there is one for each cadet.

ACTIVITY INSTRUCTIONS

1. Tape a rank to the back of each cadet (the cadet does not get to see the rank that is on their back). Cadets should not talk while this is being done.
2. Have the cadets walk around and ask other cadets yes/no questions to determine what rank they are wearing. For example, the cadet may ask “Do I have two chevrons?” The cadet has to determine from the answers what rank they are. Cadets may not ask any questions that have specific rank names, such as “Am I a Leading Seaman?”
3. There can only be one question asked to each of the other cadets to determine what rank they are. Cadets will move from cadet to cadet until they have determined the rank they are.
4. Once cadets have determined what rank they are, they will gather with any other cadets who are the same rank, if there are any.
5. After three minutes, have the cadets present what rank they think they are based on the information they have received. For example, if a group has determined they have an Army Cadet rank with only two chevrons, they would present themselves as an Army Cadet corporal.

SAFETY

N/A.

ACTIVITY

OBJECTIVE

The objective of this matching activity is to become familiar with Sea and Army Cadet ranks.

RESOURCES

Matching cards of Sea and Army Cadet rank insignia located at Annex D.

ACTIVITY LAYOUT

Cut out one set of matching cards of Sea and Army Cadet ranks for each group of cadets.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into groups of two or three.
2. Distribute a set of matching cards of Sea and Army Cadet ranks to each group.
3. Have the cadets match the title to the badge for each rank.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

The cadets' participation in the in-class activity in TP2 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Being able to identify the ranks of the Sea and Army Cadets will make it easier to understand the ranks worn on their uniforms. Cadets may gain an appreciation for the differences and similarities between Sea, Army and Air Cadets.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-001 A-AD-265-000/AG-001 DHH 3-2. (2001). *Canadian Forces Dress Instructions.* Ottawa, ON: The Department of National Defence.

A1-003 A-CR-005-001/AG-001 D Cdts 4. (Draft). *Royal Canadian Sea Cadets Dress Instructions.* Ottawa, ON: Department of National Defence.

A2-030 CATO 40-03 D Cdts 4. (2005). *Army Cadet Ranks and Cadet Corps.* Ottawa, ON: Department of National Defence.

THIS PAGE INTENTIONALLY LEFT BLANK

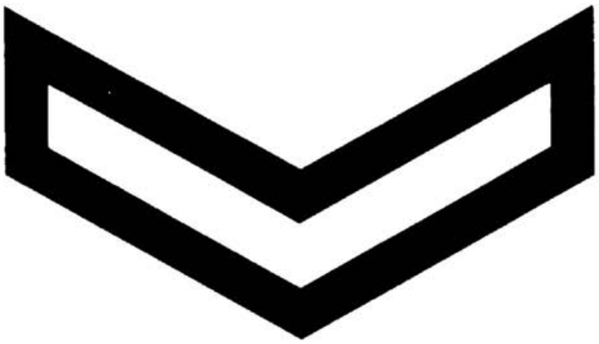
CADET RANK INSIGNIA

SEA CADET RANKS	ARMY CADET RANKS	AIR CADET RANKS
ORDINARY SEAMAN (OS) (NO BADGE)	CADET (NO BADGE)	AIR CADET (AC) (NO BADGE)
ABLE SEAMAN (AB) 	PRIVATE (Pte) 	LEADING AIR CADET (LAC) 
LEADING SEAMAN (LS) 	CORPORAL (Cpl) 	CORPORAL (Cpl) 
MASTER SEAMAN (MS) 	MASTER CORPORAL (MCpl) 	FLIGHT CORPORAL (FCpl) 
PETTY OFFICER SECOND CLASS (PO2) 	SERGENT (Sgt) 	SERGEANT (Sgt) 
PETTY OFFICER FIRST CLASS (PO1) 	WARRANT OFFICER (WO) 	FLIGHT SERGEANT (FSgt) 
CHIEF PETTY OFFICER SECOND CLASS (CPO2) 	MASTER WARRANT OFFICER (MWO) 	WARRANT OFFICER SECOND CLASS (WO2) 
CHIEF PETTY OFFICER FIRST CLASS (CPO1) 	CHIEF WARRANT OFFICER (CWO) 	WARRANT OFFICER FIRST CLASS (WO1) 

THIS PAGE INTENTIONALLY LEFT BLANK

INSIGNIA

SEA

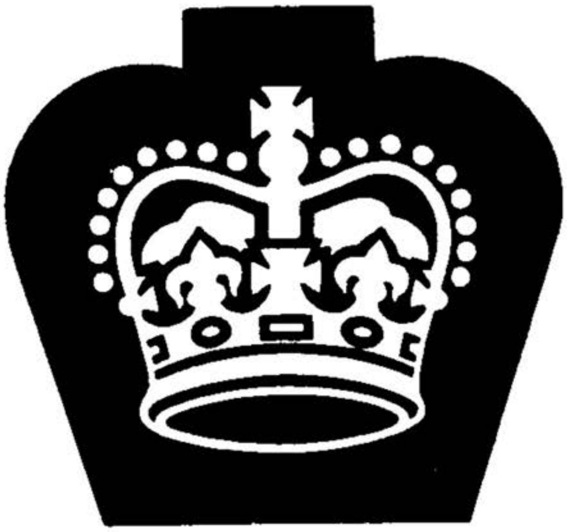


SEA

SEA

SEA

SEA



SEA

SEA

ARMY

ARMY

ARMY

ARMY

ARMY

ARMY

ARMY

ACTIONS

LEFT HAND	CHIEF PETTY OFFICER SECOND CLASS
RIGHT HAND	CHIEF PETTY OFFICER FIRST CLASS
LEFT FOOT	PRIVATE
RIGHT FOOT	CORPORAL
ABLE SEAMAN	MASTER CORPORAL
LEADING SEAMAN	SERGEANT
MASTER SEAMAN	WARRANT OFFICER
PETTY OFFICER SECOND CLASS	MASTER WARRANT OFFICER
PETTY OFFICER FIRST CLASS	CHIEF WARRANT OFFICER

THIS PAGE INTENTIONALLY LEFT BLANK

MEMORY MATCH CARDS

RECRUIT	(NO INSIGNIA)
PRIVATE (Pte)	
CORPORAL (Cpl)	
MASTER CORPORAL (Mcpl)	
SERGEANT (Sgt)	

WARRANT OFFICER (WO)	
MASTER WARRANT OFFICER (MWO)	
CHIEF WARRANT OFFICER (CWO)	
ORDINARY SEAMAN (OS)	(NO INSIGNIA)
ABLE SEAMAN (AB)	

LEADING SEAMAN (LS)	
MASTER SEAMAN (MS)	
PETTY OFFICER SECOND CLASS (Po2)	
PETTY OFFICER FIRST CLASS (Po1)	
CHIEF PETTY OFFICER SECOND CLASS (CPO2)	

CHIEF PETTY OFFICER FIRST CLASS (CPO1)	

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 6

EO C207.03 – DESCRIBE THE AFFILIATED UNIT

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-802/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.

Invite a member of the affiliated unit to participate in this lesson.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to the history of the affiliated unit and to generate interest.

An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate interest in the history of the affiliated unit among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to describe the affiliated unit.

IMPORTANCE

It is important for cadets to describe the affiliated unit, as it will help to develop a good rapport, working relationship, and understanding between the squadron and its affiliated unit.

Teaching Point 1 | **Describe the Affiliated Unit**

Time: 15 min | Method: Interactive Lecture

This TP may be conducted by a member of the affiliated unit.

Describe the affiliated unit, to include:

- size;
- location;
- role within the CF;
- formation date;
- the building(s) it occupies;
- traditions;
- previous and future deployments;
- special awards/medals awarded to members;
- role in relation to the squadron; and
- other interesting facts.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. How many members are in the affiliated unit?

Q2. What was the formation date of the affiliated unit?

Q3. What awards/medals have been awarded to members of the affiliated unit?

ANTICIPATED ANSWERS

A1. Answer will vary by unit.

A2. Answer will vary by unit.

A3. Answer will vary by unit.

Teaching Point 2 | **Conduct an Activity on the Affiliated Unit**

Time: 10 min | Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to describe the affiliated unit.

RESOURCES

- Paper/construction paper/bristol board.
- Pencils/pens.
- Coloured pencils/markers.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Have the cadets create a poster (individually or in groups) that portrays a minimum of five of the characteristics of the affiliated unit covered in TP1.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

The cadets' participation in the activity in TP2 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The affiliated unit is a frontline connection to the CF, and may provide supplementary support to the squadron (e.g. equipment, personnel, and facilities). Having knowledge of the affiliated unit will help to develop a good rapport, working relationship, and understanding between the squadron and the affiliated unit.

INSTRUCTOR NOTES/REMARKS

The instructor for this lesson may be a member of the squadron or the affiliated unit.

If the affiliated unit has access to promotional materials, these may be used as references and/or training/learning aids.

Topics found in TP1 may differ for each affiliated unit. The instructor should determine interesting facts of the affiliated unit prior to the lesson.

The posters created during this lesson may be used in a display at the annual ceremonial review.

REFERENCES

N/A.

CHAPTER 8

PO 208 – EXECUTE DRILL AS A MEMBER OF A SQUAD

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 1

EO M208.01 – EXECUTE LEFT AND RIGHT TURNS ON THE MARCH

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Select the most effective squad formation for the instruction of this lesson. A squad may be in single rank, hollow-square, or semi-circle. Ensure that all cadets are positioned to hear all explanations and see all demonstrations.

Assistant instructors may be required if the squad is broken down into smaller sections for movements that require extra practice.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration and performance was chosen for this lesson as it allows the instructor to explain and demonstrate turning on the march while providing an opportunity for the cadets to practice turning on the march under supervision.

> Develop and use a vocabulary of short, concise words to impress on the platoon that the movements must be performed smartly. For example, the words “crack”, “drive”, “seize”, and “grasp” suggest the degree of smartness required. Profanity or personal sarcasm will never be used.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to execute left and right turns on the march.

IMPORTANCE

It is important for cadets to perform drill movements at a competent level at the cadet squadron and at the CSTC. Cadets moving together as one promotes discipline, alertness, precision, pride, steadiness, and cohesion, which in turn helps develop the basis of teamwork.

> Proper drill movements should be combined with a professional demeanour throughout the period of instruction.
>
> Check for faults and correct them immediately when they occur.

> Each TP is to be conducted as follows:
>
> 1. Have cadets fall in, in an effective squad formation (e.g. hollow square).
> 2. Explain and demonstrate each of the movements given, as time allows.
> 3. Give cadets time to practice each movement on their own after the demonstration.
> 4. After all movements have been demonstrated and practiced, give commands and have the cadets perform them as a squad.

> Capitalization indicates the words of command for each movement.
>
> When bending the knee, it is raised 15 cm off the ground.
>
> Cadence is to be maintained when completing movements.

Teaching Point 1	Explain, Demonstrate, and Have Cadets Practice Left Turn on the March
Time: 25 min	Method: Demonstration and Performance

> Left turn on the march is given as the right foot is forward and on the ground.

LEFT TURN ON THE MARCH

In quick time, on the command LEFT – TURN, the cadets shall:

1. on the first movement, take one half pace forward with the left foot, with the right arm swung forward and the left arm to the rear;
2. on the second movement:

(a) cut the arms to the side as in the position of attention;

(b) bend the right knee;

(c) use the momentum of the knee to force the shoulders 90 degrees to the left to face the new direction, while simultaneously pivoting on the ball of the left foot 90 degrees to the left;

(d) straighten the right leg as in the position of attention;

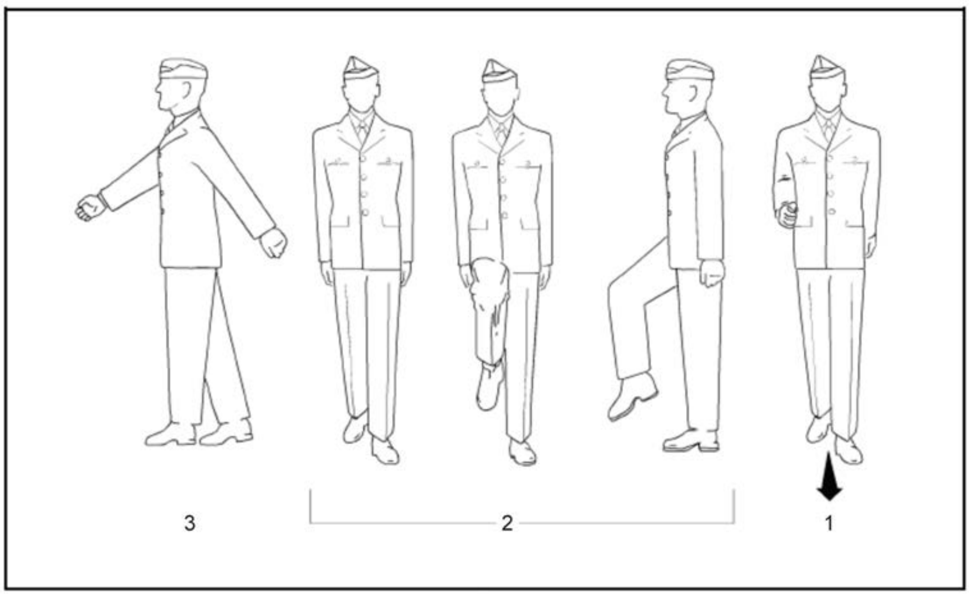
(e) shoot the left foot forward one half pace with the toe just clear of the ground;

(f) keep the body and head up; and

(g) keep the arms, body, and head steady; and

3. on the third movement, take a half pace with the left foot and continue to march (swinging the arms).

Timing for this movement is “check, pivot, left, right, left”.

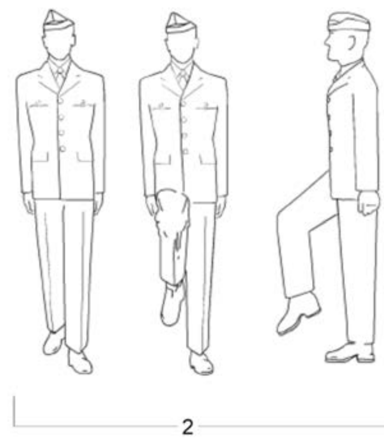


A-PD-201-000/PT-000 (p. 3-30)

Figure 1 Left Turn in Quick Time

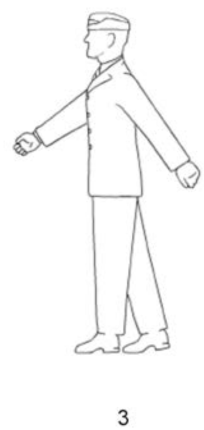
A-PD-201-000/PT-000 (p. 3-30)

Figure 2 Left Turn – Movement One



A-PD-201-000/PT-000 (p. 3-30)

Figure 3 Left Turn – Movement Two



A-PD-201-000/PT-000 (p. 3-30)

Figure 4 Left Turn – Movement Three

CONFIRMATION OF TEACHING POINT 1

Cadets will execute left turns on the march as a squad.

Teaching Point 2 | **Explain, Demonstrate, and Have Cadets Practice Right Turn on the March**

Time: 25 min | Method: Demonstration and Performance

Right turn on the march is given as the left foot is forward and on the ground.

RIGHT TURN ON THE MARCH

In quick time, on the command RIGHT – TURN, the cadet shall:

1. on the first movement, take one half pace forward with the right foot, with the left arm forward and the right arm to the rear;
2. on the second movement:
   (a) cut the arms to the side as in the position of attention;
   (b) bend the left knee;
   (c) use the momentum of the knee to force the shoulders 90 degrees to the right to face the new direction, while simultaneously pivoting on the ball of the right foot 90 degrees to the right;
   (d) straighten the left leg as in the position of attention;
   (e) shoot the right foot forward one half pace with the toe just clear of the ground;
   (f) keep the body and head up; and
   (g) keep the arms, body, and head steady; and
3. on the third movement, take a half pace with the right foot and continuing to march (swinging the arms).

Timing for this movement is “check, pivot, right, left, right”.

CONFIRMATION OF TEACHING POINT 2

Cadets will execute right turns on the march as a squad.

END OF LESSON CONFIRMATION

The confirmation of this lesson shall consist of the cadets, as a squad, executing left and right turns on the march and shall emphasize any movements that cadets had difficulty with during the class.

Practice the complete movements with:

- the **instructor** calling the time;
- the **squad** calling the time; and
- the squad **judging** the time.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Drill develops many qualities through self-discipline and practice. Drill that is well-rehearsed, closely supervised and precise is an exercise in obedience and alertness that creates teamwork among members.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-002 A-PD-201-000/PT-000 Directorate of History and Heritage 3-2. (2001). *The Canadian Forces Manual of Drill and Ceremonial.* Ottawa, ON: The Department of National Defence.

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 2

EO M208.02 – FORM SINGLE FILE FROM THE HALT

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-802/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.

Select the most effective squad formation for the instruction of this lesson. A squad may be in single rank, hollow-square, or semi-circle. Ensure that all cadets are positioned to hear all explanations and see all demonstrations.

Assistant instructors may be required if the squad is broken down into smaller sections for movements that require extra practice.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration and performance was chosen for this lesson as it allows the instructor to explain and demonstrate the skill the cadet is expected to acquire while providing an opportunity for the cadets to practice forming single file from the halt under supervision.

> Develop and use a vocabulary of short, concise words to impress on the platoon that the movements must be performed smartly. For example, the words “crack”, “drive”, “seize”, and “grasp” suggest the degree of smartness required. Profanity or personal sarcasm will never be used.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to form single file from the halt.

IMPORTANCE

It is important for cadets to perform drill movements at a competent level at the cadet squadron and at the CSTC. Cadets moving together as one promotes discipline, alertness, precision, pride, steadiness, and cohesion, which in turn helps develop the basis of teamwork.

Proper drill movements should be combined with a professional demeanour throughout the period of instruction.

Check for faults and correct them immediately when they occur.

This lesson is not broken down into movements. Demonstrate and allow time for the cadets to practice, in a variety of positions.

Capitalization indicates the words of command for each movement.

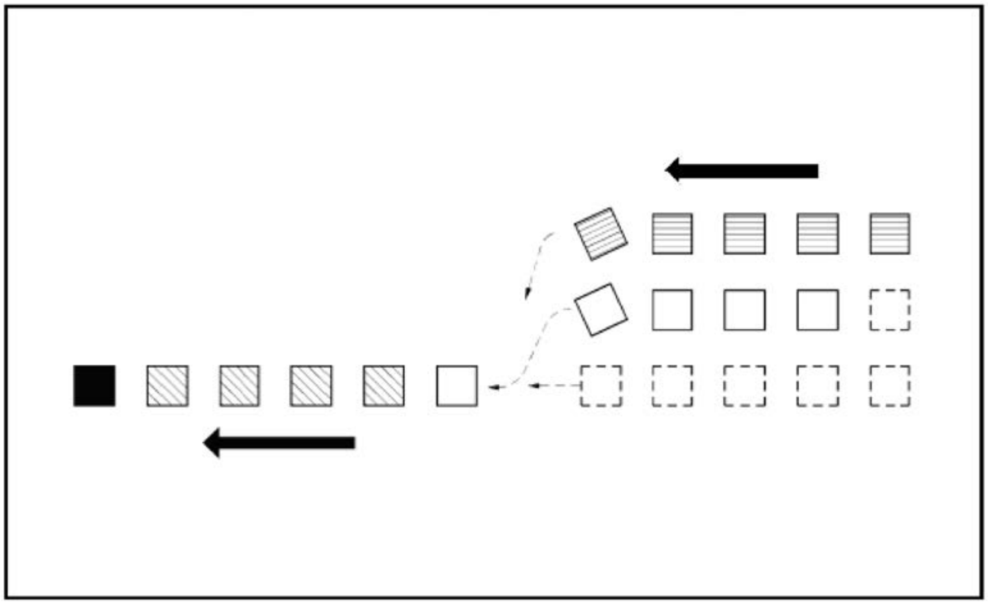
Cadence is to be maintained when completing these movements.

Teaching Point 1	**Explain, Demonstrate, and Have Cadets Practice Forming Single File From the Halt as a Squad in Threes**
Time: 15 min	Method: Demonstration and Performance

FORM SINGLE FILE FROM THE HALT AS A SQUAD IN THREES

On the command SINGLE FILE FROM THE LEFT (RIGHT), QUICK – MARCH, the movement will be completed by:

1. the directing flank marching off in single file in quick time; and
2. the remaining cadets marking time. The markers of the other two ranks executing a left (right) incline and leading off when the file on their left (right) is clear.



A-PD-201-000/PT-000 (p. 3-30)

Figure 1 Squad in Threes Forming Single File

CONFIRMATION OF TEACHING POINT 1

Practice the movement in squad formation. Cadets should have the opportunity to practice the movement from different positions in the squad.

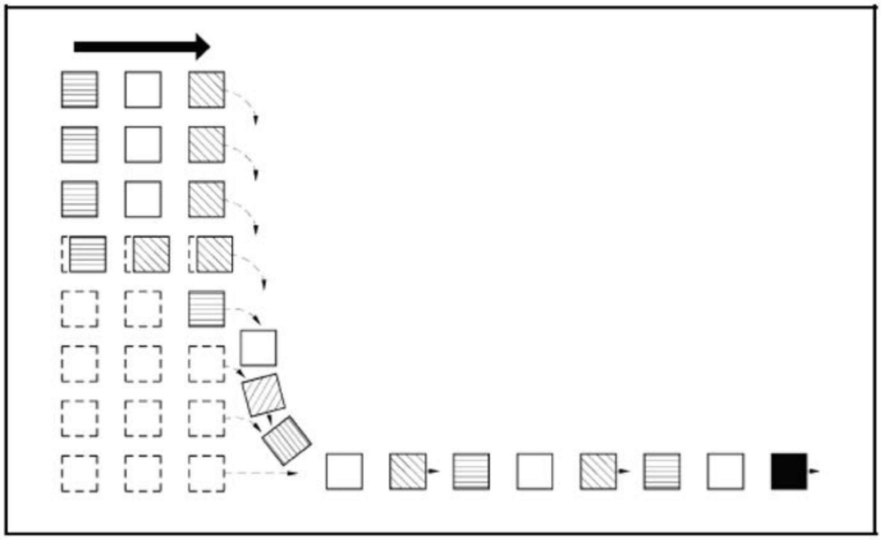
Teaching Point 2 — **Explain, Demonstrate, and Have Cadets Practice Forming Single File From the Halt as a Squad in Line**

Time: 10 min — Method: Demonstration and Performance

FORM SINGLE FILE FROM THE HALT AS A SQUAD IN LINE

On the command SINGLE FILE FROM THE LEFT (RIGHT), QUICK – MARCH, the movement will be completed by:

1. the file on the directing flank marching forward in single file in quick time; and
2. the remaining cadets marking time. The markers of the other two ranks directing the remaining cadets by wheeling in single file, following the file on their left (right) when clear.



A-PD-201-000/PT-000 (p. 3-30)

Figure 2 Squad in Line Forming Single File

CONFIRMATION OF TEACHING POINT 2

Practice the movement in squad formation. Cadets should have the opportunity to practice the movement from different positions in the squad.

END OF LESSON CONFIRMATION

The confirmation of this lesson shall consist of the cadets, as a squad, forming single file from the halt as a squad in threes and in line, and shall emphasize any aspects the cadets experienced difficulty with during the class.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Drill develops many qualities through self-discipline and practice. Drill that is well-rehearsed, closely supervised and precise is an exercise in obedience and alertness that creates teamwork among members.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-002 A-PD-201-000/PT-000 Directorate of History and Heritage 3-2. (2001). *The Canadian Forces Manual of Drill and Ceremonial.* Ottawa, ON: The Department of National Defence.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 3

EO C208.01 – PRACTICE CEREMONIAL DRILL AS A REVIEW

Total Time:	60 min

There is no Instructional Guide provided for this EO. Refer to A-PD-201-000/PT-001.

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 4

EO C208.02 – EXECUTE DRILL WITH ARMS

Total Time:	240 min

There is no Instructional Guide provided for this EO. Refer to A-CR-CCP-053/PT-001, *Royal Canadian Sea Cadets Manual of Drill and Ceremonial*.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 9

PO 211 – PARTICIPATE IN COMPETITIVE SUMMER BIATHLON ACTIVITIES

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 1

EO C211.01 – IDENTIFY CIVILIAN BIATHLON OPPORTUNITIES

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-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to civilian biathlon opportunities and to generate interest.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify civilian biathlon opportunities.

IMPORTANCE

It is important for cadets to identify civilian biathlon opportunities because they may choose to pursue the sport of biathlon outside the Cadet Program.

Teaching Point 1 **Introduce Local, Provincial/Territorial, National, and International Biathlon Training Opportunities**

Time: 10 min Method: Interactive Lecture

There are many training opportunities for biathletes at the local, provincial/territorial, national, and international levels. These training opportunities include clinics and camps ranging from weekend programs for basic and intermediate training, to year round advanced training. Training development clinics offered include coaching, race opportunities and training programs for all ranges in skill levels from the beginner to the advanced competitor training at the national team level.

LOCAL

Local ski resorts/clubs may offer a selection of biathlon programs. Biathlon Bears is a community coaching program offered across Canada. The Biathlon Bears program is open to novices and the training is tailored to the athlete's skill level. This program offers training to develop both skiing and marksmanship skills. There is a ranking structure in the program. As skills are learned and mastered, the biathlete progresses to the next Biathlon Bear level.

For examples of local biathlon training opportunities, contact the local ski resort/club.

PROVINCIAL/TERRITORIAL

Divisions of Biathlon Canada are located within many of the provinces/territories. These division offices run training and offer support to the local resorts/clubs.

For examples of provincial/territorial biathlon training opportunities, contact the division office/ Website.

NATIONAL

Biathlon Canada is the governing body for the sport of biathlon within Canada. There are two national biathlon training centres located in Canmore, Alberta and Valcartier, Quebec. These centres offer training to the national biathlon teams.

For examples of national biathlon training opportunities, contact Biathlon Canada (www.biathloncanada.ca).

INTERNATIONAL

The International Biathlon Union (IBU) is the governing body for the sport of biathlon internationally. There are biathlon training centres located across the globe. National training centres offer training to athletes who will be competing internationally. The international training centres allow high performance biathletes to train in various geographical regions where the elevation above sea level, and the changes in the oxygen density, create different training demands on the biathlete. This allows the biathlete to adapt to the environmental conditions prior to the competition, thus increasing their expected performance outcome.

For examples of international biathlon training opportunities, contact the International Biathlon Union (www.biathlonworld.com).

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Who offers biathlon training at the local level?

Q2. Where are the two Canadian national biathlon training centres located?

Q3. What is the name of the organization that governs biathlon internationally?

ANTICIPATED ANSWERS

A1. Local ski resorts/clubs.

A2. Canmore, Alberta and Valcartier, Quebec.

A3. The International Biathlon Union (IBU).

Teaching Point 2 — **Introduce Local, Provincial/Territorial, National, and International Competitive Biathlon Opportunities**

Time: 10 min — Method: Interactive Lecture

LOCAL

Local ski resorts/clubs offer competitive events across Canada from beginner to advanced racing opportunities.

For examples of local competitive biathlon opportunities, contact the local ski resort/club.

PROVINCIAL/TERRITORIAL

The division offices located within many Canadian provinces/territories offer regional competitive biathlon events. Many of these events require advancement through a ranking process. There are race qualifications that the competitors must meet, which may include, but are not limited to, age, gender, resort/club or team standings, or previous race standings (if in a series of races). Not all races lead to a higher level, they may only be a participatory race.

For examples of provincial/territorial competitive biathlon opportunities, contact the division office/Website.

NATIONAL

National competitive biathlon events offered through Biathlon Canada include:

- Canadian Championships; and
- Canada Games.

For examples of national competitive biathlon opportunities, contact Biathlon Canada (www.biathloncanada.ca).

INTERNATIONAL

International competitive biathlon events offered in conjunction with the IBU include:

- Olympic Games;
- World Cup;
- World Championship;
- European Cup; and
- Europa Cup.

For examples of international competitive biathlon opportunities, contact the International Biathlon Union (www.biathlonworld.com).

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What types of criteria must a biathlete meet to proceed to a provincial/territorial competition?

Q2. Name one national competitive biathlon event.

Q3. Name two international competitive biathlon events.

ANTICIPATED ANSWERS

A1. Age, gender, resort/club or team standings, or previous race standings (if in a series of races).

A2. National competitive biathlon events offered through Biathlon Canada include:

- Canadian Championships; and

- Canada Games.

A3. International competitive biathlon events offered in conjunction with the IBU include:

- Olympic Games;
- World Cup;
- World Championship;
- European Cup; and
- Europa Cup.

Teaching Point 3	**Identify Famous Biathletes Who Were Introduced to the Sport Through the Canadian Cadet Program**
Time: 5 min	Method: Interactive Lecture

Biathletes who were introduced to the sport through the Canadian Cadet Program have seen Olympic glory. There are numerous ex-cadets who are successful on both the national and international scene. These biathletes include Myriam Bédard, Nikki Keddie, Martine Albert, and Jean-Philippe Le Guellec.

Jean-Philippe Le Guellec, from Shannon, Quebec, was introduced to the sport of biathlon through the air Cadet Program. He won three gold medals at the 2007 Biathlon Canada Championships in Charlo, New Brunswick and participated in the 2006 Winter Olympics in Torino, Italy.

Myriam Bédard, from Ancienne-Lorrette, Quebec, was introduced to the sport of biathlon through the Army Cadet Program. She was the first Canadian athlete to win a World Cup biathlon event in 1991, and the first North American athlete to win an Olympic medal in the 1992 Winter Games at Albertville, France. She also won two gold medals at the 1994 Winter Olympics in Lillehammer, Norway. These were the first Olympic biathlon gold medals won by a North American biathlete. On 4 November 1998 Myriam Bédard was inducted into Canada's Sports Hall of Fame.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Name two famous biathletes who were introduced to the sport through the Canadian Cadet Program.

Q2. How many gold medals have been won by Jean-Philippe Le Guellec?

Q3. Myriam Bédard was introduced to the sport of biathlon through which element of the Cadet Program?

ANTICIPATED ANSWERS

A1. Myriam Bédard, Nikki Keddie, Martine Albert, and Jean-Philippe Le Guellec.

A2. Three.

A3. Army Cadets.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What is the name of the training program offered at many ski resorts/clubs in Canada?

Q2. What is the name of the organization that governs the sport of biathlon in Canada?

Q3. Jean-Philippe Le Guellec was introduced to the sport of biathlon through which element of the Cadet Program?

ANTICIPATED ANSWERS

A1. Biathlon Bears.

A2. Biathlon Canada.

A3. Air Cadets.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Biathlon is a fun and exciting activity that requires personal discipline. For those who choose to pursue this sport, there are numerous civilian training and competitive opportunities available at the local, provincial/territorial, national, and international levels.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-042 Regional Cadet Support Unit (Central). (2007). *Cadet Marksmanship and Firearms Safety Program.* Retrieved 18 April 2007, from http://www.central.cadets.ca/events/biath_cadetmarksman_e.html.

C0-082 Biathlon Canada. (2007). *Biathlon Canada.* Retrieved 12 February 2007, from http://www.biathloncanada.ca.

C0-148 International Biathlon Union. (2007). *International Biathlon Union.* Retrieved 18 April 2007, from http://www.biathlonworld.com.

C0-149 Biathlon Canada. (2005). *Biathlon Bears: Community Coaching.* Ottawa, Ontario: Biathlon Canada.

C0-153 Library and Archives Canada. (2000). *Myriam Bédard.* Retrieved 30 April 2007, from http://www.collectionscanada.ca/women/002026-223-e.html.

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 2

EO C211.02 – RUN ON ALTERNATING TERRAIN

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-802/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.

Ensure a first aid station is set up and a first aid attendant is available during the practical activities.

Photocopy the sample running schedule located at Annex B for each cadet.

Set up a running route on alternating terrain, depending on geographical location.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP5 to introduce cadets to running techniques on alternating terrain and on how to implement a running program.

A practical activity was chosen for TP2 to TP4 as it is an interactive way to introduce the cadets to running on alternating terrain in a safe and controlled environment.

INTRODUCTION

REVIEW

Review EO C111.02 (Run Wind Sprints), to include:

- preparing for summer biathlon activities; and
- running techniques.

OBJECTIVES

By the end of this lesson the cadet shall have run on alternating terrain.

IMPORTANCE

It is important for cadets to run on alternating terrain because it will be useful when participating in summer biathlon activities.

Teaching Point 1	**Describe Running Techniques for Alternating Terrain**
Time: 5 min	Method: Interactive Lecture

POSTURE/BODY ALIGNMENT

Uphill Running

On gradual inclines, runners should run a bit harder than when on level terrain. On steep inclines runners should lift the knees and push off with every step.

Downhill Running

When running downhill the runner should lean into the hill and use short, quick strides.

FOOT POSITIONING

Distance runners should land on their heels or mid-foot and roll forward to the toe while running. Running up on the toes is the method used by sprinters, and if used for distance running, may cause the shins and calves to become tight.

ENDURANCE

To increase endurance, runners should increase distance, duration, and level of difficulty of their runs.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. How should your foot strike the ground when running distances?

Q2. What technique should be used when running up steep inclines?

Q3. What technique should be used when running downhill?

ANTICIPATED ANSWERS

A1. Distance runners should land on their heels or mid-foot and roll forward to the toe.

A2. Lift the knees and push off with every step.

A3. Lean into the hill and use short, quick strides.

Teaching Point 2	Conduct a Warm-up Session Composed of Light Cardiovascular Excercises
Time: 5 min	Method: Practical Activity

> The following information will be explained to the cadets during the warm-up activity.

PURPOSE OF A WARM-UP

A warm-up is composed of stretches and light cardiovascular exercises designed to:

- stretch the muscles;
- gradually increase respiratory action and heart rate;
- expand the muscles' capillaries to accommodate the increase in blood circulation which occurs during physical activity; and
- raise the muscle temperature to facilitate reactions in muscle tissue.

GUIDELINES FOR STRETCHING

The following guidelines should be followed while stretching to prepare for physical activity and to help prevent injury:

- Stretch all major muscle groups, including the back, chest, legs, and shoulders.
- Never bounce while stretching.
- Hold each stretch for 10 to 30 seconds to let the muscles release fully.
- Repeat each stretch two to three times.
- When holding a stretch, support the limb at the joint.
- Static stretching, which is stretching a muscle and holding it in position without discomfort for 10 to 30 seconds, is considered the safest method.
- Stretching helps to relax the muscles and improve flexibility, which is the range of motion in the joints.
- As a guide, allow 10 minutes to warm-up for every hour of physical activity.

> The stretches chosen should focus on the areas of the body that will be used the most during the running activity.

ACTIVITY

OBJECTIVE

The objective of this warm-up activity is to stretch the muscles and perform light cardiovascular exercises to prepare the body for physical activity and to help prevent injuries.

RESOURCES

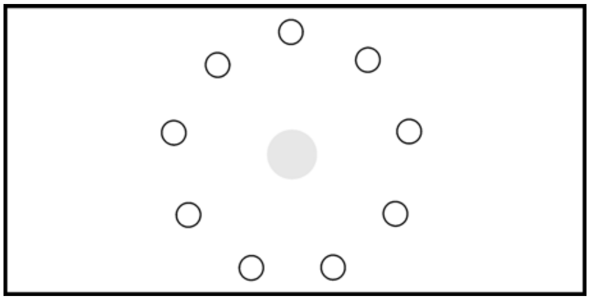
N/A.

ACTIVITY LAYOUT

N/A.

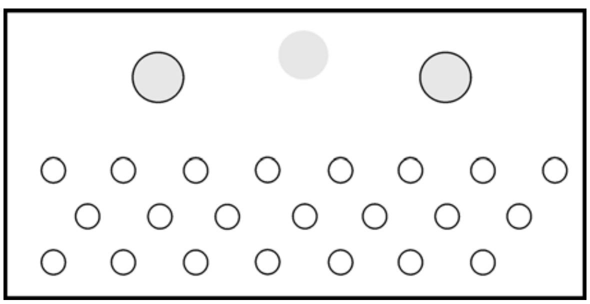
ACTIVITY INSTRUCTIONS

- Arrange the cadets in either a warm-up circle or in rows (as illustrated in Figures 1 and 2).



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 1 Instructor in the Centre of a Warm-up Circle



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 2 Instructor at the Front With Two Assistant Instructors

- Demonstrate before having the cadets attempt each stretch/light cardiovascular exercise.
- Assistant instructors can help demonstrate the exercises and ensure the cadets are performing them correctly.
- Have cadets perform each stretch/light cardiovascular exercise.

Light cardiovascular activities should be done to warm-up the muscles prior to stretching to avoid injury to or tearing of the muscles. For example, running on the spot for 30 seconds or performing jumping jacks should be performed prior to conducting the stretching activities located at Annex A.

SAFETY

- Ensure there are at least two arm lengths between the cadets so they can move freely.
- Ensure the cadets perform the stretches and light cardiovascular exercises in a safe manner, following the guidelines for stretching listed in this TP.

CONFIRMATION OF TEACHING POINT 2

The cadets' participation in the warm-up will serve as the confirmation of this TP.

Teaching Point 3	**Supervise While the Cadets Run on Alternating Terrain**
Time: 5 min	Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets run on alternating terrain.

RESOURCES

- Area with alternating terrain that is large enough to conduct a run.
- A whistle.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

- Have the cadets run at a comfortable pace.
- Ensure that the run includes some uphill and downhill inclines, and that the cadets use the techniques described in TP1.

SAFETY

- Ensure a designated first aider and first aid kit are available.
- Ensure water is available for the cadets after they complete the run.

CONFIRMATION OF TEACHING POINT 3

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

Teaching Point 4	**Conduct a Cool-down Session Composed of Light Cardiovascular Exercises**
Time: 5 min	Method: Practical Activity

The following information will be explained to the cadets during the cool-down activity.

PURPOSE OF A COOL-DOWN

A cool-down is composed of stretches and light cardiovascular exercises designed to:

- allow the body time to slowly recover from physical activity and to help prevent injury;
- prepare the respiratory system to return to its normal state; and
- stretch the muscles to help relax and restore them to their resting length.

The stretches chosen should focus on the areas of the body that were used the most during the running activity.

ACTIVITY

OBJECTIVE

The objective of the cool-down is to stretch the muscles and perform light cardiovascular exercises that allow the body time to recover from physical activity, and to prevent injury.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

- Arrange the cadets in either a warm-up circle or in rows (as illustrated in Figures 1 and 2).
- Demonstrate before having the cadets attempt each stretch/light cardiovascular exercise.
- Assistant instructors can help demonstrate the movements and ensure the cadets are performing them correctly.
- Have cadets perform each stretch/light cardiovascular exercise.

SAFETY

- Ensure there are at least two arm lengths between the cadets so they can move freely.
- Ensure the cadets perform the stretches and light cardiovascular exercises in a safe manner, following the guidelines for stretching listed in TP2.

CONFIRMATION OF TEACHING POINT 4

The cadets' participation in the cool-down will serve as the confirmation of this TP.

Teaching Point 5 | **Describe How to Create and Implement a Running Schedule**

Time: 5 min | Method: Interactive Lecture

PURPOSE OF RUNNING SCHEDULE

A running schedule will help a new runner ease into a training plan, or guide an experienced runner to increase their endurance. The schedule should allow the runner to gradually increase intensity at a comfortable pace. A sample running schedule is located at Annex B.

GUIDELINES FOR RUNNING SCHEDULES

The following guidelines should be followed when creating a running schedule to increase endurance and to help prevent injury:

- If there is no running background, begin with eight consecutive days of walking (20 minutes the first four days, and 30 minutes the remaining four days).
- If there is a running background, begin by walking/running four times a week for 20 to 30 min (e.g. 2 min running/4 min walking, repeat this five times for a 30 min workout).
- Increase the running time, as fitness level allows until the cadet is able to run for 30 minutes continuously.
- The distance run in 30 minutes will increase as fitness level improves, allowing for the run to be calculated based on distance instead of time.
- Change the terrain as fitness level improves.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS

Q1. What is the purpose of a running schedule?

Q2. What should a person with no running background begin with?

Q3. What will increase as fitness level improves?

ANTICIPATED ANSWERS

A1. A running schedule will help a new runner ease into a training plan, or guide an experienced runner to increase their endurance.

A2. Begin with eight consecutive days of walking.

A3. The distance that can be run in 30 minutes will increase as fitness level improves.

END OF LESSON CONFIRMATION

The cadet's participation in the activity in TP3 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Running on alternating terrain will help to increase endurance, which will be useful when participating in summer biathlon activities.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-002 (ISBN 0-88962-630-8) LeBlanc, J. & Dickson, L. (1997). *Straight Talk About Children and Sport: Advice for Parents, Coaches, and Teachers.* Oakville, ON and Buffalo, NY: Mosaic Press.

C0-057 Martha Jefferson Hospital. (2001). *Warm-ups.* Retrieved 16 October 2006, from http://www.marthajefferson.org/warmup.php.

C0-058 Webb Physiotherapists Inc. (ND). *Running Exercises.* Retrieved 26 October 2006 from http://www.physioline.co.za/conditions/article.asp?id=46.

C0-059 Webb Physiotherapists Inc. (ND). *Exercise Programme for Squash, Tennis, Softball, Handball.* Retrieved 25 October 2006 from http://www.physioline.co.za/conditions/article.asp?id=49.

C0-060 Impacto Protective Products Inc. (1998). *Exercises.* Retrieved 25 October 2006, from http://www.2protect.com/work3b.htm.

C0-061 City of Saskatoon, Community Services Department. (ND). *Stretch Your Limits: A Smart Guide To Stretching for Fitness.* Retrieved 26 October 2006, from http://in-motion.ca/walkingworkout/plan/flexibility/.

C0-080 Cool Running. (2007). *Fitness and Performance.* Retrieved 12 February 2007, from http://www.coolrunning.com/engine/2/2_3/181.shtml.

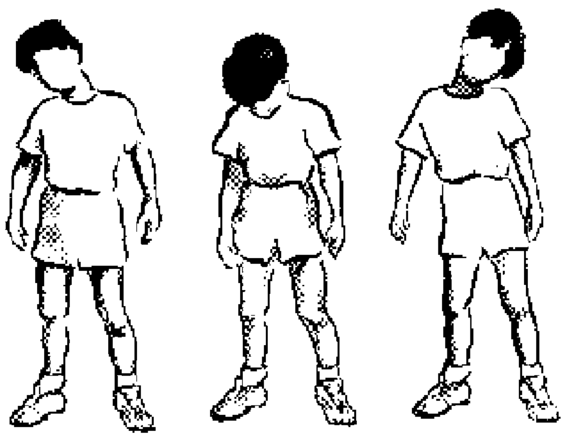
C0-089 (ISBN 0-936070-22-6) Anderson, B. (2000). *Stretching: 20th Anniversary* (Rev. ed.). Bolinas, CA: Shelter Publications, Inc.

C0-146 Will-Weber, M. (2006). *Runner's World: Beginner's: Training: First Steps.* Retrieved 18 April 2007, from http://www.runnersworld.com/article/printer/1,7124,s6-380-381-386-678-0,00.html.

C0-154 Hansen, B. (1999). *Moving on the Spot: Fun and Physical Activity: A Collection of 5 minute Stretch and Movement Sessions.* Retrieved 26 October 2006, from http://lin.ca/resource/html/dn3.htm#l1.

SAMPLE STRETCHES

NECK



Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1

Figure A-1 Neck Stretch

Slowly roll your head across your chest from shoulder to shoulder. Do not roll your head backwards.

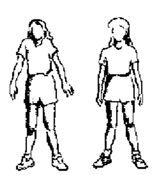
SHOULDERS

Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1

Figure A-2 Shoulder Push

Stand and extend your arms behind you, interlocking your fingers. Push up and back with your shoulders.

Hold this position for a minimum of 10 seconds.



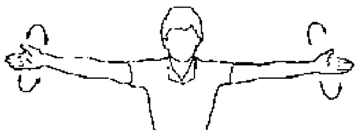
Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1

Figure A-3 Shoulder Shrug

Stand and raise your shoulders as high as possible and then lower your shoulders, stretching your neck up.

Pull your shoulders back as far as possible and then round your shoulders forward by pushing your shoulders forward as far as possible.

Hold each position for a minimum of 10 seconds.

 *Warm Ups, by Martha Jefferson Hospital, Copyright 2001 by Martha Jefferson Hospital. Retrieved 26 October 2006, from http://www.marthajefferson.org/warmup.php* Figure A-4 Arm Circles	Hold your arms straight out, palms up. Make small circles with your arms, gradually increasing the size. Reverse the direction of your circles.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-5 Shoulder Stretch	Either standing or sitting, take your right arm in your left hand and bring it across your chest, supporting the joint by holding it behind the elbow. Pull the elbow lightly towards your chest. You should feel the stretch in your right shoulder. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

ARMS

 *Exercises. Copyright 1998 by Impacto Protective Products Inc. Retrieved 26 October 2006, from http://www.2protect.com/home.htm* Figure A-6 Wrist Rotations	Rotate your hands in circular motions at the wrist. Change direction and repeat on both sides.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-7 Triceps Stretch	Stand and bring your right arm over your head, bent at the elbow. Use your left hand to gently pull your arm down. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

Exercise Programme for Squash, Tennis, Softball, Handball. Retrieved 26 October 2006, from http://www.physionline.co.za/conditions/article.asp?id=49

Figure A-8 Forearm Stretch

In a kneeling position, place your hands on the floor in front of you with your fingers pointing toward your knees, and your thumbs pointing out. Keeping your hands flat on the floor, lean back.

Hold this position for a minimum of 10 seconds.

CHEST AND ABDOMINALS

Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/

Figure A-9 Chest Stretch

Stand facing a wall. With your right arm bent and your elbow at shoulder height, place your palm against the wall. Turn your body away from your right arm. You should feel the stretch on the front side of your armpit and across the front of you chest.

Hold this position for a minimum of 10 seconds and repeat on the opposite side.

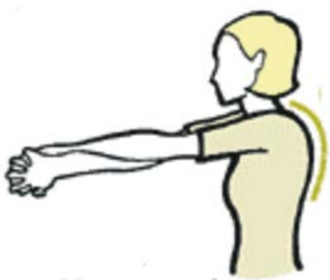
Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1

Figure A-10 Side Stretch

Stand with your left arm up over your head. Bend at the waist towards the right side of your body.

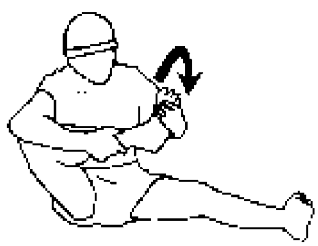
Hold this position for a minimum of 10 seconds and repeat on the opposite side.

BACK

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-11 Lower Back Stretch	Lie on your back and bring your knees toward your chest. Grasp the back of your knees. Hold this position for a minimum of 10 seconds.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-12 Upper Back Stretch	Extend your arms straight in front of you at shoulder height crossing one arm over the other. With the palms facing each other, intertwine your fingers and press out through your arms. Let your chin fall to your chest as you exhale. You should feel the stretch in the upper back. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

LEGS

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-13 Hamstring Stretch	Lie flat on the floor with your knees bent and your back flat on the floor. Slowly raise and straighten one leg, grasping it behind your thigh with both hands. Hold this position for a minimum of 10 seconds.

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-14 Inner Thigh Stretch	Sit on the floor with your knees bent and the soles of your feet together. Grab your toes and pull yourself forward while keeping your back and neck straight. Hold this position for a minimum of 10 seconds. Grab your ankles and push your knees down toward the floor with your elbows. Hold this position for a minimum of 10 seconds.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-15 Hip Flexor	Kneel on your right knee. Position your left foot in front of you, bending your knee and placing your left hand on that leg for stability. Keep your back straight and abdominal muscles tight. Lean forward, shifting more body weight onto your front leg. You should feel the stretch in the front of your hip and the thigh of the leg you are kneeling on. Cushion your kneecap with a folded towel if necessary. Hold this position for a minimum of 10 seconds and repeat on the opposite side.
 *Running Exercises. Retrieved 26 October 2006, http://www.physionline.co.za/conditions/article.asp?id=46* Figure A-16 Ankle Rotations	From a sitting position, rotate your foot in a clockwise, and then a counterclockwise, direction. Switch and repeat on the opposite side.

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-17 Calf Stretch	Stand three steps away from and facing a wall. Step in towards the wall with your right leg, bending your right knee and keeping your left leg straight. Extending your arms with your palms forward, reach out to the wall and let your body fall toward the wall. Keep your toes forward and your heels down. Lean your body into the wall with your left leg straight behind your body. You should feel the stretch in your left calf. Hold this position for a minimum of 10 seconds and repeat on the opposite side.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-18 Quadriceps Stretch	Stand with your hand against a wall for balance. Lift your left foot off the ground, bending your knee as if you are trying to kick your bottom with your heel. Do not lean forward at the hips. Grab and hold your ankle with your left hand. You should feel the stretch in your left thigh. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

TEN WEEK RUNNING SCHEDULE

Week	Run	Walk	Number of Cycles	Notes
1	2 min	4 min	5	
2	3 min	3 min	5	
3	5 min	2.5 min	4	
4	7 min	3 min	3	
5	8 min	2 min	3	
6	9 min	2 min	2	Run an additional 8 min after the two cycles are completed.
7	9 min	1 min	3	
8	13 min	2 min	2	
9	14 min	1 min	2	
10	30 min			

Note: Always remember to include a warm-up and a cool-down in your schedule.

"First Steps", by Mark Will-Weber, 2006, Runner's World: Beginner's: Training, Copyright 2006 by Rodale Inc. Retrieved 18 April 2007, from http://www.runnersworld.com/article/printer/1,7124,s6-380-381-386-678-0,00.html

Figure B-1 Sample Running Schedule

THIS PAGE INTENTIONALLY LEFT BLANK

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 3

EO C211.03 – FIRE THE CADET AIR RIFLE USING A SLING FOLLOWING PHYSICAL ACTIVITY

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-802/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.

Construct a range IAW A-CR-CCP-177/PT-001.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to review holding techniques using the cadet air rifle sling.

A practical activity was chosen for TP2 to TP4 as it is an interactive way to allow the cadets to experience firing the cadet air rifle using the cadet air rifle sling following physical activity.

INTRODUCTION

REVIEW

Review EO C111.03 (Fire the Cadet Air Rifle Following Physical Activity).

OBJECTIVES

By the end of this lesson the cadet shall be expected to demonstrate summer biathlon marksmanship skills using the cadet air rifle.

IMPORTANCE

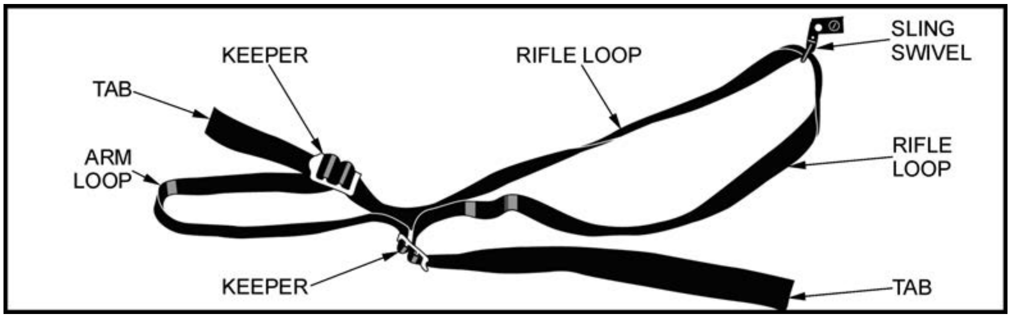
It is important for cadets to be able to adjust the sling on the cadet air rifle and aim while in the prone position because these skills will be useful during summer biathlon activities.

Teaching Point 1 | **Review Holding Techniques Using the Cadet Air Rifle Sling**

Time: 5 min | Method: Interactive Lecture

The cadet air rifle sling helps the cadet maintain a comfortable and stable position, improving the ability to hold the cadet air rifle. It also allows the right hand to be free to load the air rifle while the rifle remains in position.

ASSEMBLING THE SLING



A-CR-CCP-121/PT-001 (p. 6-17)

Figure 1 Cadet Air Rifle Sling

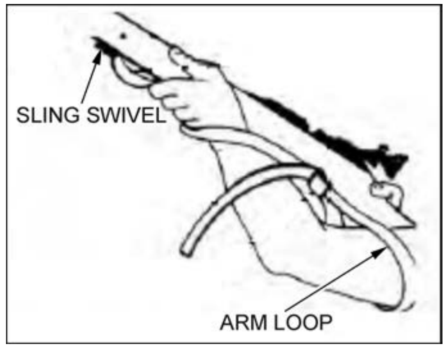
The cadet air rifle sling is assembled in the following sequence:

1. Hold the sling parallel to the ground with the short section in the left hand, ensuring the rounded tip of the keeper is pointing to the left.
2. Take the tab of the short section, loop it through the middle slot of the keeper and then back down through the front slot nearest to the rounded tip. The short section will now form a loop.
3. Turn the sling over and slide the sling swivel onto the long section. Ensure the sling swivel hangs downwards, as it will later attach to the rifle.
4. Loop the tab of the long section up through the middle slot of the keeper and then back through the rear slot of the keeper.

An assistant instructor can be used to demonstrate as the instructor explains wearing, adjusting and attaching the cadet air rifle sling.

POSITIONING THE SLING ON THE ARM

The sling arm loop should be positioned on the upper part of the arm, above the bicep muscle near the shoulder. The sling can be held in place by the rubber pad on a shooting jacket. When a shooting jacket is not worn, the sling can be kept in place using a safety pin. This will prevent the sling from slipping down the arm while in the prone position.

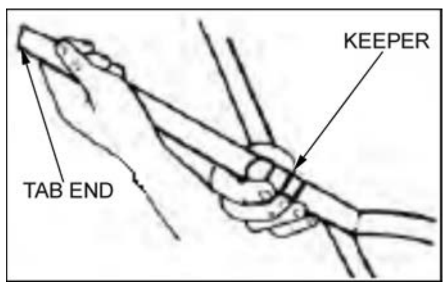


Daisy Outdoor Products, Operational Manual – Avanti Legend EX Model 853C, Daisy Outdoor Products (p. 7)

Figure 2 Positioning Sling

ADJUSTING THE ARM LOOP

To adjust the arm loop, pull the tab away from the keeper. If the sling is too loose, it will not fully support the cadet air rifle and it will have to be kept in place using the muscles. If the sling is too tight, it will restrict blood flow to the arm and can cause discomfort, numbness, or a more pronounced feel of the body's pulse. Therefore, the sling must be comfortable without pinching the arm, while providing maximum support of the cadet air rifle.



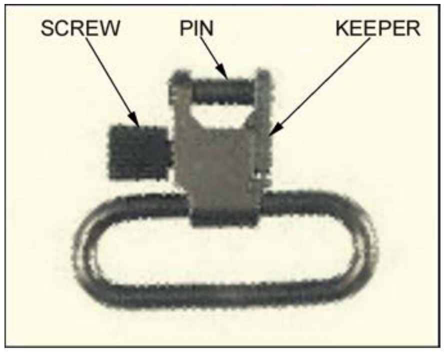
Daisy Outdoor Products, Operational Manual – Avanti Legend EX Model 853C, Daisy Outdoor Products (p. 8)

Figure 3 Adjusting Arm Loop

ATTACHING THE SLING TO THE CADET AIR RIFLE

To attach the sling to the cadet air rifle:

- open the keeper on the sling swivel by pressing on the screw;
- insert the swivel pin into the hole of the sling swivel on the fore end of the rifle; and
- screw the keeper over the pin to lock the swivel in place.

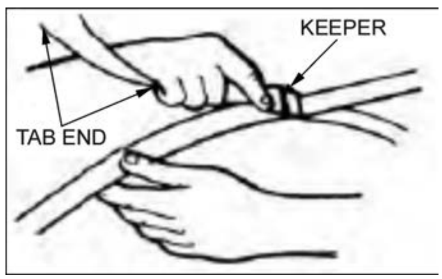


D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure 4 Sling Swivel

ADJUSTING THE RIFLE LOOP

To adjust the rifle loop, pull the tab away from the keeper. The tension of the sling should allow the forearm to be in its proper position. If the sling is too loose, it will not provide maximum support of the cadet air rifle. If the sling is too tight, it could cause discomfort and affect the cadet's position.



Daisy Outdoor Products, Operational Manual – Avanti Legend EX Model 853C, Daisy Outdoor Products (p. 8)

Figure 5 Adjusting Rifle Loop

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is the purpose of the cadet air rifle sling?

Q2. Where should the cadet air rifle sling be positioned on the arm?

Q3. Why is it important to not over tighten the sling on your arm?

ANTICIPATED ANSWERS

A1. The cadet air rifle sling helps the cadet maintain a comfortable and stable position, improving the ability to hold the cadet air rifle.

A2. The sling arm loop should be positioned on the upper part of the arm, above the bicep muscle near the shoulder.

A3. If the sling is too tight, it will restrict blood flow to the arm and can cause discomfort, numbness, or a more pronounced feel of the body's pulse.

Teaching Point 2 | **Conduct a Warm-up Session Composed of Light Cardiovascular Exercises**

Time: 5 min | Method: Practical Activity

> The following information will be explained to the cadets during the warm-up activity.

PURPOSE OF A WARM-UP

A warm-up is composed of stretches and light cardiovascular exercises designed to:

- stretch the muscles;
- gradually increase respiratory action and heart rate;
- expand the muscles' capillaries to accommodate the increase in blood circulation which occurs during physical activity; and
- raise the muscle temperature to facilitate reactions in muscle tissue.

GUIDELINES FOR STRETCHING

The following guidelines should be followed while stretching to prepare for physical activity and to help prevent injury:

- Stretch all major muscle groups, including the back, chest, legs, and shoulders.
- Never bounce while stretching.
- Hold each stretch for 10 to 30 seconds to let the muscles release fully.
- Repeat each stretch two to three times.
- When holding a stretch, support the limb at the joint.
- Static stretching, which is stretching a muscle and holding it in position without discomfort for 10 to 30 seconds, is considered the safest method.
- Stretching helps to relax the muscles and improve flexibility, which is the range of motion in the joints.
- As a guide, allow 10 minutes to warm-up for every hour of physical activity.

> The stretches chosen should focus on the areas of the body that will be used the most during the activity.

ACTIVITY

OBJECTIVE

The objective of this warm-up activity is to stretch the muscles and perform light cardiovascular exercises to prepare the body for physical activity and to help prevent injuries.

RESOURCES

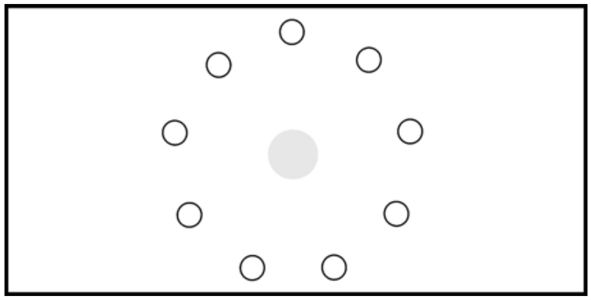
N/A.

ACTIVITY LAYOUT

N/A.

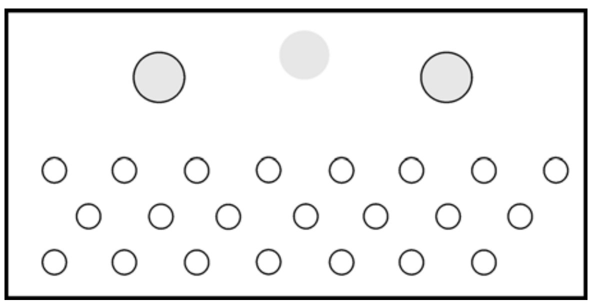
ACTIVITY INSTRUCTIONS

- Arrange the cadets in either a warm-up circle or in rows (as illustrated in Figures 6 and 7).



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 6 Instructor in the Centre of a Warm-up Circle



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 7 Instructor at the Front With Two Assistant Instructors

- Demonstrate before having the cadets attempt each stretch/light cardiovascular exercise.
- Assistant instructors can help demonstrate the exercises and ensure the cadets are performing them correctly.
- Have cadets perform each stretch/light cardiovascular exercise.

Light cardiovascular activities should be done to warm-up the muscles prior to stretching to avoid injury to or tearing of the muscles. For example, running on the spot for 30 seconds or performing jumping jacks should be performed prior to conducting the stretching activities located at Annex A.

SAFETY

- Ensure there are at least two arm lengths between the cadets so they can move freely.
- Ensure the cadets perform the stretches and light cardiovascular exercises in a safe manner, following the guidelines for stretching listed in this TP.

CONFIRMATION OF TEACHING POINT 2

The cadets' participation in the warm-up will serve as the confirmation of this TP.

Teaching Point 3 — **Conduct an Activity Where Cadets Will Fire the Cadet Air Rifle Using a Sling Following Physical Activity**

Time: 10 min — Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to fire the cadet air rifle using the cadet air rifle sling following physical activity.

RESOURCES

- Cadet air rifle (one per firing lane).
- Cadet air rifle sling (one per firing lane).
- Shooting mats (two per firing lane).
- BART and target frame (one per firing lane).
- Safety glasses/goggles.

If resources are available, the number of firing lanes may be increased.

ACTIVITY LAYOUT

Construct a range IAW A-CR-CCP-177/PT-001.

ACTIVITY INSTRUCTIONS

1. The cadets' heart rate should be elevated from participating in the warm-up activity in TP2.
2. Have the cadets approach the firing point and prepare to fire using the techniques outlined in EO C111.04 (Fire the Cadet Air Rifle Following Physical Activity).
3. Have the cadets adopt the prone position, attach the cadet air rifle sling, and simulate firing at the BART.
4. Repeat steps one to three for each relay until all cadets have participated.

SAFETY

Range activities will be conducted IAW A-CR-CCP-177/PT-001.

CONFIRMATION OF TEACHING POINT 3

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

Teaching Point 4 — **Conduct a Cool-down Session Composed of Light Cardiovascular Exercises**

Time: 5 min — Method: Practical Activity

The following information will be explained to the cadets during the cool-down activity.

PURPOSE OF A COOL-DOWN

A cool-down is composed of stretches and light cardiovascular exercises designed to:

- allow the body time to slowly recover from physical activity and to help prevent injury;
- prepare the respiratory system to return to its normal state; and
- stretch the muscles to help relax and restore them to their resting length.

The stretches chosen should focus on the areas of the body that were used the most during the activity.

ACTIVITY

OBJECTIVE

The objective of the cool-down is to stretch the muscles and perform light cardiovascular exercises that allow the body time to recover from physical activity, and to prevent injury.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

- Arrange the cadets in either a warm-up circle or in rows (as illustrated in Figures 6 and 7).
- Demonstrate before having the cadets attempt each stretch/light cardiovascular exercise.
- Assistant instructors can help demonstrate the movements and ensure the cadets are performing them correctly.
- Have cadets perform each stretch/light cardiovascular exercise.

SAFETY

- Ensure there are at least two arm lengths between the cadets so they can move freely.

- Ensure the cadets perform the stretches and light cardiovascular exercises in a safe manner, following the guidelines for stretching listed in TP2.

CONFIRMATION OF TEACHING POINT 4

The cadets' participation in the cool-down will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' participation in the activity in TP3 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Being able to fire the cadet air rifle using the cadet air rifle sling following physical activity will be useful when participating in summer biathlon activities.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

A0-027 A-CR-CCP-177/PT-001 D Cdts 3. (2001). *Canadian Cadet Movement: Cadet Marksmanship Program Reference Manual.* Ottawa, ON: Department of National Defence.

C0-002 (ISBN 0-88962-630-8) LeBlanc, J. & Dickson, L. (1997). *Straight Talk About Children and Sport: Advice for Parents, Coaches, and Teachers.* Oakville, ON and Buffalo, NY: Mosaic Press.

C0-057 Martha Jefferson Hospital. (2001). *Warm-ups.* Retrieved 26 October 2006, from http://www.marthajefferson.org/warmup.php.

C0-058 Webb Physiotherapists Inc. (ND). *Running Exercises.* Retrieved 26 October 2006, from http://www.physionline.co.za/conditions/article.asp?id=46.

C0-059 Webb Physiotherapists Inc. (ND). Exercise Programme for Squash, Tennis, Softball, Handball. Retrieved 25 October 2006, from http://www.physionline.co.za/conditions/article.asp?id=49.

C0-060 Impacto Protective Products Inc. (1998). *Exercises.* Retrieved 25 October 2006, from http://www.2protect.com/work3b.htm.

C0-061 City of Saskatoon, Community Services Department. (2006). *Stretch Your Limits: A Smart Guide To Stretching for Fitness.* Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/.

C0-080 Cool Running. (2007). *Cool Running.* Retrieved 12 February 2007, from http://www.coolrunning.com/engine/2/2_3/181.shtml.

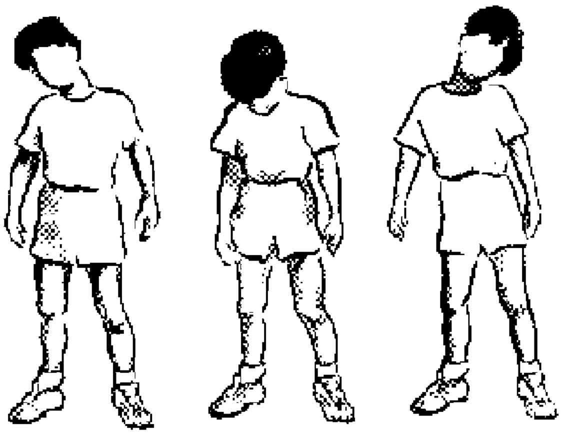
C0-085 Daisy Outdoor Products. (2006). *AVANTI Competition Pellet Rifle: Operation Manual: AVANTI Legend Model 853C.* Rogers, AR: Daisy Outdoor Products.

C0-089 (ISBN 0-936070-22-6) Anderson, B. (2000). *Stretching: 20th Anniversary* (Rev. ed.). Bolinas, CA: Shelter Publications, Inc.

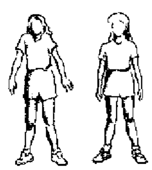
C0-154 Hansen, B. (1999). *Moving on the Spot: Fun and Physical Activity: A Collection of 5 Minute Stretch and Movement Sessions.* Retrieved 26 October 2006, from http://lin.ca/resource/html/dn3.htm#l1.

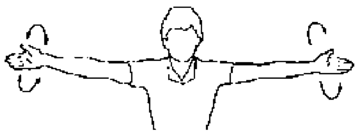
SAMPLE STRETCHES

NECK

 *Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1* Figure A-1 Neck Stretch	Slowly roll your head across your chest from shoulder to shoulder. Do not roll your head backwards.

SHOULDERS

 *Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1* Figure A-2 Shoulder Push	Stand and extend your arms behind you, interlocking your fingers. Push up and back with your shoulders. Hold this position for a minimum of 10 seconds.
 *Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1* Figure A-3 Shoulder Shrug	Stand and raise your shoulders as high as possible and then lower your shoulders, stretching your neck up. Pull your shoulders back as far as possible and then round your shoulders forward by pushing your shoulders forward as far as possible. Hold each position for a minimum of 10 seconds.

 *Warm Ups, by Martha Jefferson Hospital, Copyright 2001 by Martha Jefferson Hospital. Retrieved 26 October 2006, from http://www.marthajefferson.org/warmup.php* Figure A-4 Arm Circles	Hold your arms straight out, palms up. Make small circles with your arms, gradually increasing the size. Reverse the direction of your circles.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-5 Shoulder Stretch	Either standing or sitting, take your right arm in your left hand and bring it across your chest, supporting the joint by holding it behind the elbow. Pull the elbow lightly towards your chest. You should feel the stretch in your right shoulder. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

ARMS

 *Exercises. Copyright 1998 by Impacto Protective Products Inc. Retrieved 26 October 2006, from http://www.2protect.com/home.htm* Figure A-6 Wrist Rotations	Rotate your hands in circular motions at the wrist. Change direction and repeat on both sides.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-7 Triceps Stretch	Stand and bring your right arm over your head, bent at the elbow. Use your left hand to gently pull your arm down. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

Exercise Programme for Squash, Tennis, Softball, Handball. Retrieved 26 October 2006, from http://www.physionline.co.za/conditions/article.asp?id=49

Figure A-8 Forearm Stretch

In a kneeling position, place your hands on the floor in front of you with your fingers pointing toward your knees, and your thumbs pointing out. Keeping your hands flat on the floor, lean back.

Hold this position for a minimum of 10 seconds.

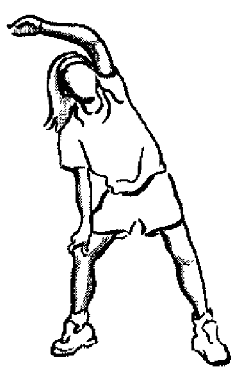
CHEST AND ABDOMINALS

Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/

Figure A-9 Chest Stretch

Stand facing a wall. With your right arm bent and your elbow at shoulder height, place your palm against the wall. Turn your body away from your right arm. You should feel the stretch on the front side of your armpit and across the front of you chest.

Hold this position for a minimum of 10 seconds and repeat on the opposite side.



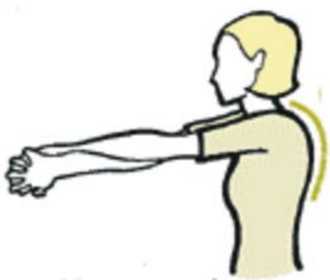
Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1

Figure A-10 Side Stretch

Stand with your left arm up over your head. Bend at the waist towards the right side of your body.

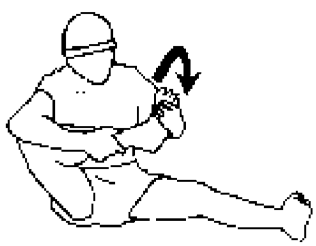
Hold this position for a minimum of 10 seconds and repeat on the opposite side.

BACK

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-11 Lower Back Stretch	Lie on your back and bring your knees toward your chest. Grasp the back of your knees. Hold this position for a minimum of 10 seconds.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-12 Upper Back Stretch	Extend your arms straight in front of you at shoulder height crossing one arm over the other. With the palms facing each other, intertwine your fingers and press out through your arms. Let your chin fall to your chest as you exhale. You should feel the stretch in the upper back. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

LEGS

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-13 Hamstring Stretch	Lie flat on the floor with your knees bent and your back flat on the floor. Slowly raise and straighten one leg, grasping it behind your thigh with both hands. Hold this position for a minimum of 10 seconds.

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-14 Inner Thigh Stretch	Sit on the floor with your knees bent and the soles of your feet together. Grab your toes and pull yourself forward while keeping your back and neck straight. Hold this position for a minimum of 10 seconds. Grab your ankles and push your knees down toward the floor with your elbows. Hold this position for a minimum of 10 seconds.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-15 Hip Flexor	Kneel on your right knee. Position your left foot in front of you, bending your knee and placing your left hand on that leg for stability. Keep your back straight and abdominal muscles tight. Lean forward, shifting more body weight onto your front leg. You should feel the stretch in the front of your hip and the thigh of the leg you are kneeling on. Cushion your kneecap with a folded towel if necessary. Hold this position for a minimum of 10 seconds and repeat on the opposite side.
 *Running Exercises. Retrieved 26 October 2006, http://www.physionline.co.za/conditions/article.asp?id=46* Figure A-16 Ankle Rotations	From a sitting position, rotate your foot in a clockwise, and then a counterclockwise, direction. Switch and repeat on the opposite side.

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-17 Calf Stretch	Stand three steps away from and facing a wall. Step in towards the wall with your right leg, bending your right knee and keeping your left leg straight. Extending your arms with your palms forward, reach out to the wall and let your body fall toward the wall. Keep your toes forward and your heels down. Lean your body into the wall with your left leg straight behind your body. You should feel the stretch in your left calf. Hold this position for a minimum of 10 seconds and repeat on the opposite side.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure A-18 Quadriceps Stretch	Stand with your hand against a wall for balance. Lift your left foot off the ground, bending your knee as if you are trying to kick your bottom with your heel. Do not lean forward at the hips. Grab and hold your ankle with your left hand. You should feel the stretch in your left thigh. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

COMMON TRAINING

INSTRUCTIONAL GUIDE

SECTION 4

EO C211.04 – PARTICIPATE IN A COMPETITIVE SUMMER BIATHLON ACTIVITY

Total Time:	180 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Ensure that all members involved in conducting this activity are well versed in the competition guidelines located at Annex A.

Ensure a first aid station is set up.

Set up a running route of 500 to 1000 m on alternating terrain and a range IAW A-CR-CCP-177/PT-001.

Photocopy Annex B.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to illustrate the application of rules, principles, and concepts of summer biathlon.

A practical activity was chosen for TP2 to TP4 as it is an interactive way to introduce cadets to summer biathlon. This activity contributes to the development of these skills and knowledge in a fun and challenging setting.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have participated in a competitive summer biathlon activity.

IMPORTANCE

It is important for cadets to participate in a competitive summer biathlon activity because it requires personal discipline, develops marksmanship skills, and promotes physical fitness.

Teaching Point 1	**Explain the Components of the Competitive Summer Biathlon Activity**
Time: 15 min	Method: Interactive Lecture

Based on the facilities, the cadet should be made aware of the start area, the course, the firing range, and the finish area.

COURSE LAYOUT

Each cadet will:

- run a loop of 500 to 1000 m;
- fire five to eight rounds in an effort to activate all five targets on the biathlon air rifle target (BART);
- run a second loop of 500 to 1000 m;
- fire five to eight rounds in an effort to activate all five targets on the BART;
- run a third loop of 500 to 1000 m; and
- finish the race.

The 500 to 1000 m course should be clearly marked prior to the start of this activity.

RULES AND REGULATIONS

Rules and regulations for the competitive summer biathlon activity include the following:

- Cadets must use the same firing lane for the duration of the activity.
- The run must be completed in the proper sequence and on the marked route.
- Rifles must be placed at the firing point by the range staff and will remain there for the duration of the activity.
- All firing will be done in the prone position.
- The cadet air rifle sling is the only firing aid that may be used.
- The rifle must be made safe upon completion of firing.
- An inoperable rifle will be replaced by the range staff, the target will be reset, and the cadet will fire five to eight shots with the new rifle.
- Safety infractions will result in time penalties.

- Missed targets will result in time penalties.

SCORING

Scoring will be calculated as follows:

- **Time.** The cadet's final time is the time from the start to the finish, plus any issued penalties.
- **Firing.** For each bout of firing, the number of missed targets will be recorded on the range recording sheet by the lane scorekeeper (located at Annex B). For each missed target, a one-minute penalty will be added to the cadet's total time.

PENALTIES

Penalties will be added to the individual's time, to include:

- Each violation of the principles of fair play or good sportsmanship will result in a one-minute penalty, to include:
  - not giving way in an area of congestion;
  - pushing or shoving;
  - using profanity; and
  - interfering with other competitors.
- Each missed target will result in a one-minute penalty.
- Each safety infraction on the firing point will result in a one-minute penalty to include:
  - not keeping control of the cadet air rifle;
  - moving forward of the firing point; and
  - intentionally firing rounds at objects other than the BART.

OUT OF BOUNDS AREAS

Make cadets aware of all out of bounds areas and safety considerations depending on the training area.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What are two rules/regulations for this biathlon activity?

Q2. How will the competitive summer biathlon activity be scored?

Q3. What is one violation of the principles of fair play/good sportsmanship?

ANTICIPATED ANSWERS

A1. Rules and regulations for the competitive summer biathlon activity include the following:

- Cadets must use the same firing lane for the duration of the activity.
- The run must be completed in the proper sequence and on the marked route.
- Rifles must be placed at the firing point by the range staff and will remain there for the duration of the activity.
- All firing will be done in the prone position.

- The cadet air rifle sling is the only firing aid that may be used.
- The rifle must be made safe upon completion of firing.
- An inoperable rifle will be replaced by the range staff, the target will be reset, and the cadet will fire five to eight shots with the new rifle.
- Safety infractions will result in time penalties.
- Missed targets will result in time penalties.

A2. The activity will be scored based on time and penalties.

A3. A violation of the principles of fair play/good sportsmanship may include:

- not giving way in an area of congestion;
- pushing or shoving;
- using profanity; and
- interfering with other competitors.

Teaching Point 2 | **Conduct a Warm-up Session Composed of Light Cardiovascular Exercises**

Time: 10 min | Method: Practical Activity

The following information will be explained to the cadets during the warm-up activity.

PURPOSE OF A WARM-UP

A warm-up is composed of stretches and light cardiovascular exercises designed to:

- stretch the muscles;
- gradually increase respiratory action and heart rate;
- expand the muscles' capillaries to accommodate the increase in blood circulation which occurs during physical activity; and
- raise the muscle temperature to facilitate reactions in muscle tissue.

GUIDELINES FOR STRETCHING

The following guidelines should be followed while stretching to prepare for physical activity and to help prevent injury:

- Stretch all major muscle groups, including the back, chest, legs, and shoulders.
- Never bounce while stretching.
- Hold each stretch for 10 to 30 seconds to let the muscles release fully.
- Repeat each stretch two to three times.
- When holding a stretch, support the limb at the joint.

- Static stretching, which is stretching a muscle and holding it in position without discomfort for 10 to 30 seconds, is considered the safest method.
- Stretching helps to relax the muscles and improve flexibility, which is the range of motion in the joints.
- As a guide, allow 10 minutes to warm-up for every hour of physical activity.

The stretches chosen should focus on the areas of the body that will be used the most during the activity.

ACTIVITY

OBJECTIVE

The objective of this warm-up activity is to stretch the muscles and perform light cardiovascular exercises to prepare the body for physical activity and to help prevent injuries.

RESOURCES

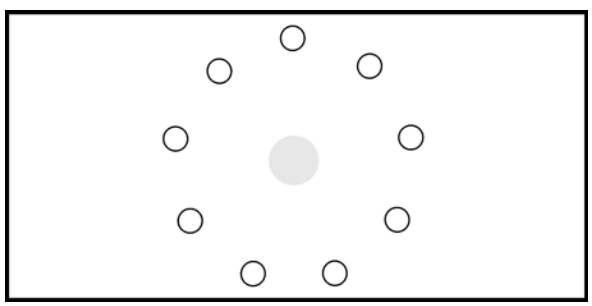
N/A.

ACTIVITY LAYOUT

N/A.

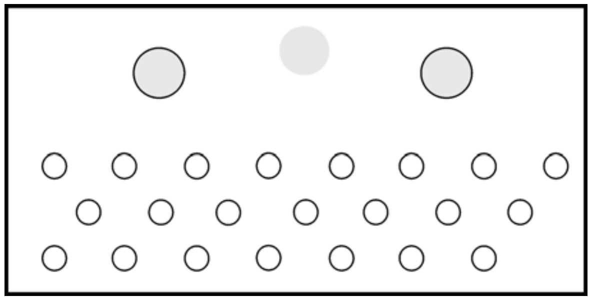
ACTIVITY INSTRUCTIONS

- Arrange the cadets in either a warm-up circle or in rows (as illustrated in Figures 1 and 2).



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 1 Instructor in the Centre of a Warm-up Circle



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 2 Instructor at the Front With Two Assistant Instructors

- Demonstrate before having the cadets attempt each stretch/light cardiovascular exercise.
- Assistant instructors can help demonstrate the exercises and ensure the cadets are performing them correctly.
- Have cadets perform each stretch/light cardiovascular exercise.

Light cardiovascular activities should be done to warm-up the muscles prior to stretching to avoid injury to or tearing of the muscles. For example, running on the spot for 30 seconds or performing jumping jacks should be performed prior to conducting the stretching activities located at Annex C.

SAFETY

- Ensure there are at least two arm lengths between the cadets so they can move freely.
- Ensure the cadets perform the stretches and light cardiovascular exercises in a safe manner, following the guidelines for stretching listed in this TP.

CONFIRMATION OF TEACHING POINT 2

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

Teaching Point 3 — **Conduct a Competitive Summer Biathlon Activity**

Time: 135 min — Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is for cadets to participate in a competitive summer biathlon activity.

RESOURCES

Based on 20 cadets per group, the following resources are required per event:

- Cadet air rifles (5);
- Cadet air rifle slings (5);
- Shooting mats (10);

- .177 air rifle pellets (a minimum of 700 pellets);
- Stopwatches (5);
- BART and target frame (5);
- Safety glasses/goggles (8);
- Pens/pencils;
- Notice board;
- Biathlon scoresheets located at Annex B;
- Course control sheets located at Annex B; and
- Range recording sheets located at Annex B.

ACTIVITY LAYOUT

- Set up a running route of approximately 500 to 1000 m on alternating terrain.
- Set up an air rifle range in accordance with Annex A.
- Set up targets and target frames.
- Place two shooting mats per shooting lane.
- Place a cadet air rifle at each firing point.
- Place a pair of safety glasses/goggles at each firing point.

ACTIVITY INSTRUCTIONS

Activity instructions are located at Annex A.

SAFETY

- Ensure all range safety procedures are followed.
- Ensure cadets drink plenty of water and apply sunscreen.
- Ensure the running route is clearly marked and crossing points are monitored anywhere a road may be crossed.
- Ensure a first aider is identified at the start of the activity and is available at all times.
- Ensure water is available for the cadets during and after the activity.

CONFIRMATION OF TEACHING POINT 3

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

Teaching Point 4 | **Conduct a Cool-down Session Composed of Light Cardiovascular Exercises**

Time: 10 min | Method: Practical Activity

The following information will be explained to the cadets during the cool-down activity.

PURPOSE OF A COOL-DOWN

A cool-down is composed of stretches and light cardiovascular exercises designed to:

- allow the body time to slowly recover from physical activity and to help prevent injury;
- prepare the respiratory system to return to its normal state; and
- stretch the muscles to help relax and restore them to their resting length.

The stretches chosen should focus on the areas of the body that were used the most during the activity.

ACTIVITY

OBJECTIVE

The objective of the cool-down is to stretch the muscles and perform light cardiovascular exercises that allow the body time to recover from physical activity, and to prevent injury.

RESOURCES

Area large enough for all cadets to conduct a cool-down activity.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

- Arrange the cadets in either a cool-down circle or in rows (as illustrated in Figures 1 and 2).
- Demonstrate before having the cadets attempt each stretch/light cardiovascular exercise.
- Assistant instructors can help demonstrate the movements and ensure the cadets are performing them correctly.
- Have cadets perform each stretch/light cardiovascular exercise.

Sample stretches are located at Annex C.

SAFETY

- Ensure there are at least two arm lengths between the cadets so they can move freely.
- Ensure the cadets perform the stretches and light cardiovascular exercises in a safe manner, following the guidelines for stretching listed in TP2.

CONFIRMATION OF TEACHING POINT 4

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

END OF LESSON CONFIRMATION

The cadets' participation in the competitive summer biathlon activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Competitive summer biathlon is an activity that requires personal discipline, develops marksmanship skills, and promotes physical fitness. Competitive biathlon opportunities are available at the local, regional, and national level.

INSTRUCTOR NOTES/REMARKS

Results should be posted for cadets to review. PO 211 is a complementary training activity. It is designed to provide an opportunity for the cadets to participate in a competitive summer biathlon activity.

EOs C111.01 (Participate in a Biathlon Briefing), C111.02 (Run Short Wind Sprints), C111.03 (Introduction to Summer Biathlon Marksmanship Skills Using the Cadet Air Rifle), C211.01 (Identify Civilian Biathlon Opportunities), C211.02 (Run on Alternating Terrain), and C211.03 (Fire the Cadet Air Rifle Using a Sling Following Physical Activity) shall be taught prior to conducting this lesson.

REFERENCES

A0-027 A-CR-CCP-177/PT-001 D Cdts 3. (2001). *Canadian Cadet Movement: Cadet Marksmanship Program Reference Manual.* Ottawa, ON: Department of National Defence.

A0-032 Cadets Canada. (2002). *Biathlon Competition Rules and IBU/Cadet Disciplinary Rules.* Ottawa, ON: Department of National Defence.

A0-036 Cadets Canada. (ND). *Canadian Cadet Movement: Biathlon Championship Series*. Ottawa, ON: Department of National Defence.

C0-002 (ISBN 0-88962-630-8) LeBlanc, J. & Dickson, L. (1997). *Straight Talk About Children and Sport: Advice for Parents, Coaches, and Teachers.* Oakville, ON and Buffalo, NY: Mosaic Press.

C0-057 Martha Jefferson Hospital. (2001). *Warm-ups.* Retrieved 26 October 2006, from http://www.marthajefferson.org/warmup.php.

C0-058 Webb Physiotherapists Inc. (ND). *Running Exercises.* Retrieved 26 October 2006, from http://www.physionline.co.za/conditions/article.asp?id=46.

C0-059 Webb Physiotherapists Inc. (ND). *Exercise Programme for Squash, Tennis, Softball, Handball.* Retrieved 25 October 2006, from http://www.physionline.co.za/conditions/article.asp?id=49.

C0-060 Impacto Protective Products Inc. (1998). *Exercises.* Retrieved 25 October 2006, from http://www.2protect.com/work3b.htm.

C0-061 City of Saskatoon, Community Services Department. (2006). *Stretch Your Limits: A Smart Guide To Stretching for Fitness.* Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/.

C0-089 (ISBN 0-936070-22-6) Anderson, B. (2000). *Stretching: 20th Anniversary* (Rev. ed.). Bolinas, CA: Shelter Publications, Inc.

C0-154 Hansen, B. (1999). *Moving on the Spot: Fun and Physical Activity: A Collection of 5 Minute Stretch and Movement Sessions.* Retrieved 26 October 2006, from http://lin.ca/resource/html/dn3.htm#l1.

GUIDELINES FOR CONDUCTING A COMPETITIVE SUMMER BIATHLON ACTIVITY

OBJECTIVES

The objectives of the competitive summer biathlon activity are:

- to practice and improve marksmanship skills;
- to improve the level of physical fitness; and
- to introduce the sport of summer biathlon.

COMPOSITION

Each cadet will enter as an individual.

FACILITIES

The facilities required to conduct a competitive summer biathlon activity are:

- a route, on alternating terrain, of approximately 500 to 1000 m with the start and finish lines located close to the range. The route should be wide enough to accommodate a maximum of 10 cadets running at one time. When roads are to be crossed, they must be clearly marked and a central crossing point established with traffic control provided; and
- an air rifle range constructed IAW A-CR-CCP-177/PT-001, Chapter 1, Section 8, with a minimum of one firing lane per cadet per group.

PARTICIPANTS

This activity may be conducted with cadets from multiple squadrons. A sample invitation for the competitive summer biathlon activity is located at Annex D.

STAFFING

Numerous staff are required to conduct a competitive summer biathlon activity. These appointments may be filled by squadron staff, and shall include:

- **Technical Delegate.** Responsible for the overall conduct of the competition, including issuing penalties, and interpreting the rules.
- **Range Safety Officer (RSO).** Responsible for the overall conduct of the activities on the range.
- **Assistant RSO.** Responsible for targets, issuing ammunition, and assisting the RSO, as required.
- **Lane Scorekeeper.** Responsible for scoring targets and recording results on the range recording sheet (located at Annex B).
- **Chief of Statistics.** Responsible for compiling all the event data (e.g. range results, start/finish time, and any penalties issued).
- **Runner.** Responsible for collecting the scoring sheets and delivering them to the chief of statistics.
- **Start and Finish Line Chief.** Responsible for starting the run and recording the finish times on the scoresheet (located at Annex B).
- **Course Control.** Responsible for recording each time the cadet runs a loop on the course control sheet (located at Annex B).
- **First Aider.** Responsible for dealing with any injuries that may occur during the competition.

FORMAT

Team Captain's Meeting

All cadets will attend the team captain's meeting. This meeting includes all the essential information required by the cadets to participate in the competitive summer biathlon activity. The cadets are given:

- start times;
- range lane assignments;
- weather updates; and
- introductions to the competition staff.

The Running Loop

Each cadet will run three separate loops of 500 to 1000 m. Each running loop will consist of:

- assembling for an individual start (cadets will begin at 10-second intervals for the first loop); and
- crossing the finish line.

The Range

Each cadet will fire five to eight pellets in an effort to activate all five targets on the BART. After each bout of firing, the appropriate lane scorer will record the cadet's results and reset the BART.

SEQUENCE

This competitive summer biathlon activity will be conducted in the following sequence:

1. running a loop of 500 to 1000 m;
2. firing five to eight pellets at the BART;
3. running a loop of 500 to 1000 m;
4. firing five to eight pellets at the BART;
5. running a third loop of 500 to 1000 m; and
6. crossing the finish line.

EQUIPMENT

Based on 20 cadets per group, the equipment required to conduct the competitive summer biathlon activity shall include, but is not limited to the following:

- Cadet air rifles (5);
- Cadet air rifle slings (5);
- Shooting mats (10);
- .177 air rifle pellets (a minimum of 700 pellets);
- Stop watches (5);
- BART and target frame (5);
- Safety glasses (8);
- Pens/pencils;

- Notice board;
- Biathlon scoresheets located at Annex B;
- Course control sheets located at Annex B; and
- Range recording sheets located at Annex B.

DRESS

Appropriate clothing according to the weather forecast.

RULES AND REGULATIONS

- Cadets must use the same firing lane for the duration of the activity.
- The run must be completed in the proper sequence and on the marked route.
- Rifles must be placed on the firing point by the range staff and will remain there for the duration of the activity.
- All firing will be done in the prone position.
- The cadet air rifle sling is the only firing aid that may be used.
- The rifle must be made safe upon completion of firing.
- An inoperable rifle will be replaced by the range staff, the target will be reset, and the cadet will fire five to eight shots with the new rifle.
- Safety infractions will result in time penalties.
- Missed targets will result in time penalties.

SCORING

Scoring will be calculated as follows:

- **Time.** The cadet's final time is the time from the start to the finish, plus any issued penalties.
- **Firing.** For each bout of firing, the number of missed targets will be recorded on the range recording sheet by the lane scorekeeper (located at Annex B). For each missed target, a one-minute penalty will be added to the cadet's total time.

PENALTIES

Penalties will be added to the individual's time, to include:

- Each violation of the principles of fair play or good sportsmanship will result in a one-minute penalty, to include:
  - not giving way in an area of congestion;
  - pushing or shoving;
  - using profanity; and
  - interfering with other competitors.
- Each missed target will result in a one-minute penalty.
- A one-minute penalty will be issued for each safety infraction, to include:
  - not keeping control of the cadet air rifle;
  - moving forward of the firing point; and

  - intentionally firing rounds at objects other than the BART.

OUT OF BOUNDS AREAS

Out of bounds areas are to be clearly identified prior to the start of the competitive summer biathlon activity.

AWARDS

Awards instructions are located at Annex E.

NOTES

- Course control staff will record each time a cadet runs through a loop. See course control sheet located at Annex B.
- The start and finish line chief will keep records for each cadet. When the sheet is full or nearly full the runner will take the sheet to the chief of statistics. See scoresheet located at Annex B.
- Bibs may be used to identify cadets, if available.

COMPETITION GUIDELINES

COURSE CONTROL SHEET

Cadet Name	Loop 1 Verification	Loop 2 Verification	Loop 3 Verification

D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-1 Course Control Sheet

SCORESHEET

Cadet Name	Start Time	Loop One	Loop Two	Loop Three	End Time	Run/Safety Penalties	Firing Penalties	Total Time

Note: The start and finish line chief is responsible for recording the run times and presenting the scoresheet(s) to the scorekeeper.

D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-2 Scoresheet

RANGE RECORDING SHEET

Scorekeeper's Name: ____________________

Cadet Name:	Lane	Shots Fired	X = Miss	Misses	Comments/Penalties
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			
Cadet Name:	Lane	Shots Fired	X = Miss	Misses	
		3 Spare			

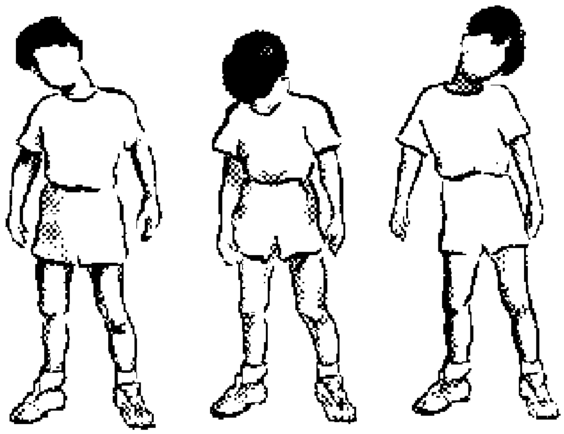
D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-3 Range Recording Sheet

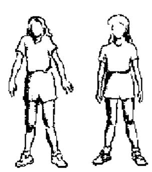
THIS PAGE INTENTIONALLY LEFT BLANK

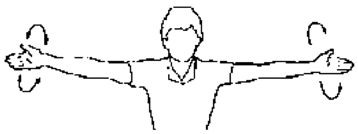
SAMPLE STRETCHES

NECK

 *Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1* Figure C-1 Neck Stretch	Slowly roll your head across your chest from shoulder to shoulder. Do not roll your head backwards.

SHOULDERS

 *Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1* Figure C-2 Shoulder Push	Stand and extend your arms behind you, interlocking your fingers. Push up and back with your shoulders. Hold this position for a minimum of 10 seconds.
 *Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1* Figure C-3 Shoulder Shrug	Stand and raise your shoulders as high as possible and then lower your shoulders, stretching your neck up. Pull your shoulders back as far as possible and then round your shoulders forward by pushing your shoulders forward as far as possible. Hold each position for a minimum of 10 seconds.

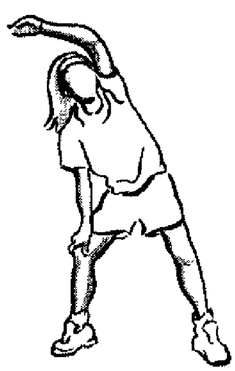
 *Warm Ups, by Martha Jefferson Hospital, Copyright 2001 by Martha Jefferson Hospital. Retrieved 26 October 2006, from http://www.marthajefferson.org/warmup.php* Figure C-4 Arm Circles	Hold your arms straight out, palms up. Make small circles with your arms, gradually increasing the size. Reverse the direction of your circles.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-5 Shoulder Stretch	Either standing or sitting, take your right arm in your left hand and bring it across your chest, supporting the joint by holding it behind the elbow. Pull the elbow lightly towards your chest. You should feel the stretch in your right shoulder. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

ARMS

 *Exercises. Copyright 1998 by Impacto Protective Products Inc. Retrieved 26 October 2006, from http://www.2protect.com/home.htm* Figure C-6 Wrist Rotations	Rotate your hands in circular motions at the wrist. Change direction and repeat on both sides.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-7 Triceps Stretch	Stand and bring your right arm over your head, bent at the elbow. Use your left hand to gently pull your arm down. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

 *Exercise Programme for Squash, Tennis, Softball, Handball. Retrieved 26 October 2006, from http://www.physionline.co.za/conditions/article.asp?id=49* Figure C-8 Forearm Stretch	In a kneeling position, place your hands on the floor in front of you with your fingers pointing toward your knees, and your thumbs pointing out. Keeping your hands flat on the floor, lean back. Hold this position for a minimum of 10 seconds.

CHEST AND ABDOMINALS

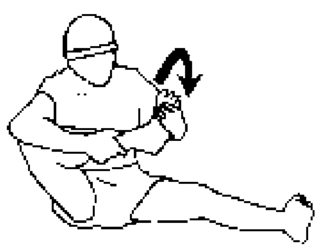
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-9 Chest Stretch	Stand facing a wall. With your right arm bent and your elbow at shoulder height, place your palm against the wall. Turn your body away from your right arm. You should feel the stretch on the front side of your armpit and across the front of you chest. Hold this position for a minimum of 10 seconds and repeat on the opposite side.
 *Moving on the Spot: A Collection of 5 Minute Stretch and Movement Sessions, by B. Hanson, 1999, Toronto, Ontario: Toronto Public Health. Retrieved 26 October 2006, from http://www.lin.ca/resource/html/dn3.htm#l1* Figure C-10 Side Stretch	Stand with your left arm up over your head. Bend at the waist towards the right side of your body. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

BACK

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-11 Lower Back Stretch	Lie on your back and bring your knees toward your chest. Grasp the back of your knees. Hold this position for a minimum of 10 seconds.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-12 Upper Back Stretch	Extend your arms straight in front of you at shoulder height crossing one arm over the other. With the palms facing each other, intertwine your fingers and press out through your arms. Let your chin fall to your chest as you exhale. You should feel the stretch in the upper back. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

LEGS

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-13 Hamstring Stretch	Lie flat on the floor with your knees bent and your back flat on the floor. Slowly raise and straighten one leg, grasping it behind your thigh with both hands. Hold this position for a minimum of 10 seconds.

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-14 Inner Thigh Stretch	Sit on the floor with your knees bent and the soles of your feet together. Grab your toes and pull yourself forward while keeping your back and neck straight. Hold this position for a minimum of 10 seconds. Grab your ankles and push your knees down toward the floor with your elbows. Hold this position for a minimum of 10 seconds.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-15 Hip Flexor	Kneel on your right knee. Position your left foot in front of you, bending your knee and placing your left hand on that leg for stability. Keep your back straight and abdominal muscles tight. Lean forward, shifting more body weight onto your front leg. You should feel the stretch in the front of your hip and the thigh of the leg you are kneeling on. Cushion your kneecap with a folded towel if necessary. Hold this position for a minimum of 10 seconds and repeat on the opposite side.
 *Running Exercises. Retrieved 26 October 2006, http://www.physionline.co.za/conditions/article.asp?id=46* Figure C-16 Ankle Rotations	From a sitting position, rotate your foot in a clockwise, and then a counterclockwise, direction. Switch and repeat on the opposite side.

 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-17 Calf Stretch	Stand three steps away from and facing a wall. Step in towards the wall with your right leg, bending your right knee and keeping your left leg straight. Extending your arms with your palms forward, reach out to the wall and let your body fall toward the wall. Keep your toes forward and your heels down. Lean your body into the wall with your left leg straight behind your body. You should feel the stretch in your left calf. Hold this position for a minimum of 10 seconds and repeat on the opposite side.
 *Smart Start: A Flexible Way to Get Fit. Retrieved 26 October 2006, from http://www.in-motion.ca/walkingworkout/plan/flexibility/* Figure C-18 Quadriceps Stretch	Stand with your hand against a wall for balance. Lift your left foot off the ground, bending your knee as if you are trying to kick your bottom with your heel. Do not lean forward at the hips. Grab and hold your ankle with your left hand. You should feel the stretch in your left thigh. Hold this position for a minimum of 10 seconds and repeat on the opposite side.

INVITATION SAMPLE

Squadron Competitive Summer Biathlon Activity

When:

Where:

Eligibility: Proficiency Level Two Cadets

Rules: Located at Annex A to EO C211.04, Instructional Guide.

Event: Individual

Category: Female: three loops of 500 to 1000 m, two relays of firing in the prone position

Male: three loops of 500 to 1000 m, two relays of firing in the prone position

Schedule:

0900hrs	Coaches meeting
1010hrs	Start
1055hrs	Last cadet start
1200hrs	Last cadet finish
1300hrs	Awards

Note: Times listed above are approximate.

Contact Information:

Special Notes:

Additional squadron officers will be required to assist in running the competitive summer biathlon activity.

Parents and spectators are invited to observe the activity.

THIS PAGE INTENTIONALLY LEFT BLANK

AWARDS INSTRUCTIONS

AWARDS

All cadets shall be awarded with a certificate/ribbon for participation. The top three competitors from each gender shall be awarded with a certificate/ribbon/medal.

AWARD CEREMONY

The technical delegate shall organize the award ceremony for the competitive summer biathlon activity.

AWARD PRESENTATIONS

The hosting squadron Commanding Officer or other local VIP shall present awards to the winning cadets and certificates to all cadets.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 10

PO X20 – PARTICIPATE IN CAF FAMILIARIZATION

COMMON TRAINING

ALL TRAINING LEVELS

INSTRUCTIONAL GUIDE

CANADIAN ARMED FORCES (CAF) FAMILIARIZATION

PO X20 – PARTICIPATE IN CAF FAMILIARIZATION

Total Time:

For the following EOs, refer to the lesson specifications located in A-CR-CCP-801/PG-001, *Royal Canadian Air Cadets Proficiency Level One Qualification Standard and Plan*:

- MX20.01A – Participate in a CAF Activity,
- MX20.01B – Participate in a CAF Familiarization Tour,
- MX20.01E – Attend a CAF Presentation,
- MX20.01F – Attend a CAF Commemorative Ceremony, and
- CX20.01 – Participate in CAF Familiarization Activities.

For the following EOs, refer to the instructional guides located in A-CR-CCP-801/PF-001, *Royal Canadian Air Cadets Proficiency Level One Instructional Guides*:

- MX20.01C – Fire the C7 Rifle,
- MX20.01D – Participate in a Mess Dinner,
- MX20.01G – Participate in CAF Familiarization Video Activities, and
- MX20.01H – Participate in CAF Familiarization Learning Stations.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 11

PO 230 – DISCUSS CANADIAN AVIATION HISTORY

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M230.01 – DISCUSS AIRCRAFT FLOWN DURING WWI AND WWII

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-802/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 presentation slides or handouts of all the figures located at Annex A.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to present background material to the cadets and to promote an interest in aircraft flown during WWI and WWII.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to discuss aircraft flown during WWI and WWII, the Battle of the Atlantic, the Battle of Britain and the aircraft flown during those conflicts.

IMPORTANCE

It is important for cadets to know about the aircraft flown in WWI and WWII so that they can better understand Canada's role during these conflicts and to understand the meaning of the parades used to commemorate the fallen men and women who gave their lives during these conflicts.

Teaching Point 1 | **Discuss Aircraft Flown During WWI**

Time: 5 min | Method: Interactive Lecture

AIRCRAFT FLOWN DURING WWI

Sopwith Triplane

- The Sopwith Triplane was a single-seater Triplane fighter aircraft used by the British in WWI.
- It was nicknamed the Tripe or the Tripehound.
- The Triplane was a successful attempt to produce a fighter with outstanding manoeuvrability and excellent visibility for the pilot.
- Even though the Triplane remained in front-line service for less than a year, it was so successful that it inspired several German Triplane designs.
- The all-Canadian B Flight of No. 10 Squadron, equipped with Triplanes, downed 87 enemy aircraft between May and July 1917.
- The all-Canadian B Flight was called the Black Flight because of the black markings of their airplanes. Their aircraft were named: Black Maria, Black Sheep, Black Prince, Black Roger, and Black Death.

Present slide or distribute handouts of Figure A-1 to the cadets.

Bristol F.2B Fighter "Brisfit"

- The versatile Bristol Fighter (B.F.) was a manoeuvrable, heavily armed two-seater biplane.
- One of the most successful fighters of the war, it got off to a poor start during "Bloody April" when it was introduced to the Western Front by the inexperienced pilots and observers of 48 Squadron.
- In the mistaken belief that the aircraft was structurally weak, pilots were instructed to avoid violent manoeuvres during combat.
- Heeding this advice, the pilots of six B.F. 2B fighters encountered Manfred von Richthofen (The Red Baron) and his flight of five Albatros D.III near Douai (northern France). In a fight that lasted almost 30 minutes, four Bristol Fighters were shot down.

Present slide or distribute handouts of Figure A-2 to the cadets.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What type of aircraft was the Sopwith Triplane?

Q2. What were the names of the aircraft in the Black Flight?

Q3. What plane was the most successful fighter of the war?

ANTICIPATED ANSWERS

A1. The Sopwith Triplane was a single-seater Triplane fighter aircraft used by the British in World War I.

A2. Black Maria, Black Sheep, Black Prince, Black Roger, and Black Death.

A3. The Bristol F. 2B Fighter was the most successful fighter of the war.

Teaching Point 2	**Discuss the Importance of the Battle of the Atlantic**
Time: 5 min	Method: Interactive Lecture

DURATION OF THE BATTLE

- The Battle of the Atlantic began on the first day of the war in Europe on September 1, 1939 and continued until May 8, 1945.
- It was the longest campaign of WWII, an extremely bloody one, and the single battle on which the whole outcome of the war depended.
- Only with the delivery of massive North American resources to Britain and Europe could the Allies defeat Hitler's Germany, the most powerful of the Axis nations.
- For six long years the Canadian Navy was one of the principle contenders in what was to be known as the "Battle of the Atlantic."
- Beginning the war with a mere 13 vessels and 3000 men, the Royal Canadian Navy ended the Battle of the Atlantic with 373 fighting ships and over 90 000 men.
- Bridging the Atlantic was the key to strategic supply. To transport as many men and goods as possible, it was necessary to organize and control ship movements and protect ships from enemy attack. Therefore, convoys were formed to regulate ship movements and more effectively provide escorts both by sea and air.
- It was in maintaining the Atlantic lifeline through convoy protection that Canadian seamen and airmen played an increasing vital role.
- The RCAF had been flying patrols from Newfoundland since 1939 and the first Maritime patrol squadron had been stationed at Gander since 1940. It now provided air support to the Newfoundland Escort Force. In the eastern Atlantic region, the convoys were guarded by the RAF Coastal Command which included RCAF squadrons. Thus flying from both sides of the Atlantic and from Iceland, aircraft patrolled the entire route except for a gap of about 483 km in mid-ocean.
- More and more Canadian seamen were crossing the Atlantic to engage in battle closer to the enemy. As they returned to British waters, men of both the Canadian Navy and Air Force showed the benefits of training and hard experience.

ALLIED FORCES AND AXIS POWERS

- The Battle of the Atlantic was a struggle between the Allied and Axis powers (mainly Britain and Germany) for control of the sea routes between the Americas, Europe and Africa.
- From the very onset of hostilities, Britain faced a second threat to her survival. This menace came from the sea as Germany was determined to starve the British people into submission by destroying their sea communications and cutting them off from overseas supplies.
- Gaining control of the entire coast of Europe from Narvik, Norway to the Pyrenees Mountains in France and Spain, the Germans set out from every harbour and airfield in western Europe to cut the lifelines to Britain.

- During the six years of the Battle of the Atlantic, the Axis powers lost over 700 U-boats and 32 000 seamen, and the Allied powers lost more than 3000 ships and 40 000 seamen. The vast majority of the Allied losses were merchant ships and the civilian seamen and passengers who sailed in them.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What were the dates of the Battle of the Atlantic?

Q2. Who was the struggle between?

Q3. How many ships and people were lost in the struggle?

ANTICIPATED ANSWERS

A1. The Battle of the Atlantic began on the first day of the war in Europe on September 1, 1939 and continued until May 8, 1945.

A2. The Battle of the Atlantic was a struggle between the Allied and Axis powers (mainly Britain and Germany) for control of the sea routes between the Americas, Europe and Africa.

A3. During the six years of the Battle of the Atlantic, the Axis powers lost over 700 U-boats and 32 000 seamen, and the Allied powers lost more than 3000 ships and 40 000 seamen. The vast majority of the Allied losses were merchant ships and the civilian seamen and passengers who sailed in them.

Teaching Point 3	**Discuss the Aircraft Flown During the Battle of the Atlantic**
Time: 5 min	Method: Interactive Lecture

AIRCRAFT FLOWN

B-24 Liberator Bombers

- The B-24 Liberator was a ten-seat long-range bomber/reconnaissance aircraft.
- An unsung hero of the Allied war effort, the B-24 Liberator was actually produced in greater numbers than any other U.S. aircraft during WWII.
- First flown on December 29, 1939, the Consolidated Aircraft Corporation's B-24 Liberator came along more than four years after the famous and popular Boeing B-17 Flying Fortress, and showed somewhat improved range and payload capabilities over the Fortress.
- The Liberator is best known for the daring long-range raids on the oilfields of Ploesti, Romania in 1942 and 1943 and for its effectiveness as a submarine hunter.
- Though instrumental in both the European and Pacific theatres, the B-24's long-range capabilities were particularly effective in the vastness of the Pacific where it excelled as a bomber, reconnaissance platform and as a supply transport.

Present slide or distribute handouts of Figure A-3 to the cadets.

Curtiss Kittyhawk Mk.1 Fighter-Bomber

- The Curtiss Kittyhawk Mk.1 served initially at Dartmouth, Nova Scotia where it was the only fighter unit available for east coast defence, and subsequentially transferred to Annette Island, Alaska as part of the RCAF reinforcement for the USAAF.
- The pilots made the 644 km trip by air – the first fighter unit to fly from coast to coast.
- The Kittyhawk Mk.1 served with the RCAF from October 9, 1941 to December 16, 1946 before being struck off strength. However, they were used predominantly in the home air defence role, which was reduced during the latter portion of the war.
- The Kittyhawk Mk.1 mounted four .50 cal. machine guns in the wings and had shackles under the fuselage for a 52 U.S. gallon drop tank or a 136-227 kg bomb.
- Racks on the outer wings could also carry six nine kg bombs.

Present slide or distribute handouts of Figure A-4 to the cadets.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What type of plane was the B-24 Liberator?

Q2. What is the B-24 Liberator best known for?

Q3. What were the dates the Kittyhawk served with the RCAF?

ANTICIPATED ANSWERS

A1. The B-24 Liberator was a ten-seat long-range bomber/reconnaissance aircraft.

A2. The Liberator is best known for the daring long-range raids on the oilfields of Ploesti, Romania in 1942 and 1943 and for its effectiveness as a submarine hunter.

A3. The Kittyhawk Mk.1 served with the RCAF from October 9, 1941 to December 16, 1946 before being struck off strength.

Teaching Point 4	**Discuss the Importance of the Battle of Britain**
Time: 5 min	Method: Interactive Lecture

DURATION OF THE BATTLE

- The Battle of Britain was fought from August 8, 1940 until October 31, 1940.
- The Battle of Britain was the first major battle to be fought wholly in the air, with both sides having roughly the same number of fighter aircraft.
- It was the largest and most sustained bombing campaign yet attempted and the first real test of the strategic bombing theories that had emerged since the previous World War.
- The battle can be roughly divided into four phases:

  - July 10–August 11: Kanalkampf, the Channel battles,
  - August 8–August 23: Adlerangriff, the early assault against the coastal airfields,
  - August 24–September 6: the Luftwaffe targets the airfields – the critical phase of the battle;
  - September 7 onward: the day attacks switch to British towns and cities.
- The Battle of Britain marked the first time that the Nazis were stopped and that air superiority became clearly seen as the key to the war. Though the battle was small in the number of combatants and casualties, had the Germans won, the war would have taken a very different path.
- The British victory marked the first failure of Hitler's war machine.
- The Royal Air Force lost 375 pilots and 358 pilots were wounded.

ALLIED FORCES AND AXIS POWERS

- The Battle of Britain was between the United Kingdom and Germany and Italy.
- The Battle of Britain is the name commonly given to the attempt by the German Luftwaffe, as part of German Blitzkrieg tactics, to gain air superiority over the Royal Air Force (RAF), before a planned sea and airborne invasion of Britain (Operation Sealion).
- Neither Hitler nor the German Wehrmacht believed it possible to carry out a successful amphibious assault on the British Isles until the RAF had been neutralized.
- Secondary objectives were to destroy aircraft production and ground infrastructure, to attack areas of political significance, and to terrorize the British people with the intent of intimidating them into seeking an armistice or surrender.
- The RAF roll of honour for the Battle of Britain recognizes 510 overseas pilots as flying at least one authorized operational mission with an eligible unit of the Royal Air Force or Fleet Air Arm between July 10 and October 31, 1940. This included pilots from Poland, New Zealand, Canada, Czechoslovakia, Belgium, Australia, South Africa, France, Ireland, the United States of America, Jamaica, Palestine and Southern Rhodesia (Zimbabwe).
- The highest scoring unit during the Battle of Britain is remarkably the No. 303 Polish Fighter Squadron.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What were the dates of the Battle of Britain?

Q2. Who was the battle between?

Q3. What were two of the other countries involved in the Battle of Britain?

ANTICIPATED ANSWERS

A1. The Battle of Britain was fought from August 8, 1940 until October 31, 1940.

A2. The Battle of Britain was between the Allied Forces and Axis powers.

A3. Poland, New Zealand, Canada, Czechoslovakia, Belgium, Australia, South Africa, France, Ireland, the United States of America, Jamaica, Palestine and Southern Rhodesia (Zimbabwe).

Teaching Point 5	**Discuss the Aircraft Flown During the Battle of Britain**
Time: 5 min	Method: Interactive Lecture

HAWKER HURRICANE MARK I

- The Hawker Hurricane Mark I was a single-seater fighter with a Rolls-Royce Merlin engine.
- It was a low-wing all-metal cantilever monoplane armed with eight Browning machine-guns – four in each wing set to fire forward outside the airscrew disc.
- The maximum speed was 539 km/h.
- The Hurricane was regarded as less ‘twitchy’ than the Spitfire and provided a more stable gun platform.
- The RAF’s preferred tactic was, if possible, to deploy the Hurricane’s awesome fire power against formations of less-agile bombers and to set up the Spitfires against fighter escorts waiting to pounce from a higher altitude.

Present slide or distribute handouts of Figure A-5 to the cadets.

THE SPITFIRE MARK 1

- The Spitfire Mark 1 was a similar single-seater fighter with a Rolls-Royce Merlin engine.
- It was a low-wing all-metal cantilever monoplane armed with eight Browning machine-guns – four in each wing set to fire forward outside the airscrew disc.
- The Spitfire’s one-piece sliding moulded canopy gave the best visibility, the pilot having a better chance of spotting an enemy.
- The maximum speed was 589 km/h.

QUALITIES OF BOTH AIRCRAFTS

- In both these aircrafts the armour in the front and back protected the pilot.
- The Spitfire and Hurricane would out-turn the Bf-109E or Emil (German Aircraft) because the Bf-109 pilots were afraid to push the plane to its limits due to the fact that the Bf-109 did not give the pilot any warning that it was going to stall, unlike the Spitfire and Hurricane, which gave the pilot plenty of warning that the plane was about to stall by shaking violently.
- Both the Spitfire and Hurricane were slower in a power dive and had the drawback of being equipped with a float-type carburetor, which cut out under negative g-forces.
- Both the RAF fighters were easy to fly and forgiving with both rough handling and novice pilots.
- The Hurricane was a superbly steady gun platform and the closely clustered .303 machine guns in each wing proved very destructive.
- A drawback to the Hurricane was the presence of a fuel tank just behind the cockpit firewall, which could catch fire and within a few seconds severely burn the pilot before he managed to bail out.

Present slide or distribute handouts of Figure A-6 to the cadets.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS

Q1. What was the maximum speed of the Hawker Hurricane?

Q2. What was the maximum speed of the Spitfire Mark 1?

Q3. What was a drawback to the Hurricane?

ANTICIPATED ANSWERS

A1. The maximum speed of the Hawker Hurricane was 539 km/h.

A2. The maximum speed of the Spitfire Mark 1 was 589 km/h.

A3. A drawback to the Hurricane was the presence of a fuel tank just behind the cockpit firewall, which could catch fire and within a few seconds severely burn the pilot before he managed to bail out.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What were the nicknames of the Sopwith Triplane?

Q2. What was the longest campaign of WWII?

Q3. Which plane was less twitchy than the Spitfire?

ANTICIPATED ANSWERS

A1. The Tripe or the Tripehound.

A2. The Battle of Britain was the longest campaign.

A3. The Hawker Hurricane.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important for cadets to know about the aircraft flown in WWI and WWII so that they can better understand Canada's role during these conflicts and to understand the meaning of the parades used to commemorate the fallen men and women who gave their lives during these conflicts.

INSTRUCTOR NOTES/REMARKS

If the squadron is participating in the parades listed in TPs 2 and 4 this EO should be conducted prior to the parade dates.

REFERENCES

A3-033 *Canada's Air Force, Aircraft: Historical Aircraft. (2006).* Retrieved 20 March 2007, from http://www.airforce.forces.gc.ca/equip/historical/hist_e.asp.

A3-038 VAC Canada Remembers. (1998). *The Battle of the Atlantic.* Retrieved 19 February 2007, from http://www.vac-acc.gc.ca/remember/sub.cfm?source=history/secondwar/canada2/batat1.

A3-039 Canada's Air Force. (2004). *World War ll -1939-45.* Retrieved 19 February 2007, from http://www.airforce.forces.ca/hist/ww_2_e.asp.

A3-042 Milberry. L and Halliday. H. (1990). *The Royal Canadian Air Force At War 1939-1945.* Toronto: CANAV Books.

C3-078 Canadian War Museum. (2004). *The Invasion Threat to Britain and the Battle of Britain, 1940.* Retrieved 16 February 2007, from http://www.warmuseum.ca/cwm/newspapers/operations/Britain_e.html.

C3-079 Canadian War Museum. (2004). *The Battle of the Atlantic.* Retrieved 9 February 2007, from http://www.warmuseum.ca/cwm/newspapers/operations/atlantic_e.html.

C3-103 Ace Pilots. (2007). *Legendary Aviators and Aircraft of World War One.* Retrieved 26 February 2007, from http://www.acepilots.com/wwi/main.html.

C3-122 *The Battle of Britain August-October 1940.* (1941). Published by his Majesty's Stationary Office, London: Crown Copyright Reserved.

C3-123 The Aviation History On-Line Museum - Aviation History. (2006). *The Sopwith Triplane.* Retrieved 20 March 2007, from http://www.aviation-history.com/sopwith/triplane.html.

C3-124 Aces and Aircraft of World War I. (2007). *The Aerodrome: Bristol F.2b Fighter.* Retrieved 20 March 2007, from http://www.theareodrome.com/aircraft/gbritain/bristol_f2b.php.

C3-125 Beehive Hockey Photos. (2006). *Consolidated B-24 Liberator Bomber.* Retrieved 20 March 2007, from http://www.beehivehockey.com/photo_18liberator.htm.

C3-129 Spaight, J. M. (1941). *The Battle of Britain 1940: The Interceptors Take Off.* Strand London: Geoffrey Bles.

C3-130 Canadian Aviation Museum. (2006). *Sopwith Triplane.* Retrieved 22 March 2007, from http://www.aviation.technomuses.ca/collections/artifacts/aircraft/SopwithTriplane.shtml.

THIS PAGE INTENTIONALLY LEFT BLANK

AIRCRAFT FLOWN DURING WWI AND WWII

Aviation History, The Sopwith Triplane – Great Britain. (2006). The Aviation History On-Line Museum. Retrieved 20 March 2007, from http://www.aviation-history.com/sopwith/triplane.htm

Figure A-1 A Sopwith Triplane

Aces and Aircraft of World War I, 2007, The Aerodrome. Bristol F.2B Fighter. Retrieved 20 March 2007, from http://www.theaerodrome.com/aircraft/gbritain/bristol_f2b.php

Figure A-2 Bristol F.2B Fighter

"Consolidated B-24 Liberator Bomber", Beehive Hockey Photos (2006). Retrieved 20 March 2007, from http://www.beehivehockey.com/photo_18liberator.htm

Figure A-3 B-24 Liberator

Department of National Defence. (2006). Canadian Forces Aircraft. Retrieved 20 March 2007, from http://www.airforce.forces.gc.ca/equip/grfx/equip_gallery/historic_gallery/wallpaper/harvarda9.jpg

Figure A-4 Curtiss 87A Kittyhawk

Department of National Defence. (2006). Canadian Forces Aircraft. Retrieved 20 March 2007, from http://www.airforce.forces.gc.ca/equip/grfx/equip_gallery/historic_gallery/wallpaper/harvarda9.jpg

Figure A-5 The Hawker Mark 1 Hurricane

Department of National Defence. (2006). Canadian Forces Aircraft. Retrieved 20 March 2007, from http://www.airforce.forces.gc.ca/equip/historical/spitfirelst_e.asp

Figure A-6 The Spitfire

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M230.02 – DISCUSS SIGNIFICANT EVENTS IN 20TH CENTURY CANADIAN MILITARY HISTORY

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-802/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 presentation slides or handouts of all the figures located at Annex A.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to present background material to the cadets and promote an interest in aircraft flown during significant events in history.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to discuss Armistice Day (Remembrance Day) and D-Day and the planes flown during D-Day.

IMPORTANCE

It is important for cadets to know about the aircraft flown during significant events in history like D-Day so that they can better understand Canada's role during this conflict. It is also important for the cadets to understand the meaning of Armistice Day and the parades used to commemorate the fallen men and women who gave their lives during wartime.

Teaching Point 1	Discuss the Importance of Armistice Day (Remembrance Day)
Time: 10 min	Method: Interactive Lecture

ANNUAL DAY OF COMMEMORATION

- "At the eleventh hour, of the 11th day, of the 11th month of the year 1918, after more than four years of continuous fighting, hostilities on the main battlefront of the greatest war in history came to an end" (Brigadier C. N. Barclay, 1968).
- An annual day of commemoration for Canada's war dead began after WWI.
- With some 60 000 Canadians killed, the war produced a profound sense of loss in a country whose greatest military tragedy to date had been 267 dead in the South African War of 1899-1902.
- The huge cost of the so-called "Great War" was startling for Canada, as it was for all combatant nations.
- As early as April 1919, Isaac Pedlow, Member of Parliament (MP) for South Renfrew, Ontario, introduced a motion in the House of Commons to institute an annual "Armistice Day" to be held on the second Monday of November.
- Members agreed that there should be a special day to mark the Armistice, but were split over the day on which it should be held.
- Responding to the views of the veterans' community, many argued that it should occur on the actual anniversary of the Armistice–November 11.
- Those who had come through the war felt that a solemn occasion marking the deaths of 60 000 comrades was important enough to merit this distinction.
- A special appeal sent out by King George V to the Empire on November 6, urging the year-old Armistice be marked by the suspension of all ordinary activities and the observance of two minutes of silence at precisely 11:00 a.m. on November 11, settled the issue.
- This was how Canada marked its first Armistice Day.

WHAT DOES ARMISTICE DAY MEAN?

- The term "armistice" denotes the cessation of hostilities in a conflict and it was used universally for the final silencing of the guns that ended the WWI at 11:00 a.m. on November 11, 1918.

NAME CHANGE

- On March 18, 1931, A.W. Neil, MP for Comox-Alberni in British Columbia, introduced a motion in the House of Commons to have Armistice Day observed on November 11 and "on no other date."
- Concerns about the holiday's impact on business, he claimed, were "irrelevant."
- At the same time, another MP, C.W. Dickie of Nanaimo, also speaking on behalf of veterans, introduced a motion changing the name from Armistice to Remembrance Day.
- This term, he felt, better "implies that we wish to remember and perpetuate."
- As historian Denise Thompson has suggested, "the term 'Remembrance Day' placed the emphasis squarely upon memory – and by extension upon the soldiers whose deaths were being remembered – rather than upon the Armistice, a political achievement in which rank-and-file soldiers were not directly involved."
- Parliament quickly adopted these resolutions and Canada held its first Remembrance Day on November 11, 1931.

- Remembrance Day has remained the official title for the annual commemoration ever since, although the term Armistice Day is sometimes used interchangeably, but unofficially.
- Remembrance Day, a more flexible and inclusive term, readily accommodates the remembrance of war dead from WWI, WWII, the Korean War, other conflicts and peacekeeping.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. When did the annual day of commemoration begin?

Q2. How did Canada mark its first Armistice Day?

Q3. When did Canada hold its first Remembrance Day?

ANTICIPATED ANSWERS

A1. An annual day of commemoration for Canada's war dead began after World War I.

A2. A special appeal sent out by King George V to the Empire on November 6, urging the year-old Armistice be marked by the suspension of all ordinary activities and the observance of two minutes of silence at precisely 11:00 a.m. on November 11 settled the issue.

A3. Canada held its first Remembrance Day on November 11, 1931.

Teaching Point 2	**Discuss How Canadians Commemorate Remembrance Day by Organizing Yearly Ceremonies**
Time: 5 min	Method: Interactive Lecture

COMMEMORATING REMEMBRANCE DAY

- Every year, ceremonies are held at cenotaphs in cities and towns across the country, involving prayer, recitations and playing the traditional military bugle calls of "Last Post" followed by "Reveille."
- The largest, carried live by national television networks, is held at the National War Memorial in Ottawa and attended by the Prime Minister, the Governor General and the "Silver Cross Mother," a mother who has actually lost a child or children in action.
- Remembrance Day ceremonies offer veterans the opportunity to remember and salute fallen comrades and all Canadians an occasion to reflect on the sacrifices made and the tragedies endured in their name.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What happens every year at cenotaphs?

Q2. Who attends the country's largest Remembrance Day ceremony?

Q3. What do Remembrance Day ceremonies offer?

ANTICIPATED ANSWERS

A1. Every year ceremonies are held at cenotaphs in cities and towns across the country, involving prayer, recitations and playing the traditional military bugle calls of "Last Post" followed by "Reveille."

A2. The largest, carried live by national television networks, is held at the National War Memorial in Ottawa and attended by the Prime Minister, the Governor General and the "Silver Cross Mother," a mother who has actually lost a child or children in action.

A3. Remembrance Day ceremonies offer veterans the opportunity to remember and salute fallen comrades and all Canadians an occasion to reflect on the sacrifices made and the tragedies endured in their name.

Teaching Point 3	**Discuss the Importance of D-Day**
Time: 5 min	Method: Interactive Lecture

CONFLICT BETWEEN THE ALLIED FORCES AND GERMANY

- On June 6, 1944, the "Second Front" became a reality.
- In the weeks before that, the Allied Air Forces had attacked the transportation network used to move German troops and equipment.
- On D-Day itself, delayed one day by bad weather in the English Channel, powerful air and naval support, as well as ground-breaking specialized armoured vehicles, such as tanks capable of "swimming", helped the infantry to get ashore on five beaches—two each for the Americans and British and one for the Canadians.
- Anglo-American-Canadian forces landed on the open beaches of Normandy, north and west of the city of Caen, France.

CANADIAN SOLDIERS LANDING AT JUNO BEACH, FRANCE

- Canadian airmen and sailors were among the first into action.
- The Royal Canadian Air Force had already been involved for several months in bombing key enemy targets in the invasion area; roads, bridges, railways, airfields and command and communications centres.
- Now they flew as part of the 171 Allied squadrons that attacked on D-Day.
- As H-Hour approached, RCAF Lancasters of No. 6 Bomber Group dropped thousands of tons of explosives on German coastal defences.
- While it was still dark in the early hours of June 6, Allied paratroopers, including 450 Canadians, jumped from aircraft or landed in gliders behind German coastal defences.
- 3rd Canadian Infantry Division and 2nd Canadian Armoured Brigade formed the Canadian assault force on D-Day, while 1st Canadian Parachute Battalion jumped as part of the great airborne force protecting the flanks of the landing.
- Canadian destroyers, corvettes, minesweepers, landing ships and landing craft supported the landings, as did the many RCAF squadrons overhead.
- Separated by gusty winds, outnumbered and only lightly armed, they nevertheless captured a German headquarters, destroyed a key bridge and seized an important crossroad, all the while sowing confusion and disorder within enemy ranks.
- 340 Canadian soldiers died, 547 were wounded and 47 were taken prisoner.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What is the date of D-Day?

Q2. Between whom was the conflict?

Q3. How many Canadian soldiers died on D-Day?

ANTICIPATED ANSWERS

A1. June 6, 1944.

A2. The Allied Forces and Germany.

A3. 340 Canadian soldiers died on D-Day.

Teaching Point 4	**Discuss Aircraft Flown During D-Day**
Time: 5 min	Method: Interactive Lecture

AIRCRAFT FLOWN DURING D-DAY

Black and White Striped MK IXB

- The black and white striped MK IXB was a Spitfire.
- The day before D-Day at the RAF Station Tangmere near Chichester in the south of England ground crew painted black and white “invasion stripes” on their Spit IXs.
- In the dangerous skies over France, these markings would indicate to friendly fighters to not shoot.
- Aircraft without stripes were fair game.

Present slide or distribute handouts of Figure A-1 to the cadets.

Halifax LW170

- The Halifax LW170 had an unusual combat history in the RCAF.
- From May to August 1944 this aircraft participated in 28 missions to Germany and France during the critical days preceding and during D-Day.
- The Halifax LW 170 participated in the bombing and destruction of the German heavy guns, which threatened the entire Allied invasion fleet on the historic morning of June 6, 1944.
- Finally, due for major maintenance in August 1944, LW170 was replaced by other Halifaxes and consigned to repairs, or at worst, the scrap yard.
- Fate intervened and this Halifax was repaired and was to be handed over to a weather patrol squadron where it soldiered on until just after the end of the war in 1945.

Present slide or distribute handouts of Figure A-2 to the cadets.

RCAF Lancaster

- The four-engine Avro "Lancaster", a direct development of the unsuccessful twin-engine Manchester became the 'mighty pulveriser' of the RAF's Bomber Command, able to carry the great 990 kg "Ten-Ton Tessie", also known as the "Grand Slam", the heaviest bomb-load lifted by any bomber of WWII.
- Its most notable exploits were the breaching of the Mohne and Eder dams in the Ruhr, Germany in May 1943 and also the sinking of the German battleship Tirpitz in November 1944.
- A total of 420 Lancaster Xs were built in Canada in Malton, Ontario and Canadian units in the Commonwealth Tiger Force would have flown Lancaster Xs in the Pacific had the war lasted into 1946.
- After service with the twelve squadrons of the RCAF's No. 6 Group in Bomber Command during the war, the Lancaster was used by the RCAF in varied post-war roles, including photo reconnaissance, air/sea rescue and maritime reconnaissance.
- The Lancaster was finally retired from the RCAF on April 1, 1964, after being used in service for more than twenty years.

Present slide or distribute handouts of Figure A-3 to the cadets.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What did the black and white stripes indicate to friendly fighters?

Q2. How many missions did the Halifax LW170 participate in during the critical days preceding and during D-Day?

Q3. What was the Lancaster's most notable exploits?

ANTICIPATED ANSWERS

A1. In the dangerous skies over France these markings would indicate to friendly fighters to not shoot.

A2. From May to August 1944 this aircraft participated in 28 missions to Germany and France during the critical days preceding and during D-Day.

A3. Its most notable exploits were the breaching of the Mohne and Eder dams in the Ruhr, Germany in May, 1943, and the sinking of the German battleship Tirpitz in November 1944.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What does the term "armistice" mean and what is Armistice Day?

Q2. Why did Armistice Day change to Remembrance Day?

Q3. Who were among the first into action at Juno Beach?

ANTICIPATED ANSWERS

A1. The term “armistice” denotes the cessation of hostilities in a conflict and it was used universally for the final silencing of the guns that ended the WWI at 11:00 a.m. on November 11, 1918.

A2. Remembrance Day, a more flexible and inclusive term, readily accommodates the remembrance of war dead from WWI, WWII, the Korean War, other conflicts, and peacekeeping.

A3. Canadian airmen and sailors were among the first into action.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important for cadets to know about the aircraft flown during significant events like D-Day so that they can better understand Canada’s role during this conflict. It is also important for the cadets to understand the meaning of Armistice Day and the parades used to commemorate the fallen men and women who gave their lives during wartime.

INSTRUCTOR NOTES/REMARKS

This class should be taught before the Remembrance Day parade so cadets may gain an appreciation and full understanding of the significance behind this event.

REFERENCES

A3-033 *Canada’s Air Force, Aircraft: Historical Aircraft.* (2006) Retrieved 31 October 2006, from http://www.airforce.forces.gc.ca/equip/historical/hist_e.asp.

A3-040 Halifax 57 Rescue. (Canada). *LW170 Proposal.* Retrieved 20 February 2007, from http://www.57rescuecanada.comLocatingLW170/LW170_Proj_Proposal.htm.

A3-041 DND. (2005). *D-Day.* Retrieved 20 February 2007, from http://forces.gc.ca/site/Feature-Story/2003/jun03/06_f_e.asp.

A3-042 Milberry, L. and Halliday, H. (1990). *The Royal Canadian Air Force at War 1939-1945.* Toronto, ON: CANAV Books.

A3-043 National Defence. (2004). *Halifax Bomber.* Retrieved 22 March 2007, from http://www.airforce.gc.ca/equip/historical/Halifax_e.asp.

C3-080 Canada War Museum. (2003). *Remembrance Day: Armistice Day.* Retrieved 19 February 2007, from http://www.warmuseum.ca/cwm/remember/armisticeday_e.html.

C3-081 Canada War Museum. (2003). *Remembrance Day: Armistice Day Becomes Remembrance Day.* Retrieved 19 February 2007, from http://www.warmuseum.ca/cwm/remember/1931remembrance_e.html.

C3-082 Rich Thistle Studio. (1993). *The Fire at Canadian Warplane Heritage Museum.* Retrieved 20 February 2007, from http://www.richthistle.com/article_include.php?i=a12_into_the_blue.php.

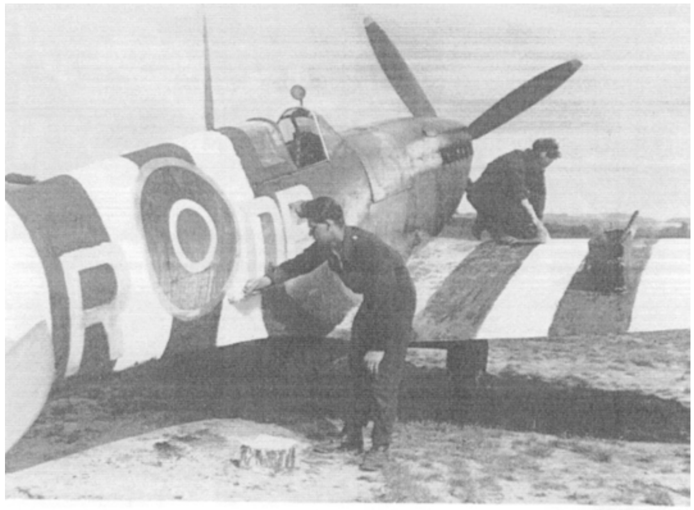
C3-083 Canada War Museum. (2003). *D-Day and the Normandy Campaigns.* Retrieved 16 February 2007, from http://www.civilization.ca/cwm/newspapers/operations/ddaynormandy_e.html.

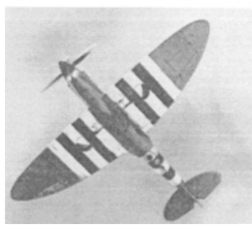
C3-126 Brigadier C.N. Barclay. (1968). *Armistice 1918.* London, UK: Dent, J. M. & Sons LTD.

C3-127 Canadian Warplane Heritage Museum. (2007). *Avro Lancaster.* Retrieved 22 March 2007, from http://secure.warplane.com/pages/aircraft_lancaster.html.

C3-128 RCAF.com (2007). *Avro Lancaster.* Retrieved 22 March 2007, from http://www.rcaf.com/aircraft/bombers/Lancaster/index.php?name=Lancaster.

AIRCRAFT FLOWN DURING D-DAY





Above: It's the day before D-Day and at RAF Station Tangmere near Chicester in the south of England groundcrew of 411 Squadron are hastily painting white and black "invasion stripes" on one of their Spit Ix's. In the crazy skies over France the next day these markings would tell friendly flak and fighters not to shoot. Aircraft without stripes would be fair game. In the second photo at left, the simple effectiveness of their stripes is evident on a Spit. (DND PI30827, RE20421-1)

L. Milberry and H. Halliday, The Royal Canadian Air Force at War 1939-1945, CANAV Books (p. 171)

Figure A-1 Black and White Painted Spitfire IX

Department of National Defence. (2004). Canadian Forces Historical Aircraft. Retrieved 22 March 2007, from http://www.airforce.forces.gc.ca/equip/historical/Halifax_e.asp

Figure A-2 Halifax Bomber

Department of National Defence. (2006). Canadian Forces Aircraft. Retrieved 22 March 2007, from http://www.airforce.forces.gc.ca/equip/grfx/equip_gallery/historic_gallery/wallpaper/lanc.jpg

Figure A-3 The Avro 683 Lancaster

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 12

PO 231 – EXPLAIN PRINCIPLES OF FLIGHT

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M231.01 – IDENTIFY THE FOUR FORCES THAT ACT UPON AN AIRCRAFT

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Make copies of the handouts located at Annexes A and C and slides/handouts of Figure B-1.

Create a simple paper glider from the instructions in Figure A-1 for demonstration purposes.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1, TP2 and TP4 to TP7 to introduce the forces that act upon an aircraft and give an overview of them.

An in-class activity was chosen for TP3 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify the four forces that act upon an aircraft.

IMPORTANCE

It is important for cadets to learn and identify the four forces that act upon an aircraft so that they will understand the principles of flight by which an aircraft operates.

Teaching Point 1 — **Explain That Every Aircraft Has Weight and That a Glider on Tow Gains Energy As It Gains Altitude**

Time: 5 min — Method: Interactive Lecture

Every aircraft has weight, which influences the design and performance of the aircraft.

The weight of an aircraft is the force that acts vertically downward toward the centre of the Earth and is the result of gravity.

The gliders used in the Air Cadet gliding program are towed to their determined altitude by a tow-plane. There are other methods of getting altitude, such as using a winch to get up to speed on the ground.

An aircraft gains energy as it gains altitude. The energy that the glider gains as it is taken to its determined altitude can be spent quickly in a rapid descent to Earth or it can be spent slowly in a long descent.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What causes an aircraft to have weight?

Q2. In what direction does weight and gravity act?

Q3. How do Air Cadet gliders get to their determined altitude?

ANTICIPATED ANSWERS

A1. Gravity.

A2. Vertically, downward toward the centre of the Earth.

A3. An Air Cadet glider is towed to altitude by a tow-plane.

Teaching Point 2 — **Explain That a Glider Experiences Drag From the Air as It Returns to the Earth After Being Released**

Time: 5 min — Method: Interactive Lecture

Drag is the resistance that any object experiences as it moves through the air.

Cadets will have experienced the resistance of air on their bicycles or just walking on a windy day.

Effort is put into aircraft design to minimize drag.

Cadets avoid drag when they lower their head and shoulders on a bicycle to gain speed.

The design of an aircraft can minimize drag but cannot avoid it entirely. The faster an aircraft is designed to fly, the more sleek and streamlined its design is likely to be.

A parachute is designed to maximize drag by catching air and using it to slow descent.

An aircraft can use drag to control flight and manoeuvre by pushing on the passing air.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is drag?

Q2. How does a parachute use drag?

Q3. How does an aircraft use drag?

ANTICIPATED ANSWERS

A1. Drag is the resistance an object experiences as it moves through the air.

A2. A parachute is designed to maximize drag by catching air and using it to slow descent.

A3. An aircraft uses drag to control flight by pushing on the passing air.

Teaching Point 3 — **Fold and Fly a Simple Paper Glider**

Time: 15 min — Method: In-Class Activity

During this activity, introduce the cadets to Newton's first law of motion, "an object in motion tends to stay in motion", with regard to aircraft.

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets make a simple paper glider and then observe the effects of drag on it as it flies.

RESOURCES

- 8.5 x 11 inch paper, and
- Handouts of instructions for folding a simple paper glider located at Annex A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Give each cadet a single sheet of 8.5 x 11 inch paper and the instructions for folding, as shown in Figure A-1.

2. Each cadet will create a simple paper glider by folding the sheet of paper according to the instructions provided.

3. When directed, the cadets will gently release their gliders and observe them as they descend.

SAFETY

Adequate supervision will ensure that cadets release the simple paper gliders gently.

CONFIRMATION OF TEACHING POINT 3

The cadets' participation in folding and flying a simple paper glider will serve as the confirmation of TP3.

Teaching Point 4	**Explain That a Descending Glider Converts the Energy of Raised Weight Into Forward Thrust by Acting Upon the Passing Air**
Time: 10 min	Method: Interactive Lecture

As demonstrated in TP3, a glider moves forward as it descends, rather than falling straight down. It accomplishes this by acting on the air in a manner similar to a cadet diving into water.

A glider is always gliding downwards through the air, but by locating atmospheric lift (rising air) to offset the downward motion of the aircraft due to gravity, the pilot can actually gain altitude and fly great distances without needing to use artificial lift again.

Thrust is a force that moves an aircraft forward. A glider spends the energy it has gained and moves forward by trading the speed of descent for forward motion. It gets this control by using its weight to push upon the air below. With its nose lowered, it slides forward over the air below.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. In what direction does a glider always move through the air after being released?

Q2. What causes the glider to descend?

Q3. What causes the glider to move forward?

ANTICIPATED ANSWERS

A1. Downward, toward the centre of the Earth.

A2. Weight, resulting from gravity.

A3. Thrust, developed by spending energy, trades the speed of descent for forward motion.

Teaching Point 5 | **Explain That a Glider's Wings Are Designed To Convert the Energy of the Glider's Descent From Downward Motion To Lift**

Time: 5 min | Method: Interactive Lecture

A glider's wings are designed to project out into the passing air. Glider's wings are usually very large for the size of aircraft because a glider depends on its wings to develop lift without help from an engine or a propeller. As air moves over and under the wing, the air is used by the wing to generate lift.

The purpose of a glider's wings is not to go fast to minimize descent. The object of soaring is to get as much forward distance as possible, while losing as little altitude as possible for each unit of energy that the glider loses in descent. The distance travelled forward compared to the altitude lost is referred to as glide ratio. This should be a very large number such as 30 metres forward for each metre of descent.

The glider's wing is designed to develop lift because lift reduces the rate of descent while allowing forward motion. The lift of the aircraft's wing will counteract the aircraft's weight, to a degree, and this will improve the aircraft's glide ratio. Generally, the larger the wing, the more lift can be developed.

A wing generates lift by acting upon the passing air in a highly sophisticated manner that will be explored in the next lesson.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS

Q1. Why does a glider have large wings?

Q2. What is required for an aircraft wing to develop lift?

Q3. What is used to overcome the weight of an aircraft?

ANTICIPATED ANSWERS

A1. A glider depends upon its wings to develop lift without help from an engine.

A2. Air must move over and under the wing.

A3. Lift that is created by the aircraft's wing.

Teaching Point 6 | **Explain That a Powered Aircraft Has Weight and, When in Flight, Also Experiences Drag, Thrust, and Lift**

Time: 10 min | Method: Interactive Lecture

A powered aircraft also experiences weight, drag and lift as does a glider. However, while a glider can gain forward motion only by trading the energy of its descent for thrust, a powered aircraft can generate thrust by running its engine. In this case, thrust is provided to the aircraft via a driven propeller or a high-speed jet exhaust.

Show the cadets a slide (OHP or PPT), or paper handouts, of the four forces that act upon an aircraft shown in Figure B-1.

On the other hand, the engine adds weight to the aircraft and both the propeller and engine body add to the drag that the aircraft experiences. A powered aircraft, therefore, will usually not have the high glide ratio of a glider.

A powered aircraft, though, can attain equilibrium, which is something a glider cannot do. Equilibrium is a condition where lift equals weight or thrust equals drag. Pilots often refer to this as flying straight and level.

- If lift is greater than weight, the aircraft will climb higher.
- If weight is greater than lift, the aircraft will descend.
- If thrust is greater than drag, the aircraft's forward speed will increase.
- If drag is greater than thrust, the aircraft's speed will decrease.

CONFIRMATION OF TEACHING POINT 6

QUESTIONS

Q1. What is aircraft equilibrium?

Q2. What is necessary for an aircraft to climb higher?

Q3. What is a downside of having an engine?

ANTICIPATED ANSWERS

A1. Equilibrium is the condition where lift equals weight or thrust equals drag.

A2. If lift is greater than weight, the aircraft will climb higher.

A3. An engine increases the aircraft's weight and often increases its drag.

Teaching Point 7 — **Explain That Thrust and Drag Allow an Aircraft To Fly by Overcoming Drag and Weight**

Time: 5 min — Method: Interactive Lecture

A glider can fly even though it does not produce its own thrust. It can fly even though its weight is greater than its lift. However, in the Earth's gravity, its flight is limited by atmospheric conditions and the pilot's skill. On a day without wind, even the most skilful pilot will soon return to Earth after being released.

With a powered aircraft, descent can be delayed by turning the energy of burning fuel into thrust because thrust can then be turned into lift by the aircraft's wings.

CONFIRMATION OF TEACHING POINT 7

QUESTIONS

Q1. What are the four forces that act upon an aircraft?

Q2. What force can overcome weight?

Q3. What force can overcome both weight and drag?

ANTICIPATED ANSWERS

A1. Weight, drag, thrust and lift.

A2. Lift.

A3. Thrust, because thrust can be converted to lift by the aircraft's wings.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. How must the four forces that act on an aircraft be arranged to achieve equilibrium?

Q2. In what direction does weight and gravity act?

Q3. What is required for an aircraft wing to develop lift?

ANTICIPATED ANSWERS

A1. Lift must equal weight and thrust must equal drag.

A2. Vertically, downward toward the centre of the Earth.

A3. Air must move over and under the wing.

Have each cadet fill in the names of the four forces that act upon an aircraft in the drawing located at Annex C.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Gliders and powered aircraft are designed for different purposes but they each are subject to the forces of weight, drag, lift and thrust.

INSTRUCTOR NOTES/REMARKS

Advise the cadets that each of the concepts introduced in this lesson will be explored in following lessons.

REFERENCES

C3-017 (ISBN 1-895569-23-0) Schmidt, N. (1998). *Fabulous Paper Gliders.* New York, NY: Sterling Publishing.

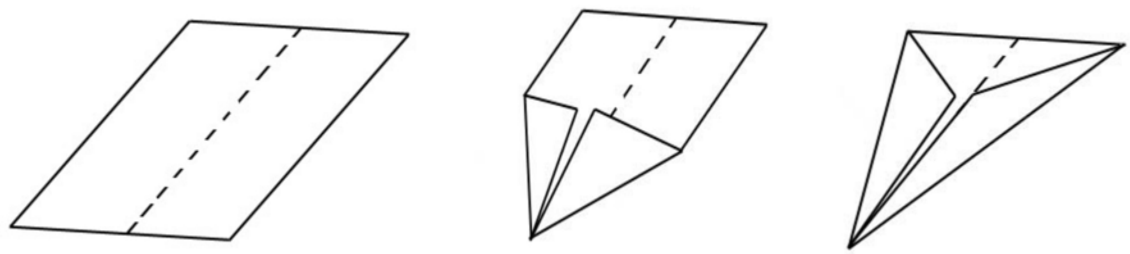
C3-058 (ISBN 1-4027-3034-9) Schmidt, N. (2005). *Paper Creations Paper Airplanes.* New York, NY. Sterling Publishing.

C3-090 National Aeronautics and Space Administration (NASA). (2007). *Virtual Skies.* Retrieved 22 February 2007, from http://virtualskies.arc.nasa.gov/aeronautics/tutorial/intro.html.

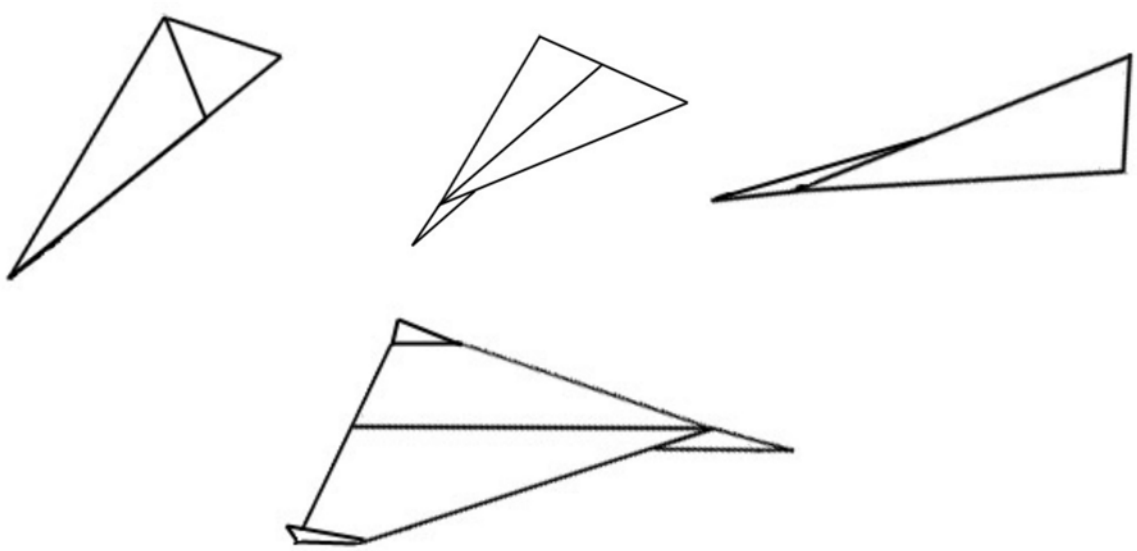
C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

PAPER AIRPLANE ASSEMBLY INSTRUCTIONS

1. Fold paper down the centre lengthwise.
2. Fold the two upper corners down to the centreline.
3. Fold the two folded corners down to the centreline.



4. Fold the plane in half.
5. Fold one wing down, flip the plane over, and fold the other wing down.
6. Open the plane and fold the wing tips up.

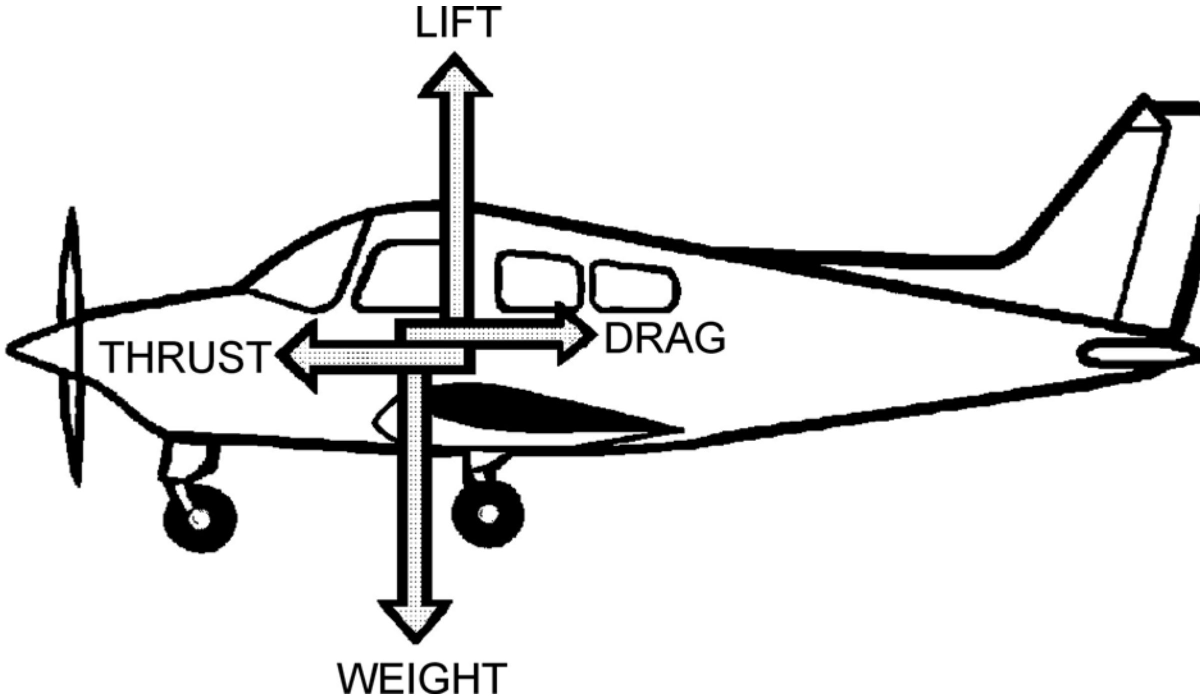


"NASAexplores", Express Lessons and Online Resources. Retrieved 7 March 2007, from http://www.nasaexplores.com/show_58_student_st.php?id=02123190203

Figure A-1 Paper Plane Assembly Instructions

THIS PAGE INTENTIONALLY LEFT BLANK

FOUR FORCES THAT ACT UPON AN AIRCRAFT



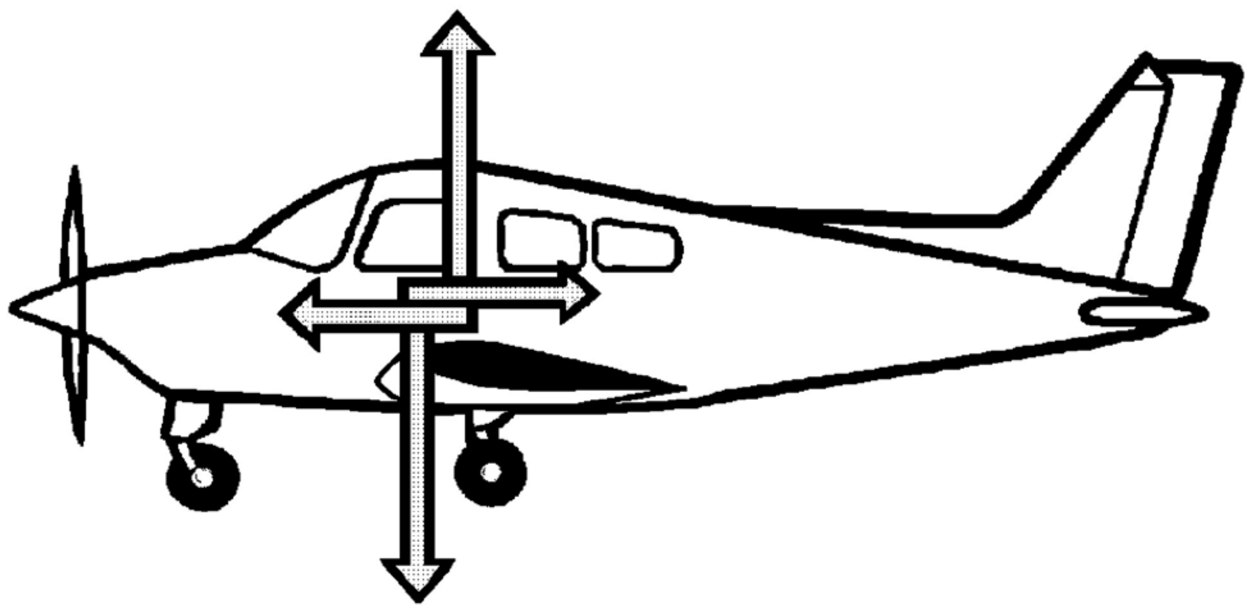
Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure B-1 The Four Forces That Act Upon an Aircraft

THIS PAGE INTENTIONALLY LEFT BLANK

IDENTIFYING THE FOUR FORCES THAT ACT UPON AN AIRCRAFT

FILL IN EACH OF THE FOUR FORCES NEXT TO THE ARROWS



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure C-1 Identifying the Four Forces That Act Upon an Aircraft

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M231.02 – DESCRIBE THE PRODUCTION OF LIFT BY AN AIRCRAFT WING

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 presentation slides or handouts of Figures A-1, A-2, B-1 and C-1.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1, TP2 and TP4 to introduce the production of lift and give an overview of it.

An in-class activity was chosen for TP3 and TP5 as it is an interactive way to provoke thought and stimulate interest among cadets.

INTRODUCTION

REVIEW

Review for this lesson is from EO M231.01 (The Four Forces That Act Upon an Aircraft). Review the four forces that act upon an aircraft and the condition of equilibrium.

OBJECTIVES

By the end of this lesson the cadet shall be expected to describe the production of lift by an aircraft wing.

IMPORTANCE

It is important for cadets to learn about the production of lift by an aircraft wing so that they can develop an understanding of subsequent and related principles of flight.

Teaching Point 1 — **Explain That Air Acts Like a Fluid Insofar As It Has Inertia, Speed, and Pressure**

Time: 5 min — Method: Interactive Lecture

Air follows Newton's laws of motion:

- Newton's first law predicts that air, being a gaseous fluid, tends to remain in motion when it is moving.
- Newton's second law of motion requires that a force must be applied to change the air's motion.
- Newton's third law of motion allows the aircraft wing, by applying a force that changes the motion of air, to develop lift through an opposite and equal reaction.

The fact that air has mass is very important in aviation. Even though air's mass is less than the mass of most solids, its mass is still great enough to allow an aircraft to fly and to allow the aircraft to control its own flight.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. How does air follow Newton's first law of motion?

Q2. How does air follow Newton's second law of motion?

Q3. How does air follow Newton's third law of motion?

ANTICIPATED ANSWERS

A1. When in motion, air tends to remain in motion.

A2. When in motion, a force must be applied to change air's motion.

A3. When air's motion is changed, an equal and opposite reaction results.

Teaching Point 2 — **Introduce Bernoulli's Principle, Which States That a Liquid's Pressure Drops When Its Speed Increases (Venturi Effect)**

Time: 10 min — Method: Interactive Lecture

To develop the equal and opposite reaction described by Newton's third law of motion, the wing is given a shape that takes advantage of Bernoulli's Principle to make the air change direction. Air behaves like a fluid since it has pressure and speed. As airspeed increases, its pressure drops. A wing uses Bernoulli's Principle to deflect air, which causes an equal and opposite reaction.

Show the cadets a slide or handout of definitions of Bernoulli's principle shown in Figure A-1.

One part of Bernoulli's Principle that is very useful to remember is that if air speed increases, pressure decreases and if speed decreases, pressure increases. This is an inverse relationship between airspeed and air pressure. This part of Bernoulli's Principle is often referred to as the venturi principle. The shape of the wing is carefully calculated to decrease pressure above while increasing pressure below.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What relationship exists between air speed and air pressure?

Q2. What is the wing's connection between Newton's third law and Bernoulli's Principle?

Q3. What is a wing's shape calculated to do?

ANTICIPATED ANSWERS

A1. An inverse relationship: as speed increases, pressure drops and as speed drops, pressure increases.

A2. A wing uses Bernoulli's Principle to deflect air, which causes an equal and opposite reaction.

A3. A wing's shape is calculated to decrease pressure above while increasing pressure below.

Teaching Point 3	**Have the Cadets Explore Bernoulli's Principle**
Time: 10 min	Method: In-Class Activity

The pressure of moving air can be examined by blowing gently over a small piece of curved paper. The air does not push the paper down as might be intuitively assumed. Instead, the paper behind the curve rises toward the moving air. This happens because the air pressure drops over the paper due to the air's increased speed – this would seem to match the description of speed/pressure relationship. The curvature in the paper enhances the effect of the lowered air pressure.

A similar effect can be observed when air moves past any object that is light enough to be affected by the drop in air pressure associated with movement. A balloon is light enough to show this effect clearly.

Show the cadets a slide or handout of Figure A-2. Have one half of the class duplicate this paper airfoil activity at their desks while the other half of the class performs the following activity with balloons.

Then, have the groups switch and repeat.

ACTIVITY

Time: 5 min

OBJECTIVE

The objective of this activity is to have the cadets reduce the air pressure over a sheet of paper and observe the results.

RESOURCES

- Paper 8 1/2 x 11, and
- Pencil.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Tear a sheet of paper 8 1/2 x 11 vertically, into two pieces.
2. Curve one end of the sheet gently over a pencil as shown in Figure A-2.
3. Blow gently over the paper as shown in Figure A-2.
4. Observe that the paper rises into the moving air.

SAFETY

N/A.

ACTIVITY

Time: 5 min

OBJECTIVE

The objective of this activity is to have the cadets see the action of air pressure.

RESOURCES

- Balloons, and
- String.

ACTIVITY LAYOUT

Hang two long well-inflated balloons at the front of the classroom so they are at shoulder height, hanging 15 centimetres apart. This must be in a draft-free area. The balloons must hang very still so that the effect is clearly visible.

Alternatively, for more visual effect, this can also be done with helium-filled balloons with strings weighted to the floor, floating a metre high.

ACTIVITY INSTRUCTIONS

Have each cadet approach the balloons slowly, one at a time, and blow gently between them. The cadet will observe that the balloons move toward each other, not apart.

If a single balloon is used, the cadet can simply blow beside the balloon and the balloon will move toward the moving air.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Why does the paper airfoil rise when a cadet blows over it?

Q2. Why do balloons move toward moving air?

Q3. Why was the paper deliberately curved before blowing over it?

ANTICIPATED ANSWERS

A1. Air pressure over the paper drops as the air moves, so the still air below the paper pushes it up.

A2. Moving air pressure is lower, so still air pushes the balloon into the moving air.

A3. The curvature in the paper enhances the effect of the lowered air pressure.

Teaching Point 4	**Introduce Angle of Attack**
Time: 5 min	Method: Interactive Lecture

An aircraft wing is an airfoil because of its cross-sectional shape. The top surface is curved outward (convex curvature). Therefore, the air flowing over the top has further to go, over the curve, and so it must move faster which, as we know, will result in lower pressure. This happens above the wing.

Below the wing, the air is deliberately slowed to increase its pressure. This is done by curving the surface slightly inward (concave curvature) and by sloping the wing so that it is slightly higher at the front (leading edge) than it is at the back (trailing edge). This angle of the wing's under-surface, which encounters the moving air, is called the wing's angle of attack.

Use a model aircraft to demonstrate to the cadets that the wing's angle of attack increases when the aircraft's nose is raised during flight.

The greater the wing's angle of attack, the more air the under-surface of the wing will encounter, thereby generating more lift. This is a direct relationship between angle of attack and lift.

Increasing the wing's speed will also cause it to encounter more air, thereby generating more lift. This is also a direct relationship between speed and lift.

There is a limit to the amount of lift that can be produced by merely increasing the angle of attack. Long before the wing becomes vertical, it stops generating lift above and this often happens abruptly. The wing "stalls" and stops generating lift when this happens.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. Which surface of an aircraft wing is curved outward (convex)?

Q2. What shape is often given to the underside of an aircraft wing?

Q3. What happens to air pressure under a wing as angle of attack increases?

ANTICIPATED ANSWERS

A1. The top surface of a wing is curved outward.

A2. A slight inward, or concave, curve is often given to an aircraft wing.

A3. The pressure increases as angle of attack increases.

Teaching Point 5	**Have Each Cadet Create and Fly an Airfoil**
Time: 25 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets see an airfoil lift itself in a stream of moving air.

RESOURCES

- Index cards,
- Tape,
- Hole punch or sharp pencil,
- Scissors,
- Plastic drinking straw,
- Bamboo skewers or large straightened paper clips,
- Base that the skewers can stick into (Styrofoam or corrugated cardboard), and
- Hairdryer or fan.

ACTIVITY LAYOUT

This activity may take place at the cadets' desks/tables.

ACTIVITY INSTRUCTIONS

Give each cadet an index card to fold into an airfoil shape with mounting holes for the launching skewers. The cadets will:

1. Fold the card in half. Tape the top of the card down to the bottom half of the card so that about 6 mm (1/4 inch) of the bottom shows, leaving the top in a curve and the bottom flat. This will produce a cross-section airfoil shape.
2. Use the hole punch (or a sharp pencil) to put two sets of holes in the thickest part of the airfoil.
3. Cut the straw so you get two pieces 5 cm (2 inches) long. Fit these mini-straws through the holes in the airfoil.
4. Set the airfoil on the base and slip a skewer or unbent paper clip through each of the mini-straws and into the base.

5. Use the hairdryer or fan to move air over the airfoil to create lift. Try it both ways—with the flat side of the airfoil on the bottom and with the flat side on the top. Note which position the airfoil is in when it climbs best.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 5

The cadet's participation in creating and flying an airfoil will serve as the confirmation of TP5.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. How does the top surface of a wing generate lift?

Q2. How does the under-surface of a wing generate lift?

Q3. What determines how much lift is produced by a wing at a given speed?

ANTICIPATED ANSWERS

A1. The top surface of a wing generates lift by lowering air pressure over the wing.

A2. The under-surface of a wing generates lift by raising air pressure under the wing.

A3. The angle of attack will determine how much lift is produced at a given speed.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

There are other methods of producing lift, such as rocketry, but airfoils are by far the most common, not just because of their elegance, but because they are best suited to prolonged horizontal flight.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-017 (ISBN 1-895569-23-0) Schmidt, N. (1998). *Fabulous Paper Gliders.* New York, NY: Sterling Publishing.

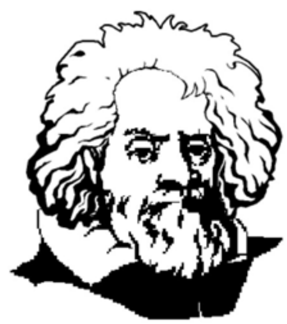
C3-058 (ISBN 1-4027-3034-9) Schmidt, N. (2005). *Paper Creations Paper Airplanes.* New York, NY: Sterling Publishing.

C3-091 (ISBN 1-55652-477-3) Carson, M. K. (2003). *The Wright Brothers for Kids: How They Invented the Airplane.* Chicago, IL: Chicago Review Press.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

PAPER AIRFOIL ACTIVITY

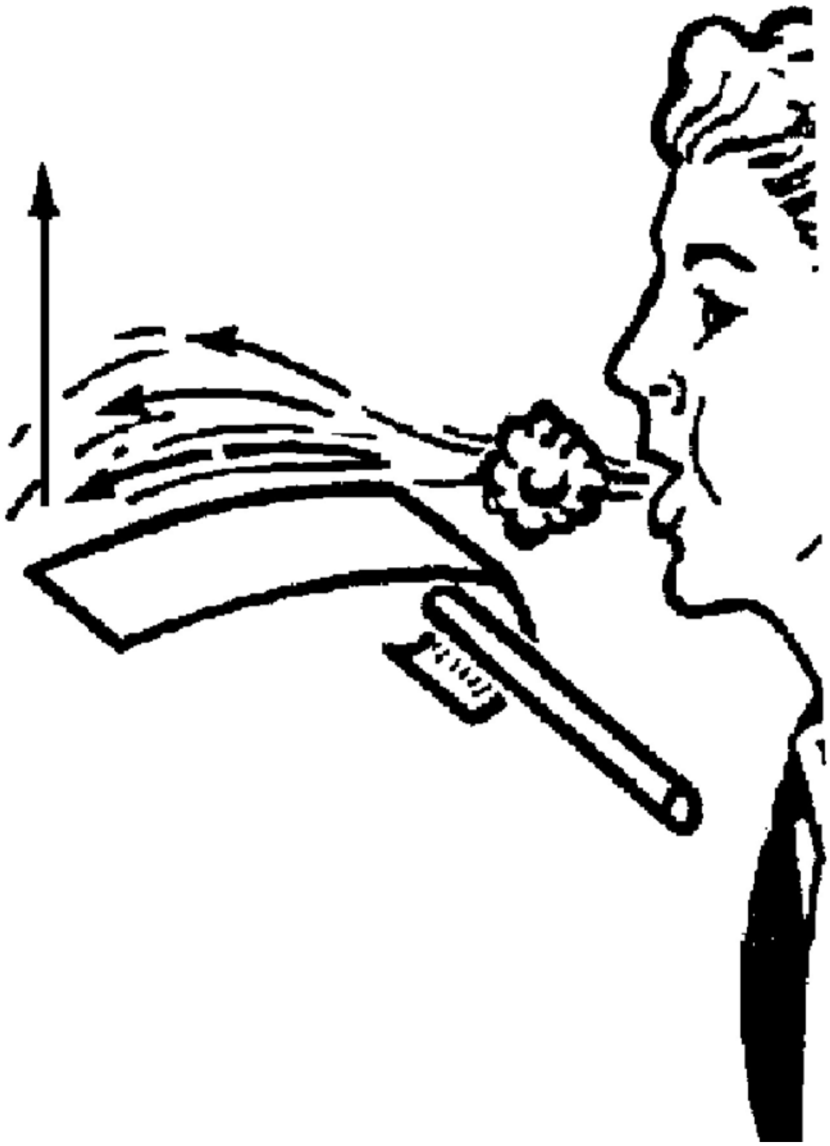
- BERNOULLI'S PRINCIPLE STATES THAT THE TOTAL ENERGY IN A SYSTEM REMAINS CONSTANT.
- A FLUID SYSTEM HAS ENERGY IN THE FORM OF SPEED AND PRESSURE.
- IF SPEED INCREASES, PRESSURE DECREASES AND IF SPEED DECREASES, PRESSURE INCREASES.



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-1 Bernoulli's Principle

CREATING LIFT



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-2 Lift

AN AIRFOIL SECTION

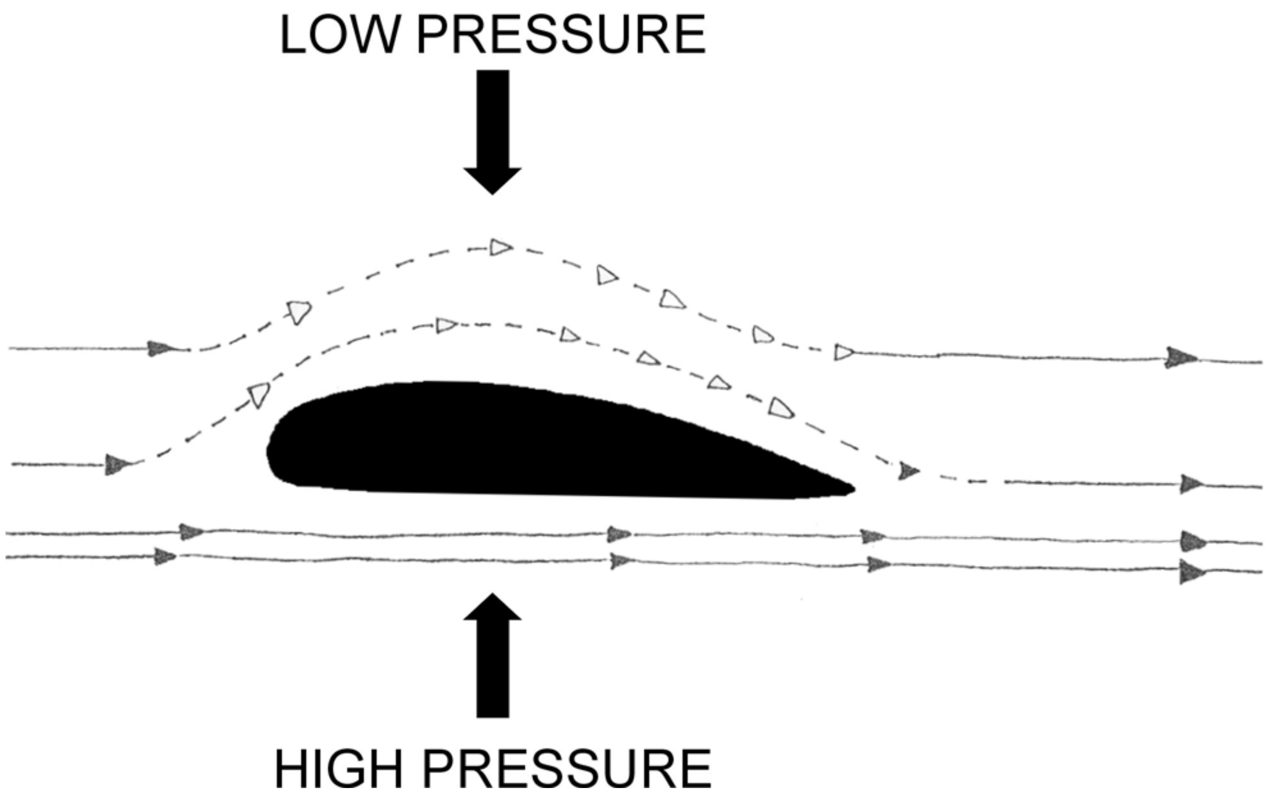
Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure B-1 An Airfoil Section

THIS PAGE INTENTIONALLY LEFT BLANK

LIFT FROM AN AIRFOIL

LIFT PRODUCTION



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure C-1 Lift from an Airfoil

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO M231.03 – DESCRIBE THE TYPES OF DRAG THAT ACT UPON AN AIRCRAFT

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 presentation slides or handouts of all figures located at Annexes A to D.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1, TP2 and TP4 to introduce the subject of drag and give an overview of it.

An in-class activity was chosen for TP3 and TP5 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

Review EO M231.01 (The Four Forces That Act Upon an Aircraft), to include:

- weight,
- drag,
- thrust, and
- lift.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify and discuss the types of drag that act upon an aircraft.

IMPORTANCE

It is important for cadets to know the types of drag that act upon an aircraft so that they will understand subsequent and related principles of flight.

Teaching Point 1	**Introduce Drag as a Useful Force and Explain the Two Types of Drag**
Time: 5 min	Method: Interactive Lecture

Drag is the force that opposes the forward motion of an aircraft. The two main types of drag are parasite drag and induced drag.

Show the cadets a slide or distribute handouts of drag definitions located at Annex A.

Parasite drag is caused by those parts of the aircraft that do not generate lift such as the fuselage, landing gear, struts, antennas, wing tip fuel tanks, etc. Any drag caused by openings, such as those in the cowling and those between the wing and the ailerons and flaps, add to parasite drag.

Induced drag is produced by those parts of an aircraft that are active in producing lift, such as the wings. Induced drag is the result of the wing and is therefore a part of lift and can never be eliminated.

It is true that drag does limit an aircraft's performance. However, drag also allows the pilot to control flight because an aircraft turns by increasing the drag in certain areas using control surfaces that push on the passing air. Without drag, an aircraft could not fly in a controlled manner.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is drag?

Q2. What causes parasite drag?

Q3. What produces induced drag?

ANTICIPATED ANSWERS

A1. Drag is the force that opposes the forward motion of an aircraft.

A2. Parasite drag is caused by those parts of the aircraft that do not generate lift.

A3. Induced drag is produced by those parts of an aircraft that are active in producing lift.

Teaching Point 2 — **Define the Components of Parasite Drag**

Time: 5 min — Method: Interactive Lecture

Show the cadets a slide or distribute handouts of parasite drag definitions located at Annex B.

Parasite drag is broken down into two components; form drag and skin friction:

- Form drag refers to the drag created by the form or shape of a body as it resists motion through the air.
- Skin friction refers to the tendency of air flowing over a body to cling to its surface.

Using a model aircraft with wing struts and a fixed landing gear, show the cadets parts of the aircraft that contribute to parasite drag.

Although parasite drag can never be eliminated, it can be reduced. One method is to remove parts of the aircraft that cause it. For this reason, retractable landing gears have been developed. Another method is to streamline those parts that cannot be eliminated. Skin friction can be reduced substantially by the removal of dust, dirt, mud or ice that has collected on the aircraft.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. Identify and describe the two types of parasite drag.

Q2. How do aircraft designers reduce form drag?

Q3. How do aircraft operators reduce skin friction?

ANTICIPATED ANSWERS

A1. Form drag refers to the drag created by the form or shape of a body as it resists motion through the air. Skin friction refers to the tendency of air flowing over a body to cling to its surface.

A2. Aircraft designers reduce form drag by removing or streamlining those parts of the aircraft that cause it.

A3. Aircraft operators can reduce skin friction by removing dust, dirt, mud or ice that has collected on the aircraft.

Teaching Point 3 | **Demonstrate Form Drag**

Time: 15 min | Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets fold and fly a device with greater drag on one side than the other and then to see that it always falls in the direction with the least drag.

RESOURCES

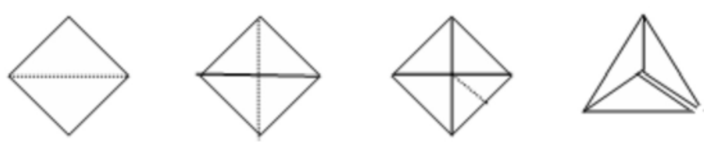
- Square paper 70 mm x 70 mm (square self-adhesive notes are ideal), and
- Tape.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Have the cadets fold their paper squares diagonally on both diagonals from point to point and then in half vertically. The paper square can now be put into the shape of a three-sided pyramid by tucking in only the bottom area along the vertical fold. The top area of the vertical fold must be smoothed flat to remove the fold. This will produce a hollow three-sided pyramid of paper which, when dropped in any orientation, will orient itself during the fall to always land on its point.



D Cdts 3, 2007 Ottawa, ON: Department of National Defence.

Figure 1 Folding a Hollow Pyramid

Have the cadets try dropping their paper pyramids in all orientations and have them observe how the pyramids land on their points in all cases.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

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

Teaching Point 4	Explain Induced Drag
Time: 10 min	Method: Interactive Lecture

> Show the cadets a slide or distribute handouts of the induced drag definitions located at Annex C.

Induced drag is another force that opposes the forward motion of the aircraft, but it is produced by those parts of an aircraft that are active in producing lift. Induced drag results from the wing and is therefore a part of lift that can never be eliminated.

> Induced drag increases as the angle of attack increases and decreases as the angle of attack decreases.

Induced drag can only be reduced during the initial designing of the aircraft. The phenomenon known as wing tip vortices seen in Figure D-1 is testimony to the existence of induced drag.

> Show the cadets a slide or distribute handouts of the aircraft shown in Figure D-1.
>
> Point out the wing tip vortices.

Aircraft are often fixed with upwardly swept wing tip "winglets" to reduce wing tip vortices and their associated induced drag as shown in Figure D-2.

The various forms of drag change with different flying conditions and, in general, they increase with speed. As well, when the pilot uses control surfaces, they produce both form drag and induced drag.

> Cadets interested in further reading can read the explanation of wing tip vortices in A-CR-CCP-263/PT-001, *From the Ground Up: Millennium Edition*, in the section on induced drag.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What is the relationship between angle of attack and induced drag?

Q2. When is the optimum time to minimize induced drag?

Q3. What is the relationship between drag and air speed?

ANTICIPATED ANSWERS

A1. Induced drag increases as the angle of attack increases and induced drag decreases as the angle of attack decreases.

A2. During the design of the aircraft.

A3. Drag tends to increase with increasing speed.

Teaching Point 5 | **Demonstrate Induced Drag**

Time: 20 min | Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets experience the sensation of induced drag.

RESOURCES

- Bristol board,
- Tape, and
- Fan.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Create a wing-like surface by taping together two pieces of Bristol board 50 cm square. Tape only three sides so that the cadet can put one hand inside this “wing”.

Turn on the fan. Have each cadet place a hand in the wing below the fan and slowly raise the wing toward the moving air, using only a very slight angle of attack. In addition to the feeling of lift into the moving air, the cadet will also sense the backward pull of induced drag just before the stronger push of form drag is experienced.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 5

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What are the main types of drag?

Q2. What causes parasite drag?

Q3. What is the relationship between angle of attack and induced drag?

ANTICIPATED ANSWERS

A1. The main types of drag are parasite drag and induced drag.

A2. Parasite drag is caused by those parts of the aircraft that do not generate lift.

A3. Induced drag increases as the angle of attack increases and induced drag decreases as the angle of attack decreases.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Understanding drag is important because drag affects both the design and performance of aircraft.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-017 (ISBN 1-895569-23-0) Schmidt, N. (1998). *Fabulous Paper Gliders.* New York, NY: Sterling Publishing.

C3-058 (ISBN 1-4027-3034-9) Schmidt, N. (2005). *Paper Creations Paper Airplanes.* New York, NY. Sterling Publishing.

C3-092 (ISBN 0-7460-0978-X) Edom, H., Butterfield, M., Heddle, R. and Unwin, M. (1992). *The Usborne Book of Science Activities: Volume Two.* Tulsa OK: EDC Publishing.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

THIS PAGE INTENTIONALLY LEFT BLANK

DRAG DEFINITIONS

DRAG IS THE FORCE THAT OPPOSES THE FORWARD MOTION OF AN AIRCRAFT.

- THE TWO MAIN TYPES OF DRAG ARE **PARASITE DRAG** AND **INDUCED DRAG**.

- PARASITE DRAG IS FURTHER BROKEN INTO TWO TYPES, **FORM DRAG** AND **SKIN FRICTION**.

THIS PAGE INTENTIONALLY LEFT BLANK

PARASITE DRAG DEFINITIONS

PARASITE DRAG

PARASITE DRAG IS THE DRAG PRODUCED BY THOSE PARTS OF THE AIRCRAFT THAT **DO NOT** CONTRIBUTE TO THE PRODUCTION OF LIFT.

- **FORM DRAG** REFERS TO THE DRAG CREATED BY THE SHAPE OF A BODY AS IT RESISTS MOTION THROUGH THE AIR.

- **SKIN FRICTION** REFERS TO THE TENDENCY OF AIR FLOWING OVER A BODY TO CLING TO ITS SURFACE.

THIS PAGE INTENTIONALLY LEFT BLANK

INDUCED DRAG DEFINITIONS

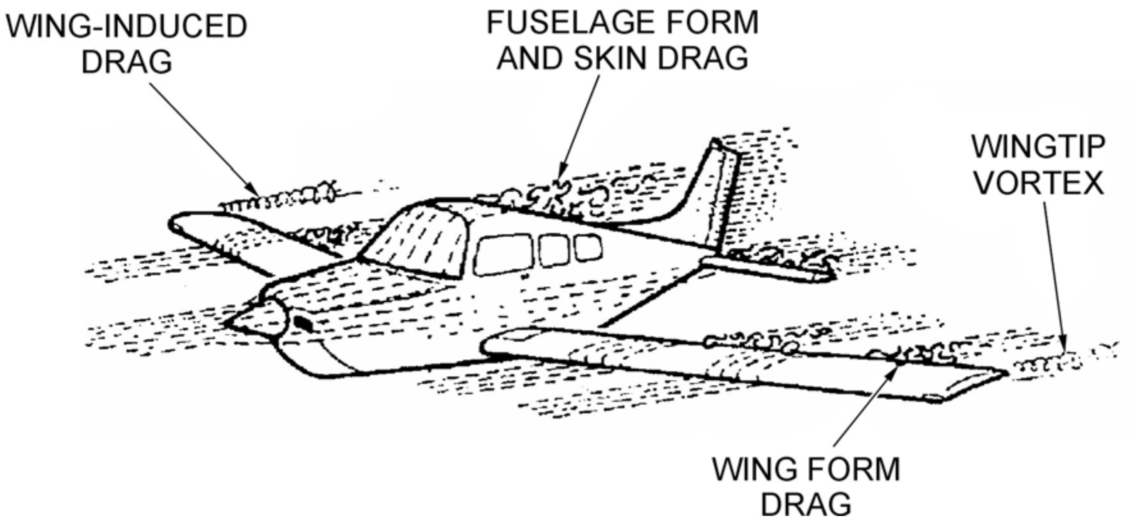
INDUCED DRAG

- INDUCED DRAG IS THE DRAG PRODUCED BY THOSE PARTS OF THE AIRCRAFT THAT **ARE ACTIVE** IN THE PRODUCTION OF LIFT.

- IT IS THE RESULT OF THE WING'S WORK AND THEREFORE A PART OF LIFT AND CAN NEVER BE ELIMINATED.

THIS PAGE INTENTIONALLY LEFT BLANK

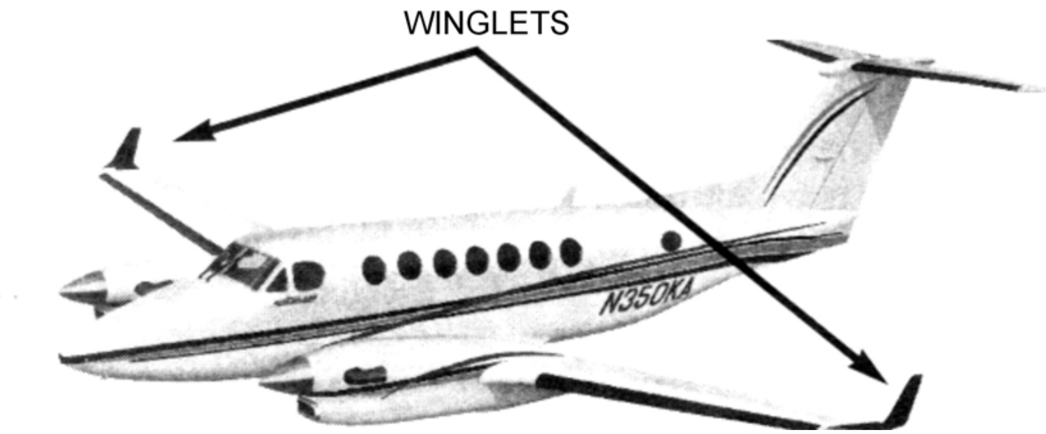
TYPES OF DRAG



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure D-1 Types of Drag on an Aircraft

PREVENTING WING TIP VORTICES



A-CR-CCP-263/PT-001 (p. 27)

Figure D-2 Winglets

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO M231.04 – DESCRIBE THE AXIAL MOVEMENTS OF AN AIRCRAFT

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-802/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 presentation slides of Figure A-1.

Copy the handouts located at Annexes A and B for each cadet.

Obtain a model of a light fixed-wing aircraft with wing struts, fixed gear and control surface detail.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP2 to introduce the subject of axial movement and give an overview of it.

A group discussion was chosen for TP3 and TP4 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions, and feelings about axial aircraft movement.

INTRODUCTION

REVIEW

Review EO M231.01 (The Four Forces That Act Upon an Aircraft), to include:

- weight,
- drag,
- thrust,
- lift, and
- the state of equilibrium.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify the three axes of an aircraft and describe an aircraft's movement about them.

IMPORTANCE

It is important for cadets to learn about aircraft axes and axial movement so that they can understand subsequent and related principles of flight.

Teaching Point 1 — **Identify the Three Axes of Aircraft Movement**

Time: 5 min — Method: Interactive Lecture

Aircraft operate in a three-dimensional space so there are three corresponding ways they can turn. Each of the three possibilities has an associated axis of motion:

- the longitudinal axis,
- the lateral axis, and
- the vertical axis.

Show the cadets a slide or distribute handouts of aircraft axes in Figure A-1.

When an aircraft is airborne, it can move in almost any direction. All movement of the aircraft takes place around the centre of gravity. This is the aircraft's balance point, or point through which all weight acts downwards.

The centre of gravity is the point where the three axes intersect.

To clarify the ways that aircraft can move in flight, the aircraft is said to move around an axis. This is an imaginary line running through the centre of gravity of the aircraft and around which the aircraft rotates.

There are three such axes and the aircraft may rotate around one, two or all three axes at the same time. They are the longitudinal axis, the lateral axis, and the vertical axis:

- The longitudinal axis runs lengthwise through the fuselage from the nose to the tail and passes through the centre of gravity.
- The lateral axis runs from wingtip to wingtip through the centre of gravity.
- The vertical axis runs vertically through the centre of gravity. It is situated at right angles to the other axes.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Why does an aircraft have exactly three axes of motion?

Q2. Where is an aircraft's centre of gravity located?

Q3. What are the three axes of an aircraft called?

ANTICIPATED ANSWERS

A1. An aircraft operates in a three-dimensional space and needs an axis for each dimension.

A2. At the intersection of the three axes of motion.

A3. The three axes of an aircraft are the longitudinal axis, the lateral axis and the vertical axis.

Teaching Point 2 — **Describe the Three Axial Movements That Aircraft Make**

Time: 10 min — Method: Interactive Lecture

Using a model aircraft, describe the three movements that aircraft make around their three axes, to include:

- roll about the longitudinal axis;
- pitch about the lateral axis; and
- yaw about the vertical axis.

Rolling. Movement of an aircraft about the longitudinal axis is called roll.

Pitching. Movement of an aircraft about the lateral axis is called pitch.

Yawing. Movement of an aircraft about the vertical axis is called yaw.

Show the cadets a slide or distribute handouts of aircraft axes in Figure A-1, bringing their attention to the motions of roll, yaw and pitch.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is roll?

Q2. What is pitch?

Q3. What is yaw?

ANTICIPATED ANSWERS

A1. Roll is the movement of an aircraft about its longitudinal axis.

A2. Pitch is the movement of an aircraft about its lateral axis.

A3. Yaw is the movement of an aircraft about its vertical axis.

Teaching Point 3 | **Discuss Simultaneous Axial Movement of an Aircraft**

Time: 5 min | Method: Group Discussion

BACKGROUND KNOWLEDGE

> The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

It is possible for an aircraft to move in only one axis at a time but it is not necessary. Although an aircraft can climb or descend using only pitch around the lateral axis, movement around all three axes simultaneously is necessary for efficient flight.

> Show the cadets a slide or distribute handouts of aircraft axes in Figure A-1.

When riding a bicycle around a high-speed turn, it is necessary to not only yaw to make the turn, but efficient cycling requires the cyclist to lean into the turn, (or roll) slightly as the turn is made. A turn without leaning would be very slow and inefficient and would be the mark of a beginner cyclist.

> Using a model aircraft, demonstrate that a turn with only yaw requires that the aircraft side-slip.

Similarly, an aircraft normally makes a “bank” manoeuvre in a level turn, involving movement about the longitudinal as well as the vertical axis. A climbing or descending turn requires that movement around the lateral axis be included as well.

> Demonstrate a climbing turn with a model aircraft.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. Can an aircraft turn around one axis at a time? Why?

Q2. What axial movements are normally used in a level turn? Why?

Q3. What manoeuvre requires movement around all three axis simultaneously? Why?

Q4. How does an aircraft bank?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 3

The cadets' participation in the group discussion will serve as confirmation of the TP.

Teaching Point 4 | **Brainstorming How Aircraft Flight Might Be Controlled**

Time: 5 min | Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

Have the cadets brainstorm various methods of controlling yaw, roll and pitch. Encourage them to "think outside the box". Tell them that the usual way of accomplishing control is only one of many that have been tried and used successfully over the years (Hint: a space shuttle and a helicopter both use different methods at different times).

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

QUESTIONS

Q1. How might the pilot of an aircraft control the aircraft's movements during flight?

Q2. How do you think yaw might be controlled?

Q3. How do you think pitch might be controlled?

Q4. How do you think roll might be controlled?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 4

The cadets' participation in the group discussion will serve as confirmation of the TP.

END OF LESSON CONFIRMATION

SUGGESTED QUESTIONS

Q1. Name one axial aircraft movement and its associated axis.

Q2. Name a second axial aircraft movement and its associated axis.

Q3. Name a third axial aircraft movement and its associated axis.

ANTICIPATED ANSWERS

A1. Roll is the axial movement around an aircraft's longitudinal axis.

A2. Pitch is the axial movement around an aircraft's lateral axis.

A3. Yaw is the axial movement around an aircraft's vertical axis.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Movement through a three-dimensional space requires three axes of movement. The names of the axes and the names of the movements are borrowed from the sea, where ships have pitched, yawed and rolled for thousands of years.

INSTRUCTOR NOTES/REMARKS

N/A.

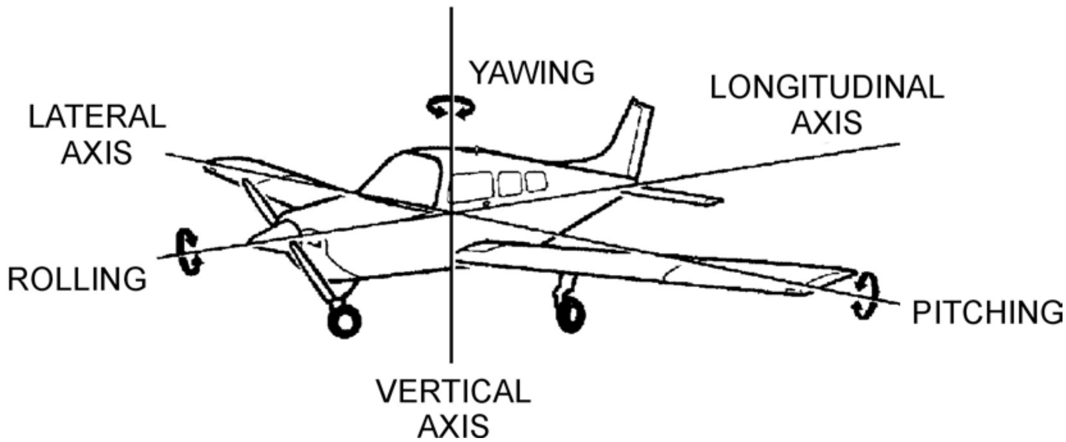
REFERENCES

C3-017 (ISBN 1-895569-23-0) Schmidt, N. (1998). *Fabulous Paper Gliders.* New York, NY: Sterling Publishing.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

AXES OF AN AIRCRAFT

AXIAL MOVEMENTS



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

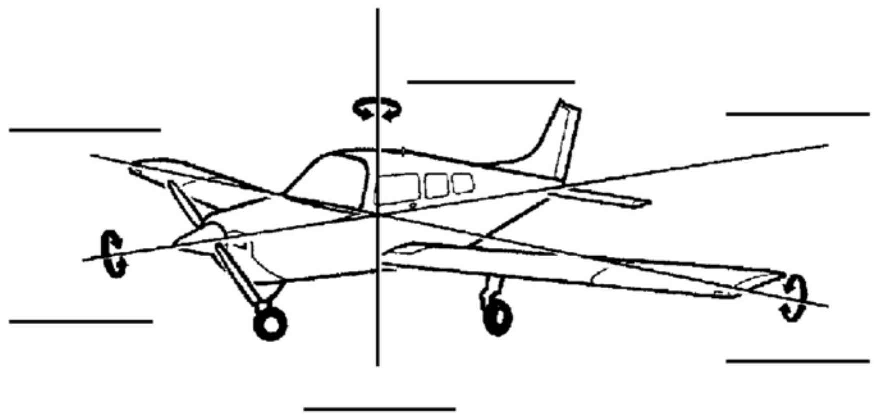
Figure A-1 Axes of an Aircraft

THIS PAGE INTENTIONALLY LEFT BLANK

IDENTIFYING AXES OF AN AIRCRAFT

LABEL THE FOLLOWING AXES AND THE MOVEMENT ABOUT THEM.

NAME: ____________



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure B-1 Identifying Axes of an Aircraft

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 5

EO M231.05 – DESCRIBE AIRCRAFT CONTROL SURFACES

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 presentation slides or handouts of Figures A-1, B-1, C-1 and D-1.

Create handouts of Figure E-1.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to TP4 and TP6 to TP10 to introduce aircraft control surfaces and give an overview of them.

An in-class activity was chosen for TP5 and TP11 as it is an interactive way to provoke thought and stimulate an interest among the cadets.

INTRODUCTION

REVIEW

Review EO M231.01 (Identify the Four Forces That Act Upon an Aircraft) and EO M231.04 (Describe the Axial Movements of an Aircraft), to include:

- Weight,
- Drag,
- Thrust,
- Lift,
- Yaw,
- Pitch, and

- Roll.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify and describe the locations, operations, methods and purposes of aircraft control surfaces.

IMPORTANCE

It is important for cadets to learn about aircraft control surfaces so they can understand subsequent and related principles of flight.

Teaching Point 1	**Identify Control Surface of the Empennage**
Time: 5 min	Method: Interactive Lecture

An aircraft's empennage is very often called the tail section. Its most obvious parts are the vertical and horizontal stabilizers, each of which has other names as well. The vertical stabilizer is sometimes referred to as the fin and the horizontal stabilizer is sometimes referred to as the tailplane.

Use a model of a light fixed-wing aircraft with control surface detail to demonstrate the location of the empennage and associated control surfaces.

The rudder is hinged to the back of the vertical stabilizer or fin. It is used to steer (yaw) the aircraft around the vertical axis.

Show the cadets a slide or handout of the aircraft control surfaces located at Annex A.

The elevator is hinged to the back of the horizontal stabilizer or tailplane. It is used to climb or descend by changing pitch around the lateral axis.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What two stabilizers are found on the empennage?

Q2. Which two moveable control surfaces are located in the empennage?

Q3. What axial movements do the elevator and the rudder produce?

ANTICIPATED ANSWERS

A1. The vertical stabilizer, or fin, and the horizontal stabilizer, or tailplane, are on the empennage.

A2. The rudder and the elevator are found in the empennage.

A3. The rudder changes yaw around the vertical axis and the elevator changes pitch around the lateral axis.

Teaching Point 2	**Explain How Stabilizers Reduce Unwanted Axial Movement**
Time: 5 min	Method: Interactive Lecture

The horizontal and vertical stabilizers reduce unwanted pitch and yaw. The control surfaces are held straight by the passing wind. This is because the air moving past the flat surfaces of the stabilizers tends to resist a change of direction as predicted by Newton's second law (a force must be applied to alter the motion of the air).

Use a model of a light fixed-wing aircraft with control surface detail to demonstrate the location of the vertical and horizontal stabilizers.

The vertical stabilizer, or fin, provides the aircraft with directional stability. Air moving past the fin resists any unwanted yaw around the vertical axis.

The horizontal stabilizer, or tailplane, provides the aircraft with longitudinal stability. That is, air moving past the tailplane resists unwanted roll around the longitudinal axis and unwanted pitch around the lateral axis.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What axial movement does the vertical stabilizer or fin reduce?

Q2. What axial movement does the horizontal stabilizer or tailplane reduce?

Q3. How do stabilizers reduce unwanted axial movements?

ANTICIPATED ANSWERS

A1. The vertical stabilizer reduces unwanted roll and unwanted yaw.

A2. The horizontal stabilizer reduces unwanted roll and unwanted pitch.

A3. Air moving past the flat stabilizer surfaces tends to resist any change of motion.

Teaching Point 3	**Explain How the Rudder Produces Yaw**
Time: 5 min	Method: Interactive Lecture

The rudder is located at the very back of the aircraft, hinged to the trailing edge of the vertical stabilizer, or fin. The rudder can be turned left and right to give the pilot directional control. The rudder rotates the aircraft about its vertical (yaw) axis by pushing the tail to the left or to the right.

The rudder operated by itself causes the aircraft to yaw around its vertical axis.

When the rudder is turned to the right side of the fin, the moving air will push the empennage to the left, causing the aircraft to yaw to the right around its vertical axis.

When the rudder is turned to the left side of the fin, the moving air will push the empennage to the right, causing the aircraft to yaw to the left around its vertical axis.

Show the cadets a slide or handout of the rudder control system located at Annex B.

The rudder is operated by the rudder bar or pedals in the cockpit. The pedals work together. When the bar or pedals are level the rudder is straight. Pressure applied to the right pedal moves the left pedal upwards and vice versa.

Pressure on the left rudder pedal displaces the rudder to the left into the airflow. This increases pressure on the left side and forces the tail to move to the right. This moves the nose of the aircraft to the left. Conversely, pressure applied to the right pedal moves the rudder to the right. The tail moves to the left and the aircraft yaws to the right.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Where is the rudder located?

Q2. What is the rudder used for?

Q3. What controls the rudder?

ANTICIPATED ANSWERS

A1. The rudder is hinged to the trailing edge of the vertical stabilizer of fin.

A2. To produce controlled yaw by rotating the aircraft about its vertical (yaw) axis.

A3. A set of pedals in the cockpit.

Teaching Point 4	**Explain How the Elevator Controls Pitch**
Time: 5 min	Method: Interactive Lecture

Both the left and right portions of the horizontal stabilizer, or tailplane, have a moveable control surface known as an elevator.

The elevator rotates the aircraft about its lateral (pitch) axis by pushing the empennage, or tail-section, up or down.

The elevator, of which there is normally a left and a right section, is located on the trailing edge of the horizontal stabilizer. It is used to give the pilot lateral control. Raising the elevator into the moving air above the tailplane will push the empennage down, thus raising the aircraft's nose. Alternately, lowering the elevator down into the air moving below the tailplane will push the empennage up, thus lowering the aircraft's nose. These pitch movements take place around the lateral axis.

The pilot controls the elevator by pushing or pulling on the control column.

Pushing the control column forward lowers the elevator into the wind passing under the tailplane, pushing the empennage up. This causes the aircraft's nose to drop and the aircraft will descend.

Pulling the control column back raises the elevator into the wind passing over the tailplane, pushing the empennage down. This causes the aircrafts nose to rise and the aircraft will climb.

> Show the cadets a slide or handout of the elevator control system located at Annex C.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. Where is the elevator control surface located?

Q2. What axial movement does the elevator control?

Q3. How does the pilot operate the elevator?

ANTICIPATED ANSWERS

A1. The elevator control surface is located on the trailing edge of the horizontal stabilizer.

A2. The elevator controls pitch around the aircraft's lateral axis.

A3. The pilot pushes on the control column to descend and pulls back to climb.

Teaching Point 5	**Enact Control Surface Movements Controlled by a Pilot**
Time: 5 min	Method: In-Class Activity

> Review the cockpit controls that move the associated empennage control surfaces. Have the cadets enact control movements with a "pilot" calling out pedal and stick movements to the remainder of the class, who then act as pitch and yaw control surfaces.

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets learn what cockpit control causes which control surface to move.

RESOURCES

N/A.

ACTIVITY LAYOUT

Form the cadets into a circle. Have the cadet who is the pilot seated where the other cadets can see the pilot's movements.

ACTIVITY INSTRUCTIONS

One cadet is designated the pilot and is seated in the clear view of the standing cadets. The seated cadet, who is the pilot, will pretend to move pedals and pretend to move a control column, but only one at a time.

Divide the remainder of the class into "rudders" and "elevators". The standing cadets must mimic the correct moving control surface with their right arm (elevator: up and down) or left arm (rudder: left and right). After a minute of imaginary flight, ask the cadets to perform both elevator and rudder movements with both right and left hands simultaneously.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 5

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

Teaching Point 6	**Identify the Wing Control Surfaces**
Time: 5 min	Method: Interactive Lecture

Show the cadets a slide or handout of the aircraft control surfaces located at Annex A.

AILERONS

The surfaces that control roll are located near the ends of the wings on the trailing edge. They are called ailerons.

Ailerons operate simultaneously, but in opposite directions. When the right aileron rises to push the right wing down, the left aileron lowers to push the left wing up.

The down-going aileron increases the wing's lift and the up-going aileron decreases the wing's lift. Therefore, the left wing's lift increases and the right wing's lift decreases. The left wing lifts and the right wing descends, so the aircraft rolls to the right and keeps rolling until the ailerons are retracted.

To recover from the roll, the ailerons must be applied in the opposite direction until the aircraft is level and the ailerons are then again neutralized for level flight.

Show the cadets a slide or handout of the aileron control surface located at Annex D.

WING FLAPS

Show the cadets a slide or handout of the aircraft control surfaces located at Annex A.

Flaps are located nearer the fuselage on the trailing edge of the wing.

Both flaps operate together. They are raised together and they are lowered together with one control mechanism.

Flaps are lowered to create lift and to slow the aircraft. When they are lowered into the air moving past the under-surface of the wing, they slow the air and the air pushes them up, creating lift while simultaneously slowing the aircraft by creating both form drag and induced drag. When fully lowered, the drag created exceeds the lift generated.

Flaps allow for shorter landings.

CONFIRMATION OF TEACHING POINT 6

QUESTIONS

Q1. Which two wing control surfaces always move in opposite directions?

Q2. What axial movement do ailerons control?

Q3. How do flaps help with landings?

ANTICIPATED ANSWERS

A1. The left aileron and the right aileron.

A2. Ailerons control roll around the longitudinal axis.

A3. Flaps slow the aircraft allowing shorter landings.

Teaching Point 7	**Explain the Operation of Ailerons**
Time: 5 min	Method: Interactive Lecture

Ailerons lift one wing and lower the opposite wing simultaneously as a single cockpit control is operated to produce roll.

Ailerons move in opposite directions to each other and are controlled by operating the control column from side to side.

When the control column is moved to the right, the left aileron moves down and the right aileron moves up so the aircraft rolls to the right into a banked position.

When the control column is moved to the left, the left aileron goes up and the right one moves down so the aircraft rolls to the left into a banked position.

When the pilot wants to stop the roll and stay in a banked position, the control column is returned to centre and the ailerons retract. To recover from the roll into a level position, the ailerons must be extended into the opposite directions. They are then retracted for level flight.

CONFIRMATION OF TEACHING POINT 7

QUESTIONS

Q1. How do ailerons produce roll around the longitudinal axis?

Q2. How does the pilot control the ailerons?

Q3. How does the pilot stop the roll and stay in the banked position?

ANTICIPATED ANSWERS

A1. As one aileron is raised the other is lowered so they push up on one wing and down on the other simultaneously.

A2. The pilot moves the control column to the left to roll to the left and to the right to roll to the right.

A3. To stop the roll and stay in a bank, the pilot returns the control column to centre.

Teaching Point 8	**Explain the Operation of Flaps**
Time: 5 min	Method: Interactive Lecture

The aircraft's flaps are also located on the trailing edge of the wing, as are ailerons, but the flaps are placed nearer to the fuselage.

Flaps are used to generate lift at the expense of airspeed and both left and right flaps operate simultaneously.

Show the cadets a slide or handout of the aircraft control surfaces located at Annex A.

Both flaps operate together. They are raised together and lowered together.

Flaps are lowered to create lift and to slow the aircraft. When they are lowered into the air moving past the under-surface of the wing, they slow the air and the air pushes them up, creating lift while simultaneously slowing the aircraft by creating both form drag and induced drag. When fully lowered, the drag created exceeds the lift generated.

Flaps allow for shorter and safer landings.

CONFIRMATION OF TEACHING POINT 8

QUESTIONS

Q1. Where are an aircraft's flaps located?

Q2. What are flaps used for?

Q3. How do flaps affect an aircraft's landing performance?

ANTICIPATED ANSWERS

A1. An aircraft's flaps are located on the trailing edge of the wings, close to the fuselage.

A2. Flaps are used to slow the aircraft and simultaneously generate lift.

A3. By slowing the aircraft, flaps allow shorter and safer landings.

Teaching Point 9	**Explain the Use of Trim Tabs**
Time: 5 min	Method: Interactive Lecture

Trim tabs were developed to hold control surfaces in position without constant control pressure from the pilot.

A pilot has to do a lot of work to hold control surfaces in position. When the pilot has set a course in a crosswind, the control surfaces often have to stay in a working position for long periods of time.

To save the pilot from having to do this, trim tabs were invented. A trim tab is a small, adjustable control surface that can be extended from the trailing edge of an aircraft's control surface. So, it is a control surface that is hinged onto a larger control surface. The wind, pushing on the trim tab when it is extended, provides the force necessary to hold the aircraft's main control surface in position.

Trim tabs are often found on the trailing edge of the rudder, the elevators and on the ailerons.

CONFIRMATION OF TEACHING POINT 9

QUESTIONS

Q1. What are trim tabs for?

Q2. Where are trim tabs located?

Q3. How does a trim tab work?

ANTICIPATED ANSWERS

A1. Trim tabs hold control surfaces in position without constant control pressure being applied by the pilot.

A2. Trim tabs are often located on the trailing edge of control surfaces.

A3. Air pushes on the trim tab when it is extended and provides force to hold the aircraft control surface in position.

Teaching Point 10	**Explain the Use of Dynamically Balanced Control Surfaces**
Time: 5 min	Method: Interactive Lecture

Dynamically balanced control surfaces were developed to make pilots' work easier. These surfaces use air pressure to help move the controls by having a portion of the control surface in front of its own hinge to catch the passing air. This takes the load off the pilot's control mechanism. That way, the wind itself helps push the control surface into the position that the pilot has selected, making the controls feel lighter.

CONFIRMATION OF TEACHING POINT 10

QUESTIONS

Q1. Why are control surfaces dynamically balanced?

Q2. What do dynamically balanced controls use to help the pilot?

Q3. How does dynamic balance get the wind to help move the control surfaces?

ANTICIPATED ANSWERS

A1. Control surfaces are dynamically balanced to make them easier to operate.

A2. Dynamically balanced controls use the force of the wind to help operate the control surfaces.

A3. The moving air helps operate the control surface because part of the control surface is designed to project out into the wind in front of its own hinge to catch the passing air.

Teaching Point 11	**Colour and Label the Control Surfaces in a Drawing of an Aircraft**
Time: 5 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets label the control surfaces shown on a scale drawing.

RESOURCES

Coloured pencils.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Give each cadet a copy of the aircraft drawing located at Annex E and access to a variety of coloured pencils. Have each cadet colour the control surfaces and label them.

Supervise and answer questions during this activity to ensure that the colouring and labelling is done accurately.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 11

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What is one moveable aircraft control surface and what is it used for?

Q2. What is a second moveable aircraft control surface and what is it used for?

Q3. What is a third moveable aircraft control surface and what is it used for?

Q4. What is a fourth moveable aircraft control surface and what is it used for?

Q5. What is a fifth moveable aircraft control surface and what is it used for?

ANTICIPATED ANSWERS

A1. Elevators are used to produce controlled pitch of the aircraft.

A2. Rudders are used to produce controlled yaw of the aircraft.

A3. Ailerons are used to produce controlled roll of the aircraft.

A4. Flaps are used to create lift and slow the aircraft simultaneously.

A5. Trim tabs are used to hold the control surfaces where the pilot wants them.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Control surfaces are important parts of an aircraft, which control movement around the aircraft's three axes. Knowing about them is important for understanding the principles of flight.

INSTRUCTOR NOTES/REMARKS

N/A.

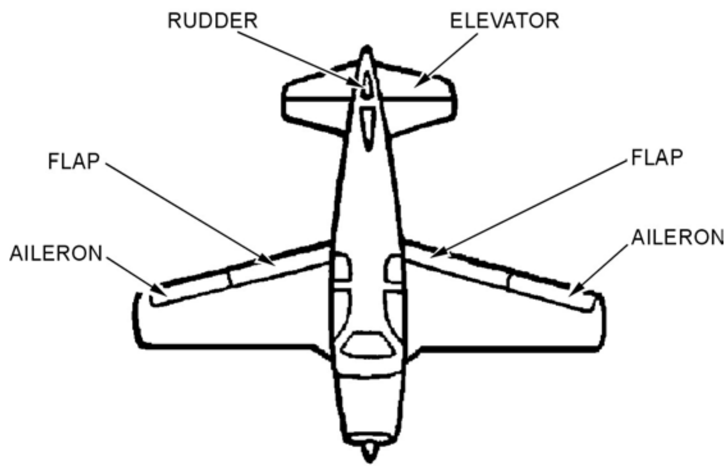
REFERENCES

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

THIS PAGE INTENTIONALLY LEFT BLANK

AIRCRAFT CONTROL SURFACES

CONTROL SURFACES



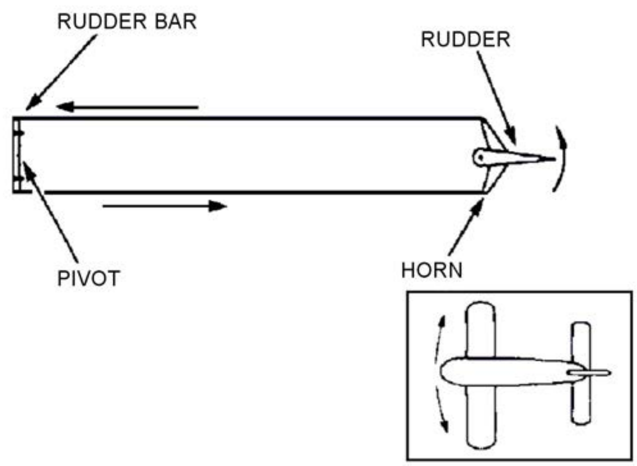
Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-1 The Control Surfaces of an Aircraft

THIS PAGE INTENTIONALLY LEFT BLANK

RUDDER CONTROL SYSTEM

THE RUDDER



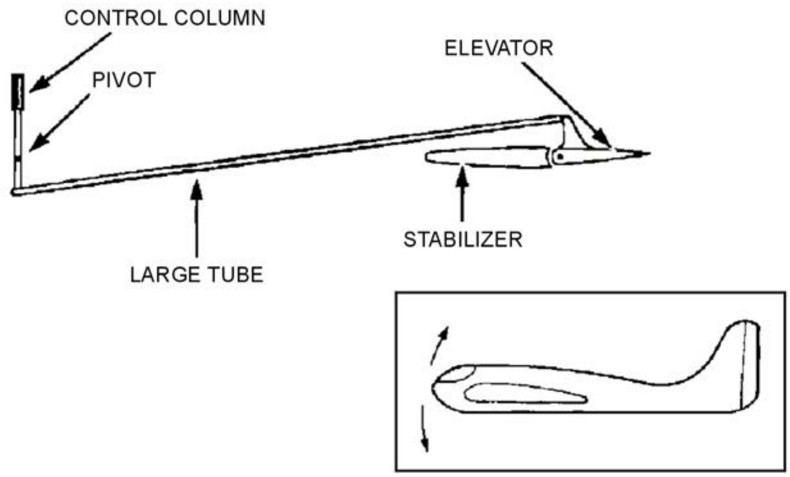
Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure B-1 Operation of a Rudder

THIS PAGE INTENTIONALLY LEFT BLANK

ELEVATOR CONTROL SYSTEM

THE ELEVATOR



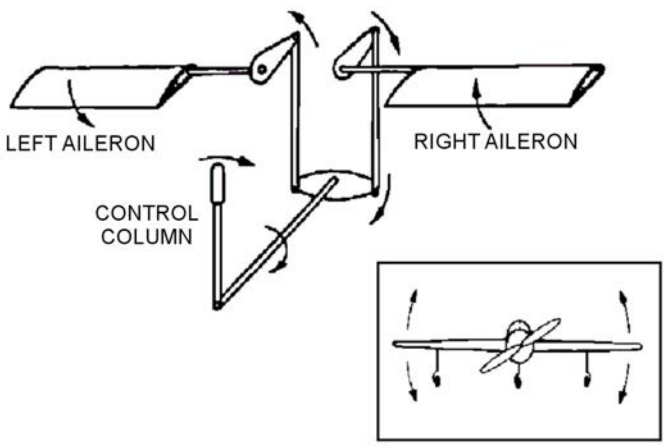
Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure C-1 Operation of an Elevator

THIS PAGE INTENTIONALLY LEFT BLANK

AILERON CONTROL SYSTEM

THE AILERONS



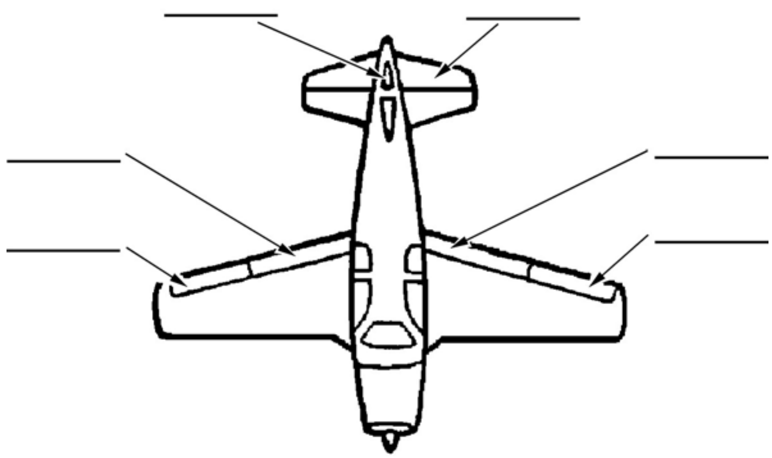
Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure D-1 Operation of Ailerons

THIS PAGE INTENTIONALLY LEFT BLANK

IDENTIFYING THE CONTROL SURFACES

CONTROL SURFACES



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure E-1 Identifying the Control Surfaces of an Aircraft

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 6

EO C231.01 – OPERATE AN EXPERIMENTAL WING

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 or copy handouts of Figures A-1 to A-4 for each group.

Gather cardboard boxes suitable for constructing a wind tunnel as described in TP2.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to introduce wind tunnels and give an overview of them.

An in-class activity was chosen for TP2 to TP4 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

The review for this lesson is from EO M231.01 (Identify the Four Forces That Act Upon an Aircraft) and will include:

- weight,
- drag,
- thrust, and
- lift.

OBJECTIVES

By the end of this lesson the cadet shall be expected to have helped to assemble a wind tunnel and to have operated an experimental wing in the wind tunnel.

IMPORTANCE

It is important for cadets to operate an experimental wing so they can experience the change in lift that follows a change in angle of attack.

Teaching Point 1	**Identify the Parts of a Wind Tunnel**
Time: 5 min	Method: Interactive Lecture

PARTS OF A WIND TUNNEL

Settling Chamber. The purpose of the settling chamber is to straighten the airflow.

Contraction Cone. The contraction cone takes a large volume of low-velocity air and reduces it to a small volume of high-velocity air without creating turbulence.

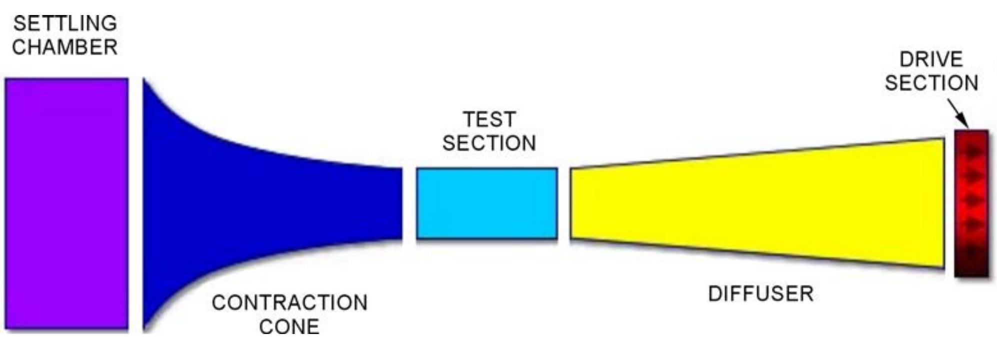
Test Section. The test section is where the test article and sensors are placed.

Diffuser. The diffuser slows the speed of airflow in the wind tunnel.

Drive Section. The drive section provides the force that causes the air to move through the wind tunnel.

Show the cadets a slide or handout of the five parts of a wind tunnel shown in Figure A-1.

There are two types of wind tunnels: open-loop and closed-loop. The difference is whether or not the air is re-circulated in the tunnel. The wind tunnel to be built in this lesson is an open-loop wind tunnel.



"NASA's Observatorium", The Parts of a Wind Tunnel. Retrieved 19 March 2007, from http://sln.fi.edu/flights/first/tunnelparts/index.html

Figure 1 A Simple Wind Tunnel

Not every improvised wind tunnel will have a settling chamber, contraction zone and diffuser, but these design elements can each improve the wind tunnel's performance by smoothing airflow.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is the purpose of a wind tunnel settling chamber?

Q2. What is the purpose of a wind tunnel diffuser?

Q3. What is the purpose of a wind tunnel contraction cone?

ANTICIPATED ANSWERS

A1. The purpose of the settling chamber is to straighten the airflow.

A2. The diffuser slows the speed of airflow in the wind tunnel.

A3. The contraction cone takes a large volume of low-velocity air and reduces it to a small volume of high-velocity air without creating turbulence.

Teaching Point 2	**Assemble a Wind Tunnel**
Time: 15 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets, organized in groups but working as a coordinated team, assemble a wind tunnel for flying experimental wings.

RESOURCES

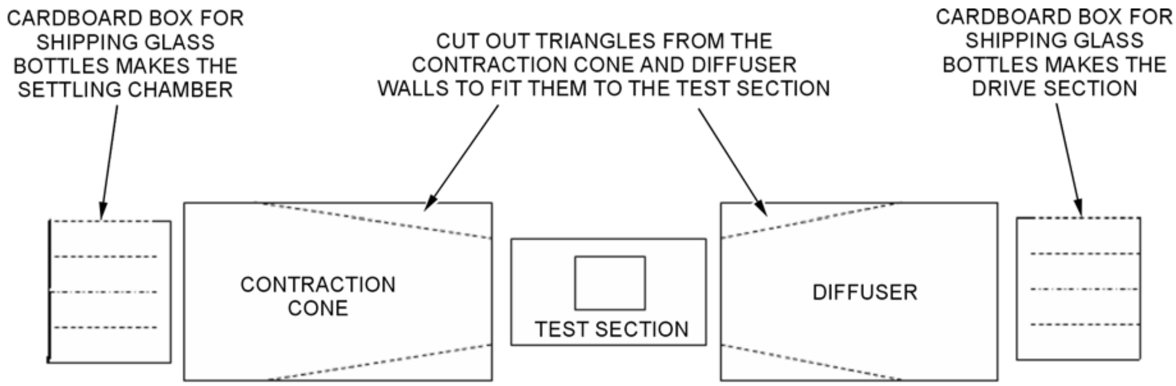
- Cardboard boxes, including two with cardboard separator inserts for packing glass bottles,
- Blank OHP slides,
- Duct tape, and
- Two multi-speed fans.

ACTIVITY LAYOUT

Place a table large enough to hold the wind tunnel and fans in an area that will provide room for groups of no more than four cadets to work comfortably, with access to power for the fans.

ACTIVITY INSTRUCTIONS

Have the cadets make a wind tunnel out of five boxes taped together with all ends open. The wind tunnel should be large enough that both hands will fit into it easily. For both the settling chamber and the drive section, use boxes that include cardboard separators for shipping glass bottles. The cardboard separators will “honeycomb” or straighten the swirling air currents from the electric fan.



D Cdts 3, 2007 Ottawa, ON: Department of National Defence

Figure 2 Parts of a Cardboard Wind Tunnel

The parts of the wind tunnel can be divided between groups of cadets but, when completed, the wind tunnel components must fit together so that each section fits tightly inside the next section.

1. Shape the contraction zone and diffuser sections by cutting out triangles of unwanted cardboard as shown at Figure A-2. Make cuts straight and smooth so the resulting joint can be made airtight.
2. Cut “windows” in the test section and cover over with OHP slide material.
3. Tape all edges and holes airtight and ensure the inside of the wind tunnel is smooth to allow the air to pass through without turbulence. Seal all box joints with duct tape.
4. Place an electric fan so that it blows into the cardboard honeycomb of the settling chamber. The fan must be run at a speed that does not produce unreasonable turbulence, yet fast enough that it pushes a large volume of air through the glass bottle separators. Place another fan at the exit of the drive section facing away from the wind tunnel to pull air from the wind tunnel.

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 — **Form Airfoil Shapes for Testing in the Wind Tunnel**

Time: 10 min — Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets create their own airfoil shapes for testing in the wind tunnel.

RESOURCES

- File folders (letter size),

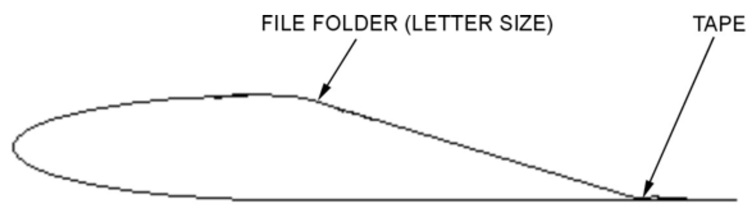
- Handout of Figures A-3 and A-4 for each group of cadets,
- Tape, and
- Locally available materials for constructing experimental wings.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

- Divide the class into groups of no more than four, giving each group a file folder and handout of Figures A-3 and A-4.
- If file folders are used to make airfoil shapes, have the cadets bend one cover of the file folder into a curved (cambered) shape and tape it into place as shown in Figure A-3. The airfoil should be pressed into the shape shown in Figure A-4.



D Cdts 3, 2007 Ottawa, ON: Department of National Defence

Figure 3 File Folder Airfoil

SAFETY

If locally available materials, such as balsa wood, knives etc., are used for constructing experimental wings instead of file folder airfoils, ensure safe practices are followed. Careful supervision will prevent unsafe use of materials or unsafe actions.

CONFIRMATION OF TEACHING POINT 3

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

Teaching Point 4	**Place Airfoils in the Wind Tunnel and Compare Lift and Drag**
Time: 25 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets suspend experimental wings in the operating wind tunnel and make changes in the wing's angle of attack, observing the change in lift.

RESOURCES

- Experimental wings created in TP3,
- String or dental floss, and

- Stapler.

ACTIVITY LAYOUT

Place the wind tunnel created in TP2 in a location that provides room for groups of no more than four cadets to work comfortably, with access to power for operating the wind tunnel fans.

ACTIVITY INSTRUCTIONS

1. Have the cadets poke tiny holes in the roof and floor of the wind tunnel test section where the trailing edge of the experimental wing will be located.
2. Poke tiny holes in the window walls where the leading edge of the experimental wing will be located.
3. Run dental floss from window wall to window wall of the test section, passing through the interior of the experimental wing to be tested, at the wing's leading edge. This will suspend the experimental wing in the centre of the test section where it can be controlled and viewed.
4. Run dental floss from roof to floor of the test section, attaching the string to the trailing edge of the experimental wing with staples. This will allow the angle of attack to be changed by pulling on the dental floss under the test section to increase the angle of attack, or pulling on the dental floss above the test section to decrease the angle of attack.
5. With two cadets holding the ends of the horizontal string and two cadets holding the ends of the vertical string, turn on the fan.
6. Ask the cadets with the vertical string to increase the angle of attack. The cadets holding the horizontal string will detect an increase in lift.
7. Have the cadets trade positions.
8. Repeat with each group of cadets.

As a concurrent activity, while cadets are waiting for their turn on the wind tunnel, they will improve their experimental wing or develop different shapes for testing.

SAFETY

Ensure the fan has a safety guard around the blade and turn fan off when not testing a wing. Ensure that the fan is not located where a cadet might touch it accidentally during the activity.

CONFIRMATION OF TEACHING POINT 4

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

END OF LESSON CONFIRMATION

The cadets' participation in the activities will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

A wind tunnel provides an inexpensive opportunity to test an airfoil design and compare it to other designs, without being exposed to the dangers of a test flight.

INSTRUCTOR NOTES/REMARKS

If room permits, the wind tunnel can be preserved for future use instead of being discarded. If a glider is available from lesson C231.02 (Fly a Paper Colditz Glider) cadets can suspend that in the test chamber and perform control surface experiments with it.

REFERENCES

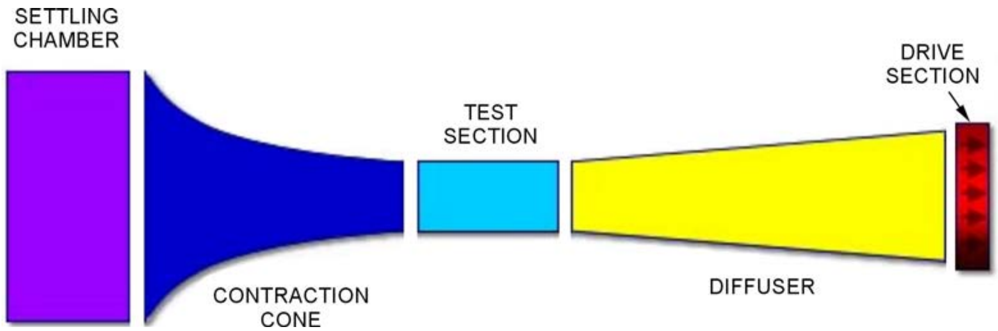
C3-091 (ISBN 1-55652-477-3) Carson, M.K. (2003). *The Wright Brothers for Kids: How They Invented the Airplane.* Chicago, IL: Chicago Review Press.

C3-093 NASA. (1996). *NASA's Observatorium Teacher's Guide.* Retrieved 12 February 2007, from http://observe.arc.nasa.gov/nasa/aero/tunnel/tunnel_parts.html.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. & Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

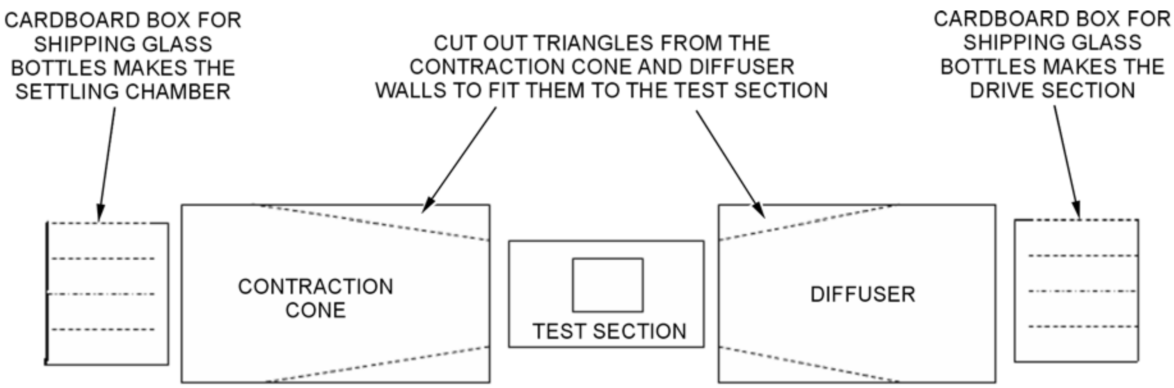
THIS PAGE INTENTIONALLY LEFT BLANK

WIND TUNNEL ACTIVITY



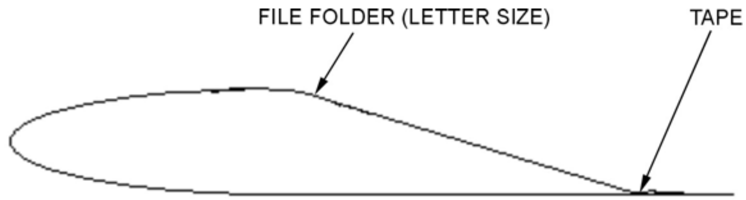
"NASA's Observatorium" Wind Tunnel Teacher's Guide. Retrieved 12 February 2007, from http://observe.arc.nasa.gov/nasa/aero/tunnel/tunnel_parts.html

Figure A-1 Parts of a Wind Tunnel



D Cdts 3, 2007 Ottawa, ON: Department of National Defence

Figure A-2 Parts of a Cardboard Box Wind Tunnel



D Cdts 3, 2007 Ottawa, ON: Department of National Defence

Figure A-3 File Folder Airfoil

Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-4 Airfoil Shape

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 7

EO C231.02 – FLY A PAPER COLDITZ GLIDER

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Copy the paper Colditz glider assembly instructions and templates located at Annex A for each cadet. Figures A-3 and A-4 require photocopy magnification so that the parts layout section fits a 5 x 8 inch standard index card.

Construct a paper Colditz glider for demonstration purposes.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 as it introduces paper gliders, orients the cadets to the topic and generates interest.

An in-class activity was chosen for TP2 and TP3 as it is an interactive way to provoke thought and stimulate an interest among cadets and to confirm the cadets' comprehension of the material.

A group discussion was chosen for TP4 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about paper gliders.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to construct and fly a paper Colditz glider.

IMPORTANCE

Constructing and flying paper gliders in a fun and challenging way allows cadets to observe some of the principles of flight in action.

Teaching Point 1 **Explain the History and Design of a Paper Colditz Glider**

Time: 15 min Method: Interactive Lecture

During World War II, Colditz Castle in German Saxony was used as a prisoner of war camp. Built on rocks high above the town of Colditz and overlooking the valley of the River Mulde, the huge structure seemed the ideal place for a high security prison. The inmates proved that this was a mistake. Between 1939 and 1945 there was a constant battle of wits between Allied officers and German guards that turned Colditz Castle into an international “Escape School”. Over 300 daring escape attempts earned “Oflag IV c” (Officers’ Camp IV c, Colditz) the reputation of a bad boys’ camp and made the Castle notorious. Allied Officers from Australia, Belgium, Canada, Czechoslovakia, France, Great Britain, India, Netherlands, New Zealand, Poland, Serbia, South Africa and the USA were imprisoned in the old castle.

Flying Officer Bill Goldfinch, a British prisoner of war, designed a small glider for an escape. Fellow prisoners built it using materials in the camp. Floorboards became wing spars, the ribs and frame were made from bed slats and control lines were electrical wires, all stealthily obtained. The covering was cotton, which came from sleeping bags sealed with slurry-type paste made by boiling down prison ration millet.

Colditz Castle is now a museum. Cadets can find out more about Oflag IV c and the prisoners by visiting the museum Website: http://www.colditz-4c.com/index.html.

When developing this escape plan, the prisoners had many things to consider. Ensuring the effective flight capability of their glider required attention to the same principles that concern this lesson.

BASIC PRINCIPLES OF FLIGHT

Weight. The force that attracts all matter and pulls objects to the Earth’s surface. In gliding, gravity provides the power to make the glider move. The wings change this downward pull (gravity) into forward motion (thrust) by acting on the passing air.

Lift. Any force that exerts an upward pull on the glider to overcome gravity.

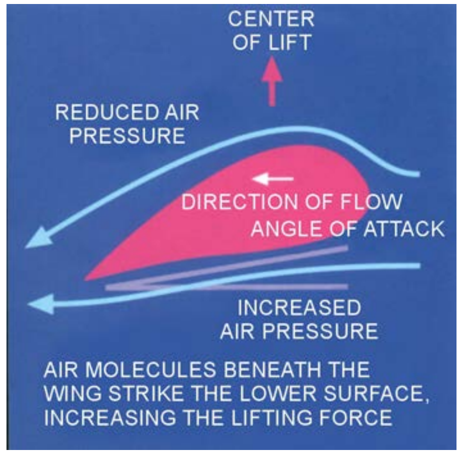
Drag. The air’s resistance to the glider’s forward motion.

Thrust. Any force that propels the glider forward.

Angle of Attack. The angle at which the wing goes through the air.

Stall. When the wing’s angle of attack is too great, the wing no longer produces lift.

A wing increases the speed of the airflow over its upper surface so that the pressure in this area is reduced. This is accomplished by curving the upper surface, which is known as camber. The distance from front to back along the curved surface is greater than the distance under the straight lower surface. Because the air molecules flowing along the curve have further to travel than the ones beneath, they increase their speed and become spaced further apart. This faster moving air exerts less pressure, which means that a partial vacuum is created above the wing.



Schmidt, N., Fabulous Paper Gliders, Sterling Publishing Company (p. 19)

Figure 1 Lift

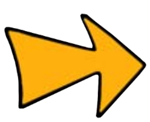
PAPER GLIDER PARTS

A paper glider is constructed with three main parts made up of smaller pieces built up in layers:

- fuselage with a vertical stabilizer,
- wings, and
- horizontal stabilizer.

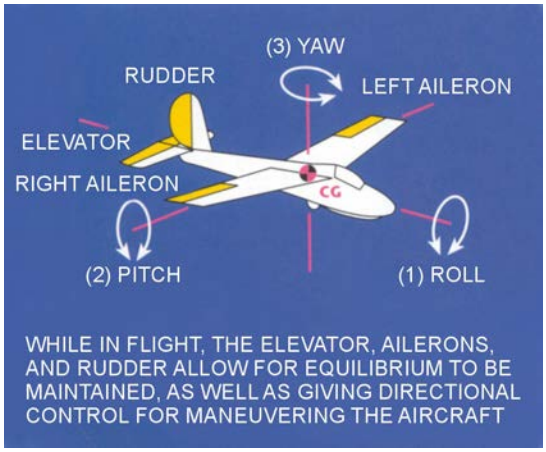
Parts templates and detailed instructions are located at Annex A. Paper glider construction will be explained in TP2.

TRIMMING FOR FLIGHT



The paper glider to be built in TP2 will be more stable in flight if the following requirements for trimming are kept in mind during construction.

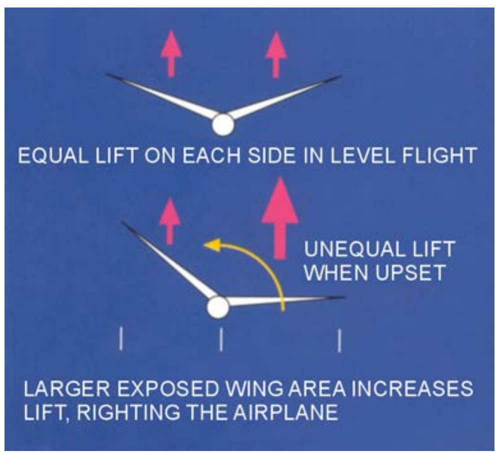
The control surfaces of the paper glider should be arranged to reduce roll, pitch and yaw. If the paper glider has an undesirable tendency to turn, bend the rudder slightly away from the direction of the turn. This should push the tail back into a straight line.



Schmidt, N., Fabulous Paper Gliders, Sterling Publishing Company (p. 22)

Figure 2 Trimming for Flight

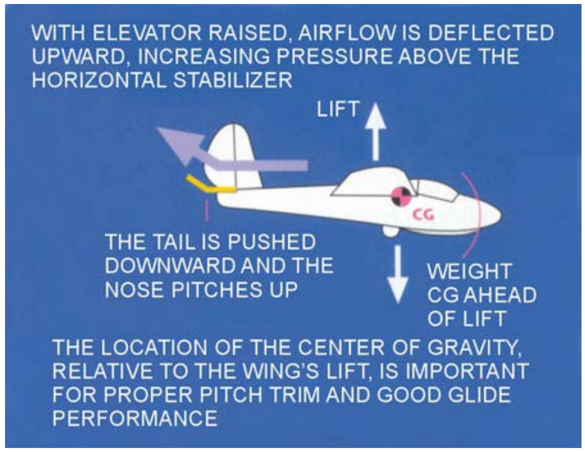
Angle the wings upward from the fuselage to inhibit roll. This is called a dihedral angle. As one wing drops and the other rises, the dropping wing will generate more lift as it approaches the horizontal and the rising wing will generate less lift as it approaches the vertical.



Schmidt, N., Fabulous Paper Gliders, Sterling Publishing Company (p. 21)

Figure 3 Controlling Roll

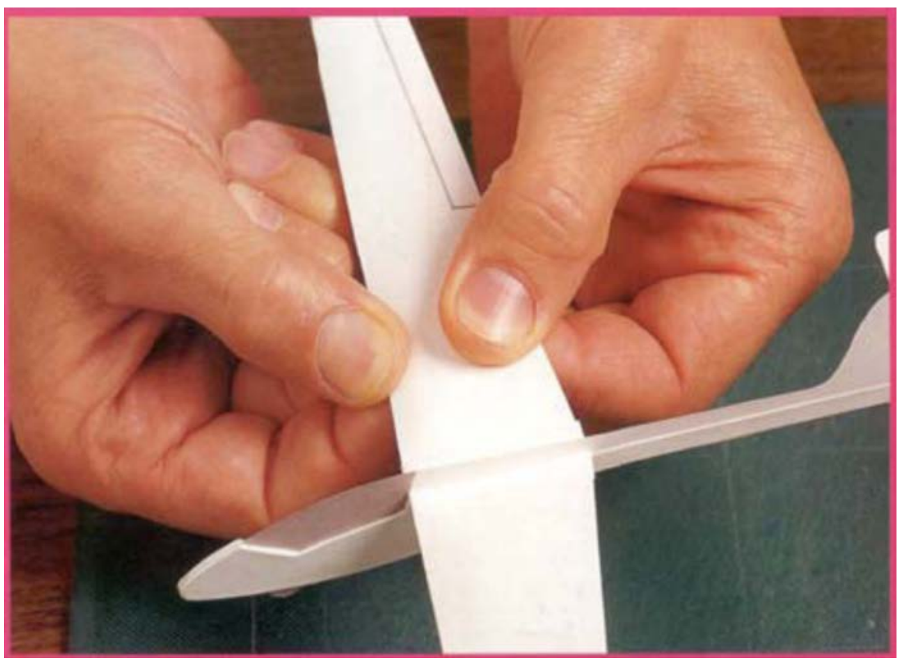
A paper glider that loses altitude too rapidly may be improved by keeping the paper glider's centre of gravity ahead of lift or by increasing the angle of the elevators at the rear of the horizontal stabilizers to lift the nose.



Schmidt, N., Fabulous Paper Gliders, Sterling Publishing Company (p. 23)

Figure 4 Lifting the Nose

The wing's ability to provide lift can be improved by adjusting the shape of the curvature. The curve should be very slight (refer to Figure A-2).



Schmidt, N., Fabulous Paper Gliders, Sterling Publishing Company (p. 8)

Figure 5 Adjusting Wing Curvature (Camber)

FLYING TIPS

Pick up and hold paper gliders by the nose. Never lift them by the wings or tail; this will distort their aerodynamic shape.

Examine the glider thoroughly from the front, back, top, bottom, and each side. Check for parts that appear bent or twisted. Each side must be exactly like the other. A paper glider must be symmetrical in all respects.

When throwing, hold the fuselage between the thumb and forefinger just behind the paper glider's centre of gravity. Throw it gently with a straight motion, not as if it were a baseball. A paper glider flies best at only one speed. Throwing it too hard will cause it to climb sharply, stall, and dive to the ground, or do a complete loop.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Why are the wings on most aircraft angled upward from the fuselage?

Q2. When gliding, what force creates thrust to overcome drag?

Q3. When gliding, what motion is necessary to create lift?

ANTICIPATED ANSWERS

A1. The wings on most aircraft are angled upward from the fuselage to provide roll stability.

A2. The force of gravity creates thrust to overcome drag.

A3. Forward motion is necessary to create lift.

Teaching Point 2	**Construct a Paper Colditz Glider**
Time: 20 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets construct a paper Colditz glider.

RESOURCES

- Index card stock 5 x 8 inch (two per cadet),
- Scissors (one pair per cadet),
- Fast-drying glue,
- Ruler (one per cadet),
- Pencil (one per cadet), and
- Glider templates located at Annex A (one set per cadet).

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Provide each cadet with the instructions and templates located at Annex A and resources as needed.
2. Have the cadets cut the parts layout section from each photocopy, as indicated on the page, to fit a 5 x 8 inch standard index card. Lightly glue the layouts to the card by applying a small spot of glue to the areas between the parts on the rear side, being careful to align the two parts.
3. Before beginning to cut out the parts, score those parts that will need to be bent later and cut opening slits where indicated. Score and cut precisely on the lines.

4. Cut out each part shown. This must be done carefully since the success or failure of every other step depends on accurately made parts. Keep track of the parts by lightly writing the part number in pencil on the backside of each part.

5. Build the glider. Begin with the 1F fuselage part, adding the other smaller parts to each side to complete the fuselage. Align parts carefully. Add drawing decoration when the glue is dry.

Ensure every cadet is finished construction before proceeding to TP3.

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	**Fly a Paper Colditz Glider**
Time: 15 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets fly a paper Colditz glider and compare its performance with the flight of other paper Colditz gliders.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Form cadets into a launching line.

Paper Colditz gliders are to be launched forward of the launching line and the paper gliders which travel the furthest and which fly the longest are to be noted by the instructor.

With the cadets, analyze and correct the performance of gliders that did not fly effectively and have the cadets try again.

The very successful gliders that finally go the furthest and fly the longest will be examined in TP4.

SAFETY

Gliders must not be launched when anyone is forward of the launching line.

CONFIRMATION OF TEACHING POINT 3

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

Teaching Point 4	**Discuss Flying Paper Colditz Gliders**
Time: 5 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw the following information from the group using the tips for answering/facilitating discussion and the suggested questions provided.

Paper is a relatively unstable material and it may be necessary to readjust the planes after every few flights. Cadets may feel frustration about erratic performance but this unpredictable quality of paper gliders can be part of the joy of flying them.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

QUESTIONS

Q1. How do you feel about paper glider aviation?

Q2. What did you enjoy most about this activity?

Q3. What things contributed to the success of the glider's flight?

Q4. How might glider performance be improved?

Q5. How might glider performance be made more consistent?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 4

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

END OF LESSON CONFIRMATION

SUGGESTED QUESTIONS

Q1. What characteristics were common to the paper gliders that flew the furthest?

Q2. What characteristics were common to paper gliders that turned in flight?

Q3. How can a paper glider be prevented from stalling?

ANTICIPATED ANSWERS

A1. Common characteristics were similar camber, similar pitch, straight rudder, etc.

A2. The common characteristic was that the rudder was not straight in line with the fuselage.

A3. To prevent a paper glider from stalling, the angle of attack of the wing can be reduced.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Cadets can improve the design and operation of a paper glider even if it is efficient already; careful application of flight principles may improve even successful paper gliders.

INSTRUCTOR NOTES/REMARKS

It is recommended that the two periods required for this EO be scheduled consecutively.

If the weather is not suitable to fly the paper Colditz gliders outdoors, flights may take place indoors.

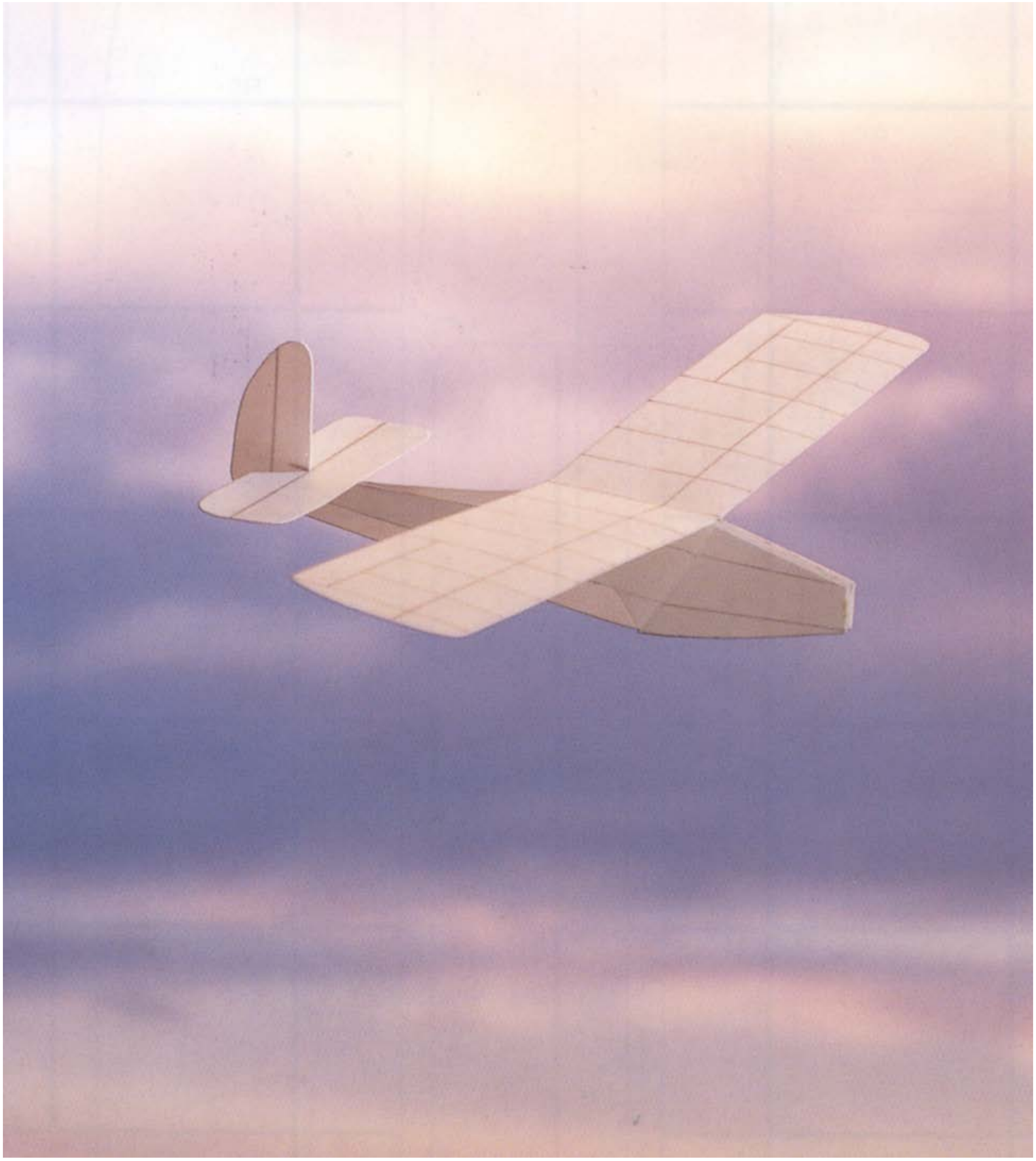
REFERENCES

C3-017 (ISBN 1-895569-23-0) Schmidt, N. (1998). *Fabulous Paper Gliders.* New York, NY: Sterling Publishing.

C3-058 (ISBN 1-4027-3034-9) Schmidt, N. (2005). *Paper Creations Paper Airplanes.* New York, NY: Sterling Publishing Company.

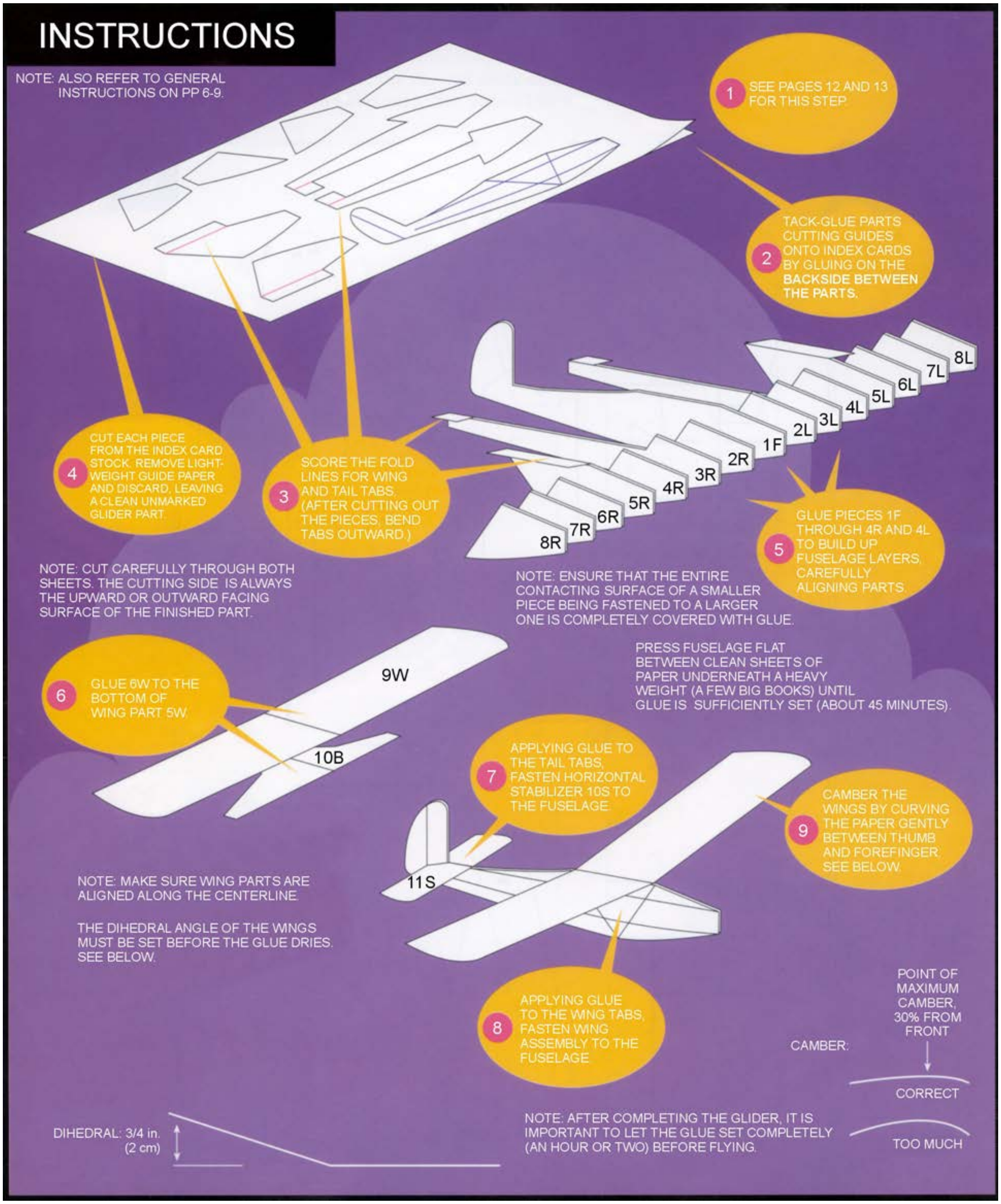
C3-094 Colditz Museum. (2005). *Colditz Glider.* Retrieved 23 February 2007, from http://www.colditz-4c.com/glider.htm.

COLDITZ PAPER GLIDER TEMPLATE AND ASSEMBLY INSTRUCTIONS



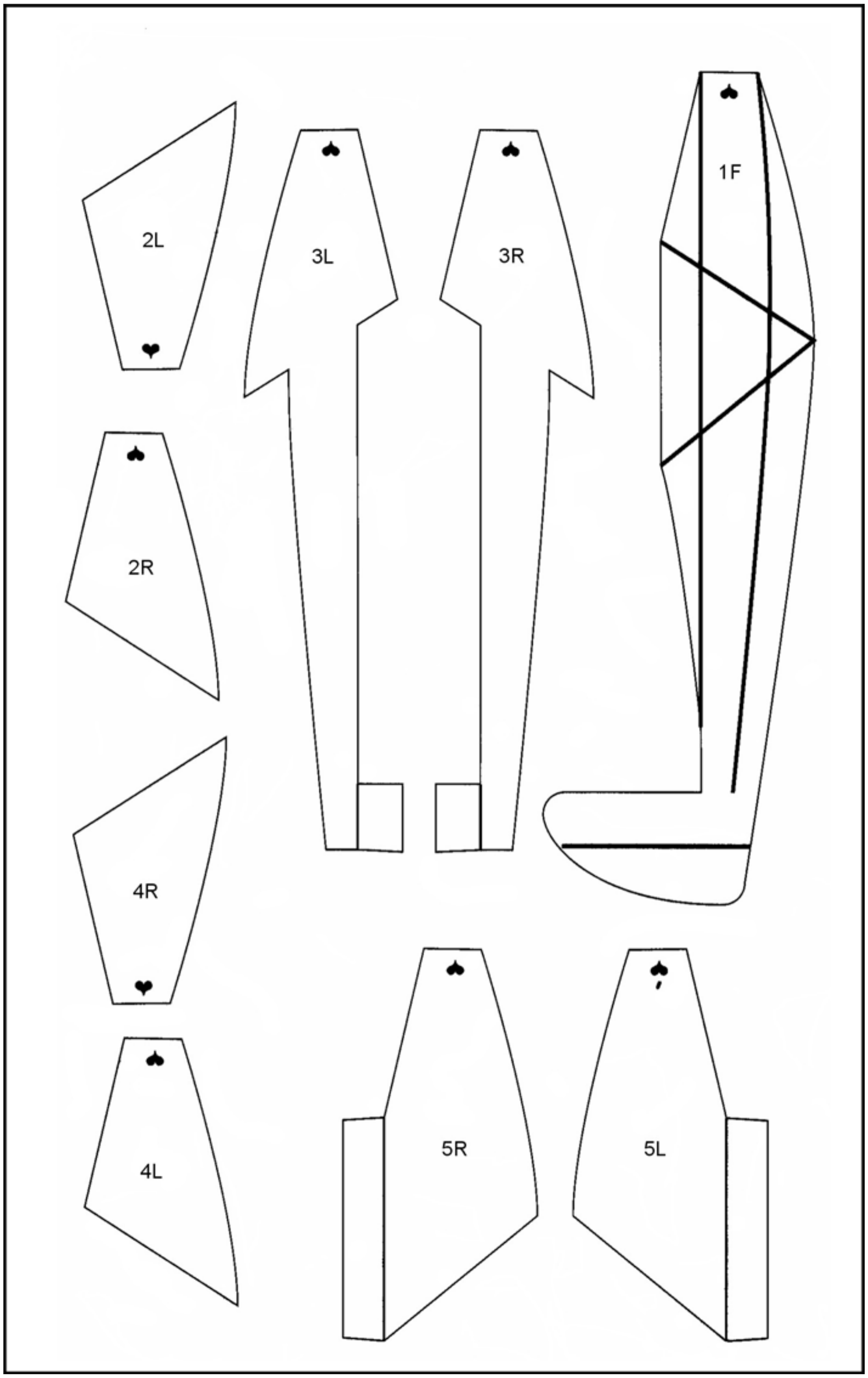
N. Schmidt, Fabulous Paper Gliders, Sterling Publishing Company (p. 52)

Figure A-1 Colditz Glider



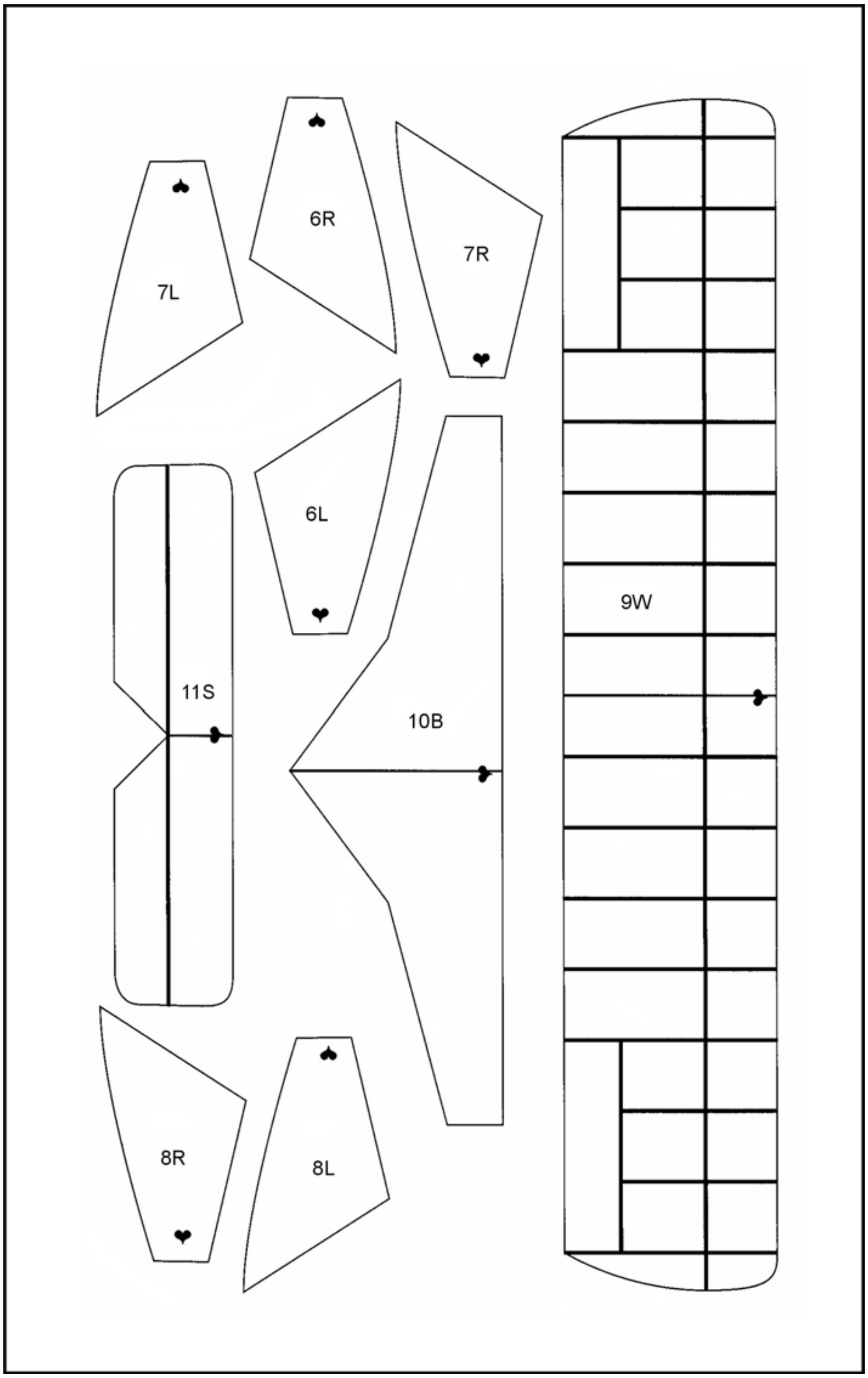
N. Schmidt, Fabulous Paper Gliders, Sterling Publishing Company (p. 53)

Figure A-2 Colditz Glider Assembly



N. Schmidt, Fabulous Paper Gliders, Sterling Publishing Company (p. 54)

Figure A-3 Colditz Glider Fuselage



N. Schmidt, Fabulous Paper Gliders, Sterling Publishing Company (p. 55)

Figure A-4 Colditz Glider Wing

CHAPTER 13

PO 232 – IDENTIFY CHARACTERISTICS OF PISTON-POWERED AIRCRAFT

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M232.01 – IDENTIFY TYPES OF AIRCRAFT ENGINES

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-802/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 or handouts of Annexes A and B.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to introduce types of aircraft engines and give an overview of them.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify types of aircraft engines.

IMPORTANCE

Engines are one of the key systems in a powered aircraft. It is important for cadets to learn about types of aircraft engines so that they can understand subsequent and related aspects of aviation.

Teaching Point 1	**Explain That a Powered Aircraft Needs a Means of Propulsion**
Time: 10 min	Method: Interactive Lecture

A powered aircraft needs a means of propulsion to overcome drag and allow the wings to generate sufficient lift to overcome weight.

The propeller and jet engine are very closely related, providing thrust by the same means – the acceleration of a mass of air. The propeller generates thrust by acting on a large mass of air, giving it a relatively small acceleration. The jet engine does exactly the same thing by giving a larger acceleration to a smaller mass of air.

The most common engine types used for aviation propulsion employ internal combustion and they include:

- rocket engines,
- gas turbine jet engines, and
- reciprocating piston-powered engines.

Show the cadets a slide or handout of rocket engine applications in Figures A-1 and A-2.

The earliest vehicle engines were rocket engines used to power ancient Chinese fire arrows. This method of propulsion proved so effective that, with many improvements, it is still commonly used today for many applications including space exploration. Self-contained with their own oxidizer, rockets have the great advantage of being able to function in a vacuum such as outer space.

All propulsion systems are reactive, meaning that they all employ an equal and opposite reaction predicted by Newton's third law of motion.

Piston-powered internal combustion engines were developed in the late nineteenth century. They were available to Orville and Wilbur Wright, who designed their 1903 flyer with a four-cylinder piston-powered engine.

Show the cadets a slide or handout of a Harvard piston-powered engine application in Figures A-3 and A-4.

Piston-powered engines are the most common vehicle engine of all and the one that Proficiency Level Two cadets will explore in most detail. In many ways, pistons are the most complicated system of converting the chemical energy of fuel into the energy of motion but they are found in many places, including aircraft, automobiles, boats and lawnmowers.

Show the cadets a slide or handout of a gas turbine jet engine application in Figures A-5 and A-6. Point out the airflow path and combustion location in the schematic.

Gas turbine jet engines are improvements upon simple ramjets. The ramjet is a liquid-fuelled rocket-like engine, which uses atmospheric oxygen to burn fuel. One of the most limiting aspects of a ramjet is that it requires high velocity to work. Therefore it cannot start combustion until it is up to speed – it must be launched from a speeding vehicle. Air-launched missiles are one of the few applications of ramjet engines.

Any turbine converts the energy of moving liquid or gases, such as jet exhaust or wind, into rotary motion to turn a shaft. A windmill is a turbine which uses wind energy to turn a shaft. Among other advantages, adding a turbine to the simple ramjet allows a compressor to generate high-pressure air so that the gas turbine jet engine can be started from a resting, or static, position. This is the secret of the modern gas turbine jet engine, which still relies on the ejection of hot gases to produce thrust. Until the turbine and compressor are functioning and delivering high-pressure air to the engine, however, the engine cannot start. Even gas turbine jet engines, therefore, must be started with a starting motor.

> Show the cadets a slide or handout of the CT-114 Tutor turbojet engine application Figures A-7 and A-8.

A gas turbine jet engine that provides thrust, with no rotating shaft output, is a TURBOJET engine.

> Show the cadets a slide or handouts of the C-130 Hercules turboprop engine application Figures A-9 and A-10.

A gas turbine jet engine that provides thrust and also drives a propeller is a TURBOPROP engine.

> Show the cadets a slide or handout of the CH-146 Griffon turboshaft engine application Figures A-11 and A-12.

A gas turbine engine that drives a helicopter rotor is usually a TURBOSHAFT engine. In a turboshaft helicopter engine, the output driveshaft is separate from the compressor turbine shaft so that engine speed is not tied to the helicopter's main rotor speed.

> Show the cadets a slide or handout of the CC-150 Polaris (A310-300 Airbus) turbofan engine application Figures A-5 and A-6. Point out the fan location.

The most common variation of the gas turbine jet engine is the TURBOFAN, which is a hybrid of a turbojet and a turboprop. The turbofan has a fan that provides thrust with bypass air, in place of a propeller, adding to the reactive thrust of the ejected exhaust gases. This application allows the aircraft to go faster than normal propellers could go, while also reducing engine noise and allowing the aircraft to make efficient use of fuel. The noise reduction and fuel efficiency of turbofans make them very effective for commercial aviation.

All three of these engine types, rocket, gas turbine jet and piston-powered engines, use internal combustion to capture the energy of expanding hot gases in a closed container.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Which engine type was the first to be used for propulsion?

Q2. Why are the rocket, gas-turbine and piston-powered engines all internal combustion engines?

Q3. Why does a gas turbine jet engine need to have a starting motor?

ANTICIPATED ANSWERS

A1. The rocket was the first to be used for propulsion.

A2. The rocket, gas-turbine and piston-powered engines all use internal combustion to capture the energy of hot expanding gases in a closed container.

A3. A gas turbine jet engine needs to have a starting motor because, until the turbine and compressor are running, there is no high-pressure air to operate the engine.

Teaching Point 2	**Explain Combustion in Rocket, Gas Turbine and Piston-powered Engines**
Time: 5 min	Method: Interactive Lecture

All rocket, jet and piston-powered engines are internal-combustion engines because they all use burning fuel to generate power from expanding gases in a closed container. However, all these engine systems have important differences that distinguish them from one another.

Show the cadets a slide or handouts of combustion in Figure B-1.

When fuel is oxidized it gives off heat. The heat causes expansion of the gases that result from the oxidization. If oxidization is very slow it is usually referred to simply as oxidization, or rusting. If the oxidization is faster, it is often referred to as burning. If it is very rapid, it is referred to as an explosion. All these processes result from fuel chemically combining with oxygen. The distinguishing characteristic between them is the speed of molecular combination.

Show the cadets a slide or handout of combustion locations in Figures B-2 and B-3.

By capturing the expanding hot gases of combustion in a tightly closed container, such as a piston-powered engine's combustion chamber or a gas-turbine jet engine's combustor, the energy of the hot gases can be put to useful work. All the engine types discussed here contain the energy of expanding gases in a tight closed container, so all are said to be internal-combustion engines.

There have been many methods developed that direct and transmit this power. The most common is the turning of a shaft, such as a turbine shaft or a crankshaft. That shaft can then be used to turn an aircraft's propeller, the impellor of an air compressor, or an automobile's wheels.

> A rocket applies the energy of the combustion's expanding gases in the most direct manner, by simply ejecting them to get the equal and opposite reaction. Gas-turbine and piston-powered engines apply the energy indirectly through moving machinery.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What causes burning gases to expand?

Q2. What is the difference between fuel burning and fuel exploding?

Q3. Which engine type applies the energy of expanding gases in the most direct manner?

ANTICIPATED ANSWERS

A1. The heat of combustion causes the gases to expand.

A2. The difference between burning and exploding is the speed of oxidization.

A3. The rocket applies the energy of expanding gases in the most direct manner.

Teaching Point 3	**Explain the Oxidization Process for Different Types of Engines**
Time: 5 min	Method: Interactive Lecture

The simplest system of combining fuel with oxygen is the self-contained system of the rocket and the most intricate is the internal combustion engine, with gas turbine jets between those extremes.

The rocket carries its own fuel and oxygen and combines them in a closed container at a rate that will generate the energy needed at any given moment. Of course, the rocket will have to start out with enough oxygen to finish the mission, since it cannot get more from outside its closed container. So, the fuel and the oxygen must be carefully calculated and loaded before launch. The hot expanding gases that result from an explosion in the rocket's combustor are blasted out the back of the rocket at high speed through a nozzle. The nozzle applies the equal and opposite reaction of the moving gases to the body of the rocket, propelling it upward.

> A jet engine is similar to a rocket engine but, because a jet engine uses air for oxidization, it must allow for the fact that air is mostly nitrogen and only about 20 percent oxygen. Therefore, obtaining enough oxygen for efficient combustion in a jet engine requires that air be somehow compressed before combustion takes place.

A gas turbine jet engine typically resembles a hollow cylinder with air sucked in the front and blasted out the back. These can be seen slung under the wing of most airliners. The fuel to be burned is stored in tanks, often in the aircraft's wing. The air, which is sucked by a compressor fan into the front of the engine, contains the oxygen that is needed for oxidization of the fuel. The fuel is combined or mixed with the pressurized air and the mixture is detonated in a container within the engine called a combustor. As in a rocket, the hot expanding gases are blasted out the back of the engine through a nozzle that applies the equal and opposite reaction of the moving gases to the body of the engine, propelling it forward. Significant in this is the presence of a turbine beside the combustor, which uses a portion of the hot expanding gases to spin a shaft. That shaft drives the compressor fan to suck the air into the engine. This system of generating propulsion power has proven so useful and reliable that many variations of the basic theme have been developed and given names such as “fan-jet”, “turboprop” and “turboshaft”.

Specialized gas-turbine applications are explored in complementary lessons of Proficiency Level Two.

The most intricate method of generating power by oxidizing fuel is the most common. The reciprocating piston-powered engine is encountered in many applications. In a four-stroke piston-powered engine, air is carefully mixed with atomized fuel droplets and then either sucked or injected into cylinders where the mixture is detonated to drive pistons in a cycle of intake, compression, power, and exhaust. These cycles will be examined in EO M232.03 (Participate in a Discussion on the Cycles of a Four-Stroke Piston-Powered Engine).

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Where does a rocket get oxygen to burn fuel in outer space?

Q2. What is used to spin the turbine in a gas-turbine engine?

Q3. Where does a jet engine, such as a gas-turbine, get oxygen to burn fuel?

ANTICIPATED ANSWERS

A1. A rocket carries its own oxygen in addition to its fuel.

A2. A portion of the hot expanding gases from the engine’s combustor is used to spin the turbine.

A3. Air entering the front of the engine contains oxygen that is used for oxidization of fuel.

Teaching Point 4	**Identify Aircraft and Associated Engine Types**
Time: 5 min	Method: Interactive Lecture

Show the cadets slides or handouts, located at Annex A, of the following aircraft pictures and, in each case, ask the cadets to identify the aircraft. Then, tell the cadets the aircraft’s engine type and ask the cadets to consider the following points:

Figure A-9 C-130 Hercules: four Alison T-56-A-7/15 turboprop engines.

Engine type is selected for the anticipated mission, so why does the C-130 Hercules in Figure A-9 have turboprops?

Today, the distinction between tactical airlift and strategic airlift depends not so much on the number of a transport aircraft's engines as on their type: jet-engine aircraft are generally seen as "strategic", while turboprop-powered (and therefore slower and shorter-ranged) aircraft are "tactical". Tactical transports are also usually designed to operate on rougher, shorter, more primitive airfields than the facilities required by strategic transports.

Figure A-5 CC-150 Polaris: two General Electric CF6-80C2A2 turbofan engines.

What is the main purpose of the CC-150 Polaris?

This strategic lift aircraft's primary role is long-range transport of personnel and equipment, up to 194 passengers or 32 000 kg of cargo. They have participated in operations supporting the CF, NATO and numerous UN and Red Cross initiatives.

Figure A-3 Harvard North American T-6J: one nine-cylinder Pratt & Whitney radial engine.

What is happening in Figure A-3?

Harvard number 20449 was a North American T-6J, one of the last of 270 such aircraft taken on strength by the RCAF in November, 1951. It was assigned to No. 1 Flying Instructors School which had been reformed at RCAF Station Trenton, Ontario on April 1, 1951. It then followed the school as it moved to RCAF Station Moose Jaw on June 8, 1959 where the school still exists today as Canadian Forces Flying Instructors School. The training aircraft was then upgraded from the Harvard to the Canadair CT-114 Tutor. The aerobatic display team of the 1950s was the Golden Hawks. The flying instructors so disparaged their former students' efforts that they formed their own team, the Goldilocks, with the Harvard training aircraft, showing what they thought of their students' formation-flying abilities.

Figure A-7 CT-114 Tutor: one General Electric J85-CAN-40 turbo jet engine.

Figure A-7 looks familiar. Where have we seen that aircraft before?

When the Snowbirds, Canada's world famous aerial acrobatic team, perform high above the clouds, their Canadair CT-114 Tutors are put through their paces. The Tutor, a Canadian designed and produced single-engine subsonic jet trainer that entered service in the mid-1960s, was used for basic and advanced pilot training until it was replaced by the CT-156 Harvard II and CT-155 Hawk in 2000.

Figure A-11 CH-146 Griffon: one Pratt & Whitney PT6T-3D turboshaft engine.

What is a Griffon used for?

As Canada's Utility Transport Tactical Helicopter (UTTH), the Griffon provides a robust, reliable and cost-effective capability to conduct: airlift of equipment and personnel, command and liaison flights, surveillance and reconnaissance, casualty evacuation, logistic transport, search and rescue, counter-drug operations, and domestic relief operations.

CONFIRMATION OF TEACHING POINT 4

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. Why are the rocket, gas-turbine and piston-powered engines all internal combustion engines?

Q2. What is used to spin the turbine in a gas-turbine engine?

Q3. What causes burning gases to expand?

ANTICIPATED ANSWERS

A1. The rocket, gas-turbine and piston-powered engines all use internal combustion to capture the energy of hot expanding gases in a closed container.

A2. A portion of the hot expanding gases from the engine's combustor is used to spin the turbine.

A3. The heat of combustion causes the gases to expand.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The topic of aircraft engines is very broad and ever-changing as new solutions are found and new products developed to push the performance envelope.

INSTRUCTOR NOTES/REMARKS

If a computer and projector are available, software to demonstrate engine operation can be found at the Websites listed below.

REFERENCES

A3-031 Canadian Forces. *Aircraft.* (2006). Retrieved 20 November 2006, from http://www.airforce.gc.ca/equip/equip1_e.asp.

C3-084 NASA Glenn Research Center. *Engines 101.* Retrieved 21 February 2007, from http://www.ueet.nasa.gov/Engines101.html#Aeronautics.

C3-086 NASA Glenn Research Center. *Engines 101.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html.

C3-087 NASA Glenn Research Center. *Propulsion Index.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html.

C3-088 NASA. *Welcome to the Beginner's Guide to Rockets.* Retrieved 21 February 2007, from http://exploration.grc.nasa.gov/education/rocket/bgmr.html.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

C3-120 Pratt & Whitney Canada. (2006). *Imagine the Power.* Retrieved 18 March 2007, from http://www.pwc.ca/en/3_0/3_0_3/3_0_3_3_1.asp.

C3-121 NASA. (2007). *Missions: Space Shuttle Main Engines.* Retrieved 18 March 2007, from http://www.nasa.gov/returntoflight/system/system_SSME.html.

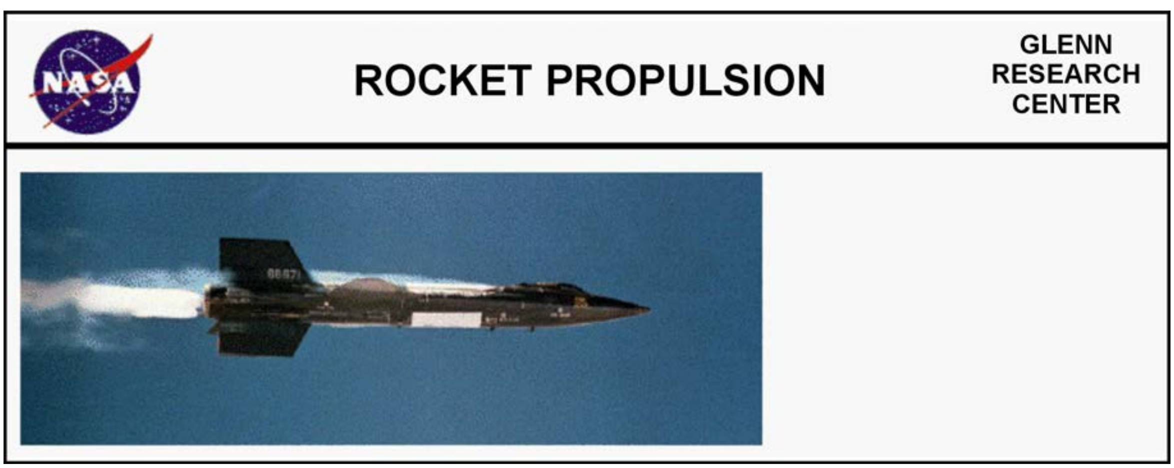
THIS PAGE INTENTIONALLY LEFT BLANK

IDENTIFYING TYPES OF AIRCRAFT ENGINES

Rocket Engines

National Aeronautics and Space Administration (NASA), "Missions" Space Shuttle System (2006). Retrieved 17 March 2007, from http://www.nasa.gov/returntoflight/system/system_SSME.html

Figure A-1 Rocket Engine Application



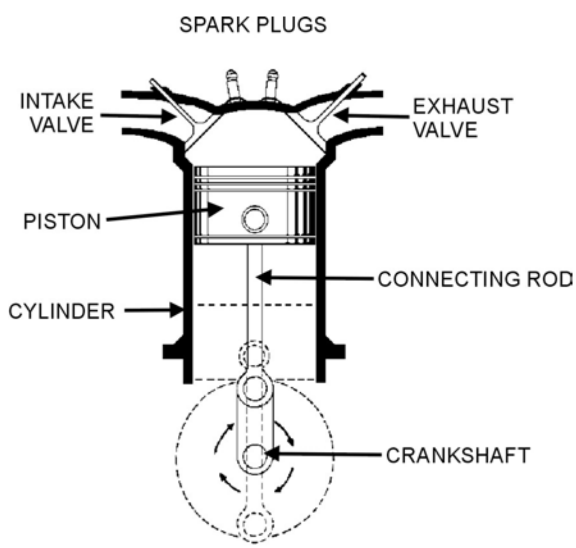
NASA Glenn Research Center. "Propulsion Index". Rocket Propulsion (2006). Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html

Figure A-2 X-15 in Flight

Piston-powered Engines

Canadian Forces. Aircraft. (2005). Retrieved 17 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure A-3 Piston-powered Engine Application



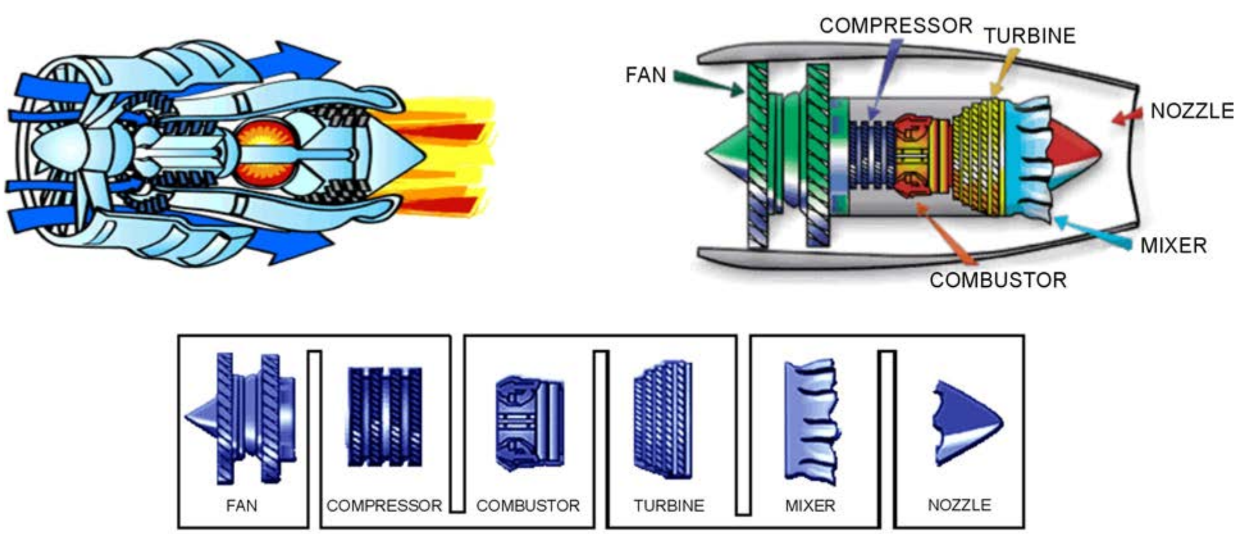
A-CR-CCP-263/PT-001 (p. 53)

Figure A-4 Piston-powered Engine Schematic

Jet Engine

Canadian Forces. Aircraft. (2005). Retrieved 17 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure A-5 Gas Turbine Engine Application



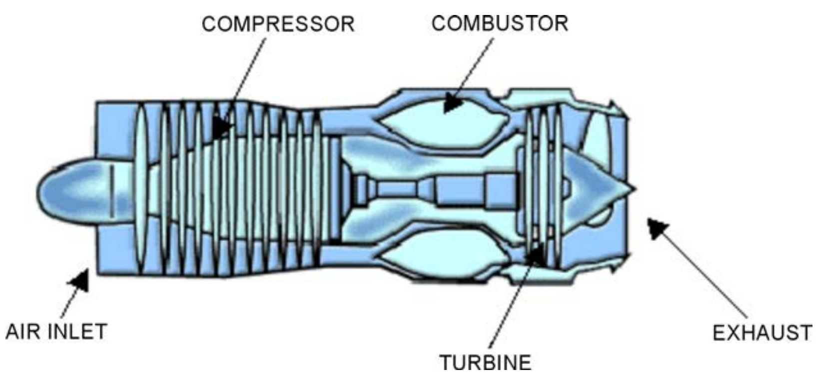
NASA "Engines 101". Ultra Efficient Engine Technology (UEET). (2001).
Retrieved 17 March 2007, from http://www.ueet.nasa.gov/Engines101.html

Figure A-6 Turbofan Parts

Turbojet Engines

Canadian Forces. Aircraft. (2005). Retrieved 17 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure A-7 Turbojet Application



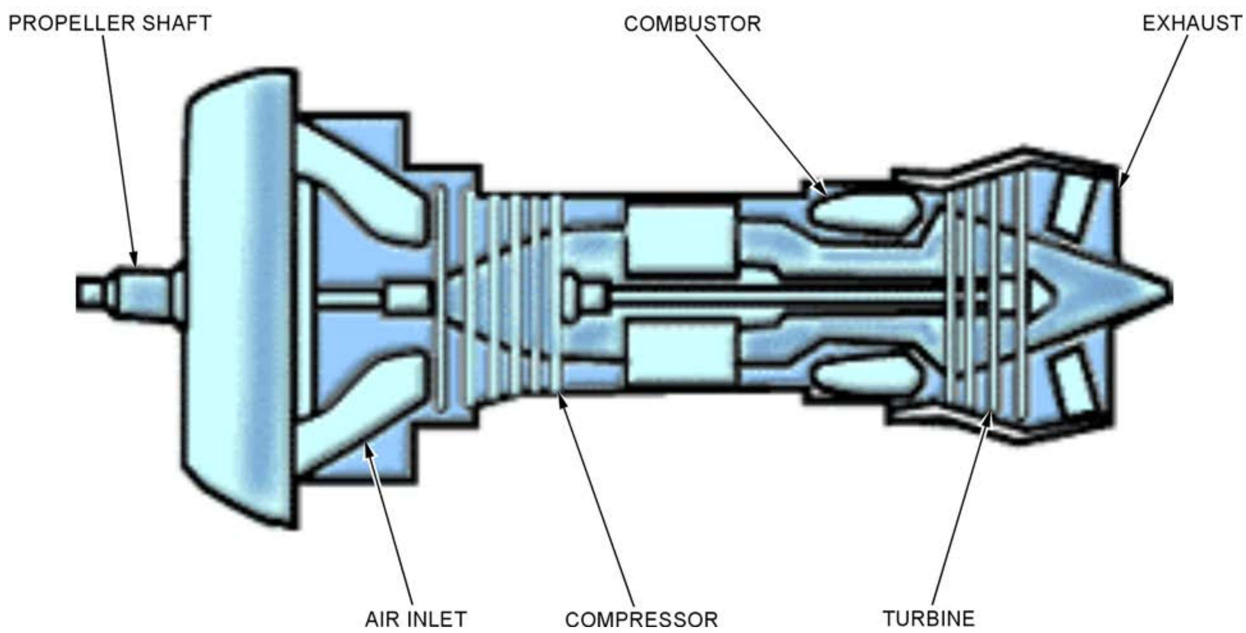
*NASA Engines 101. Ultra Efficient Engine Technology (UEET). (2001).
Retrieved 17 March 2007, from http://www.ueet.nasa.gov/Engines101.html*

Figure A-8 Turbojet Schematic

Turboprop Engines

Canadian Forces. Aircraft. (2005). Retrieved 17 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure A-9 Turboprop Application



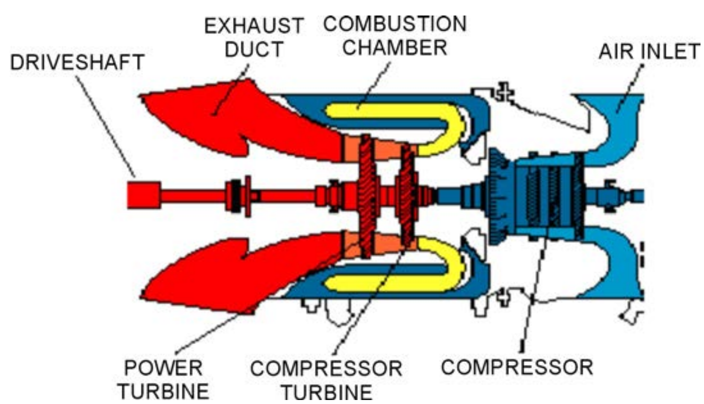
NASA Engines 101. Ultra Efficient Engine Technology (UEET). (2001). Retrieved 17 March 2007, from http://www.ueet.nasa.gov/Engines101.html

Figure A-10 Turboprop Engine Schematic

Turboshaft Engines

Canadian Forces. Aircraft. (2005). Retrieved 17 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

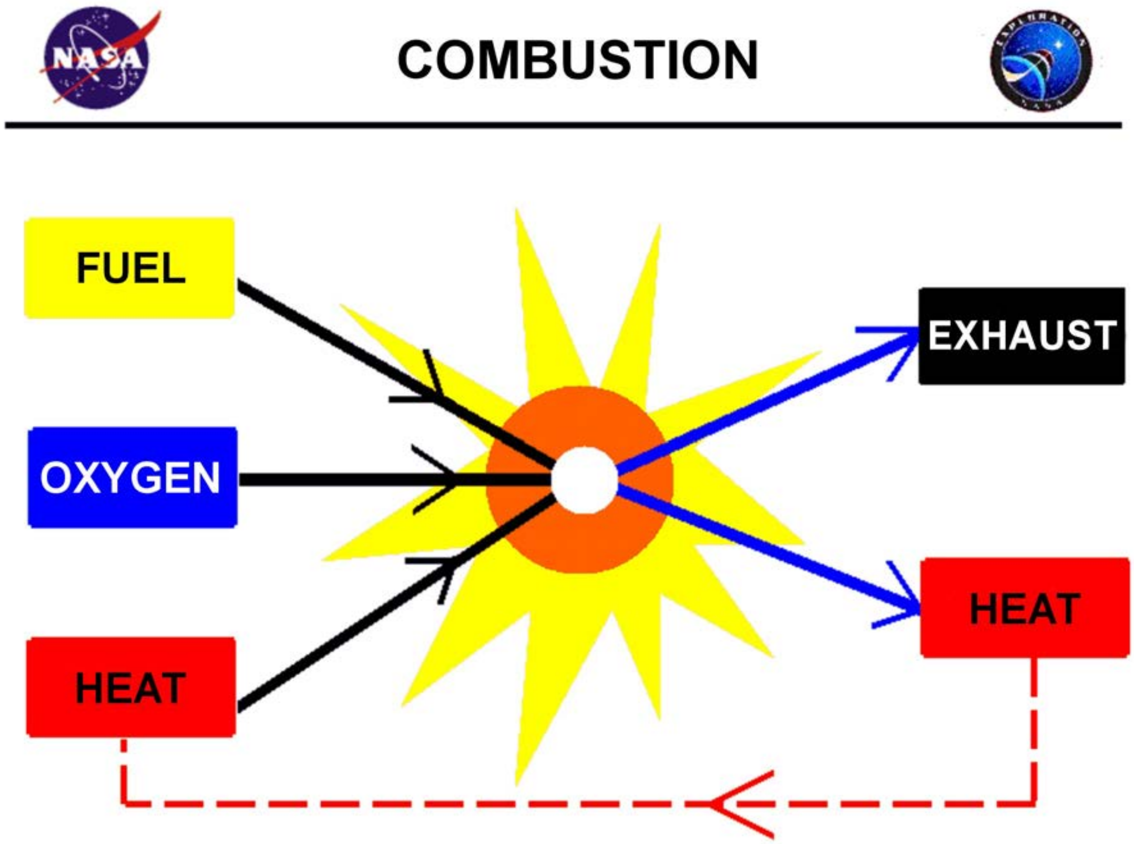
Figure A-11 Turboshaft Engine Application



Imagine the Power, Pratt & Whitney Canada. Retrieved 16 March 2007, from http://www.pwc.ca/en/3_0/3_0_3/3_0_3_3_1.asp

Figure A-12 Turboshaft Engine Schematic

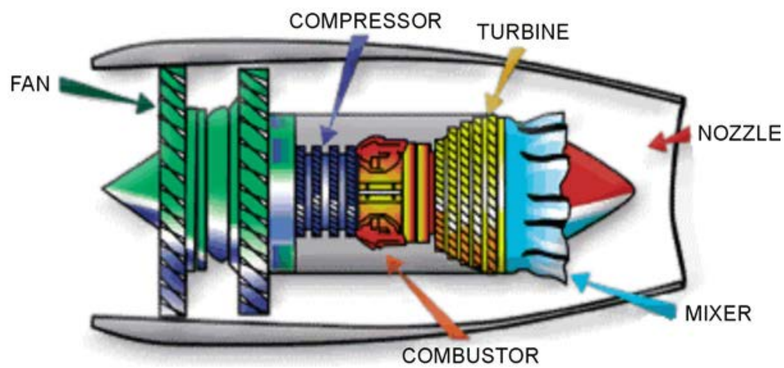
INTERNAL COMBUSTION



NASA Ultra Efficient Engine Technology (UEET). (2001). Retrieved 17 March 2007, from http://www.ueet.nasa.gov/Engines101.html

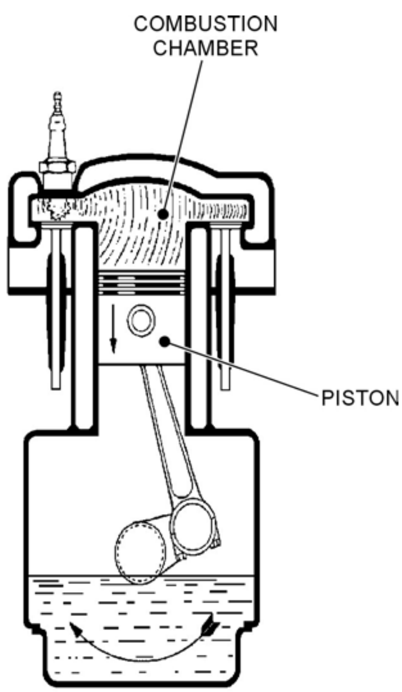
Figure B-1 Combustion

Location of Combustion



NASA Ultra Efficient Engine Technology (UEET). (2001). Retrieved 17 March 2007, from http://www.ueet.nasa.gov/Engines101.html

Figure B-2 Combustor Location in a Gas-turbine Engine



A-CR-CCP-263/PT-001 (p. 53)

Figure B-3 Combustion Chamber Location in a Piston-powered Engine

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M232.02 – IDENTIFY THE COMPONENTS OF PISTON-POWERED INTERNAL COMBUSTION ENGINES

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 or handouts of Figures A-1 to A-3, and B-1, C-1 and D-1 respectively.

Copy handouts of Figure A-4 for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to TP3 to introduce the components of internal combustion engines and give an overview of them.

An in-class activity was chosen for TP4 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify the components of piston-powered internal combustion engines.

IMPORTANCE

It is important for cadets to learn about the components of piston-powered internal combustion engines so that they can develop an understanding of subsequent and related principles of aviation.

Teaching Point 1 | **Identify and Explain the Operations of the Major Components of a Piston-powered Engine**

Time: 25 min | Method: Interactive Lecture

MAJOR COMPONENTS OF A PISTON-POWERED ENGINE

Show the cadets a slide or handout of the piston-powered engine in Figure A-1.

Cylinder. In order to understand how an engine works, it is necessary to first know what parts make up an engine. The cylinder is the main component. This is where the combustion of a gasoline and air mixture takes place.

Piston. The piston is found in the cylinder and is driven up and down by the exploding air and fuel mixture.

Connecting Rod. The piston is attached by a connecting rod to the crankshaft. The connecting rod is joined to the piston and to the crankshaft with bearings which allow movement so that the reciprocating (up-and-down) motion of the piston can be transformed into rotary (spinning) motion of the crankshaft.

Crankshaft. As the piston drives up and down, the connecting rod rotates around the crankshaft, turning it. The crankshaft can rotate while the piston goes up and down.

Camshaft. The crankshaft often turns a second shaft called a camshaft. The cams are bumps on the camshaft that open and close the intake and exhaust valves at the correct time. Of course, the crankshaft also powers the aircraft's propeller. Each cylinder has at least one set of valves operated by the cams on the camshaft. The intake valve opens to let the mixture of gasoline and air into the cylinder and then it closes. Once this is done and the mixture is burnt, the exhaust valve opens to release the exhaust and then closes.

Distributor. The gasoline and air mixture is ignited by a spark plug. Most aircraft have two spark plugs in every cylinder. The fuel takes time to burn completely. Because of this time delay, the spark must happen at just the right time; a fraction of a second before the piston has reached the top of its stroke. In a multi-cylinder engine such as aircraft use, an electrical signal must be sent to each cylinder's spark plug at exactly the right time. The timing and distribution of spark sometimes relies on a central distributor, which is worked by gears from the crankshaft. Should this distributor fail, the engine will stop. A better, though more expensive method, is to equip each cylinder with its own spark timing and delivery system.

Show the cadets a slide or handout of a carburetor in Figure A-2.

Carburetor. Before fuel is delivered to the cylinder for detonation, it is mixed with air in exact proportion. A fuel injector or a carburetor does this. For effective detonation and clean burning, the fuel must be broken into tiny droplets and mixed with air.

Oil Sump. The moving parts of the engine all need to be coated with engine oil. Oil is provided under pressure to make sure that all moving parts are coated. A wet sump stores the oil supply in the crankcase with the crankshaft, while a dry sump stores the oil in a separate tank and delivers it to the engine via piping.

Show the cadets a slide or handout of a dry-sump lubrication system in Figure A-3.

The oil is circulated and re-used, serving other purposes in addition to lubrication. As the oil circulates, it cleans the engine by flushing dirt out of the engine. It also cools the engine by carrying heat away and it improves the pressure seal to keep the combustion chamber airtight.

Have the cadets label the parts of a piston-powered engine in Figure A-4.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Where does combustion take place in a piston-powered engine?

Q2. What two valves does a piston-powered engine have?

Q3. Why does the piston go up and down?

ANTICIPATED ANSWERS

A1. In a piston-powered engine, combustion takes place in the cylinder.

A2. Piston-powered engines have an intake valve and an exhaust valve.

A3. The detonation of the air and fuel mixture drives the pistons up and down.

Teaching Point 2	**Explain the Difference Between Rotary Engines and Radial Engines**
Time: 5 min	Method: Interactive Lecture

Some early aircraft engines used rotary engines in which the cylinders themselves rotated around the stationary central crankshaft. These were different than the later radial engines in which the stationary cylinders were arranged around the rotating crankshaft.

Many larger older aircraft had radial engines. In this design the cylinders were arranged in a circle at the front of the engine with the cylinder tops pointed outwards. The crankshaft ran through the middle of the cylinders to the front of the aircraft. Radial engines had many cylinders; some aircraft from World War II had 13 cylinders.

Show the cadets a slide or handout of the radial engine located at Annex B.

Even older aircraft, before and during World War I, had rotary engines that were different but were often confused with the later radial types. In the rotary engine, the crankshaft was stationary and the cylinders rotated around the crankshaft. This is the opposite of the radial engine, which had stationary cylinders and rotating crankshaft. Rotary engine design was abandoned because the great weight of the spinning cylinders was found to interfere with turning the aircraft in flight.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. In a rotary engine which part rotates and which part is stationary?

Q2. Why was rotary engine design abandoned for aircraft?

Q3. How were the stationary cylinders arranged in an aircraft's radial engine?

ANTICIPATED ANSWERS

A1. In a rotary engine the cylinders rotate and the driveshaft is stationary.

A2. Rotary engine design was abandoned for aircraft because the great weight of the rotating cylinders was found to interfere with turning the aircraft in flight.

A3. In radial engines the cylinders were arranged in a circle at the front of the engine with the cylinder tops pointed outwards.

Teaching Point 3	**Describe Aircraft Engine Arrangements**
Time: 10 min	Method: Interactive Lecture

Internal combustion engines come in a variety of styles that are described by how the cylinders are configured.

Show the cadets a slide or handout of the horizontally opposed engine located at Annex C.

The horizontally opposed engine is most commonly used in general aviation airplanes. This engine has two banks of cylinders lying flat, directly opposite each other and working on the same crankshaft. There may be four, six or eight cylinders. The advantage of this engine type is its flat shape that generates less form drag. Form drag is a force that opposes the aircraft's movement through the air.

Show the cadets a slide or handout of an in-line engine located at Annex D.

Some older aircraft have in-line engines. This was the first type of aircraft engine used in great numbers. In an in-line engine, the cylinders are lined up in a row from the front of the engine to the back, with the tops pointed up. The crankshaft runs under the cylinders to the front of the aircraft.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. How are the cylinders arranged in an in-line engine?

Q2. How are the cylinders arranged in a horizontally opposed engine?

Q3. Why are horizontally opposed engines the favoured design for small aircraft engines?

ANTICIPATED ANSWERS

A1. In an in-line engine, the cylinders are lined up in a row from the front of the engine to the back.

A2. A horizontally opposed engine has two banks of cylinders lying flat, directly opposite each other.

A3. The horizontally opposed engine's flat shape generates less form drag.

Teaching Point 4	**Play a Game of Piston-powered Baseball**
Time: 15 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets use the information learned in this lesson to play a game that reviews the topic.

RESOURCES

- List of questions and answers located at Annex E,
- Coin,
- One large die,
- Coloured poster board, and
- Masking tape.

ACTIVITY LAYOUT

Re-arrange the classroom into the shape of a baseball diamond with poster board bases, using masking tape to connect the bases with baselines.

ACTIVITY INSTRUCTIONS

- For this review game, the instructor acts as, "pitcher", "umpire" and "scorekeeper".
- Two teams are chosen and each is seated in a "dugout" of chairs in opposing baselines in "batting order". A coin is tossed to see which team is at bat first.

- The instructor “pitches” a question to the first batter. Teammates are encouraged to give hints to the batter, but the batter must choose the answer.
- If the answer is wrong, the batter is out.
- If the answer is correct, the die is thrown. If a one, two or three comes up, the player goes to first, second or third base, respectively. A four is a home run.
- A five on the die means a foul ball and the player must field another question. There are two ways to be out – either answering incorrectly or rolling a six.
- Players on base are “forced” ahead by the next runner and will score if forced to home base.
- After three outs, the other team gets to bat.
- After five runs are batted in, the next team is up at bat.
- The process is repeated as long as time permits.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 4

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. Where does combustion take place in a piston-powered engine?

Q2. How were the stationary cylinders arranged in an aircraft’s radial engine?

Q3. Why are horizontally opposed engines the favoured design for small aircraft engines?

ANTICIPATED ANSWERS

A1. In a piston-powered engine, combustion takes place in the cylinder.

A2. In radial engines, the cylinders were arranged in a circle at the front of the engine with the cylinder tops pointed outwards.

A3. The horizontally opposed engine’s flat shape generates less form drag.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The generation and control of power is limited only by our imaginations and so, for over one 100 years, aircraft engines have been constantly improved with new designs.

INSTRUCTOR NOTES/REMARKS

If a computer and projector are available, software to demonstrate engine operation can be found at the Websites listed below.

REFERENCES

C3-003 (ISBN 0-943210-44-5) Pike, B. and Busse, C. (1995). *101 More Games for Trainers.* Minneapolis, MN: Lakewood Books.

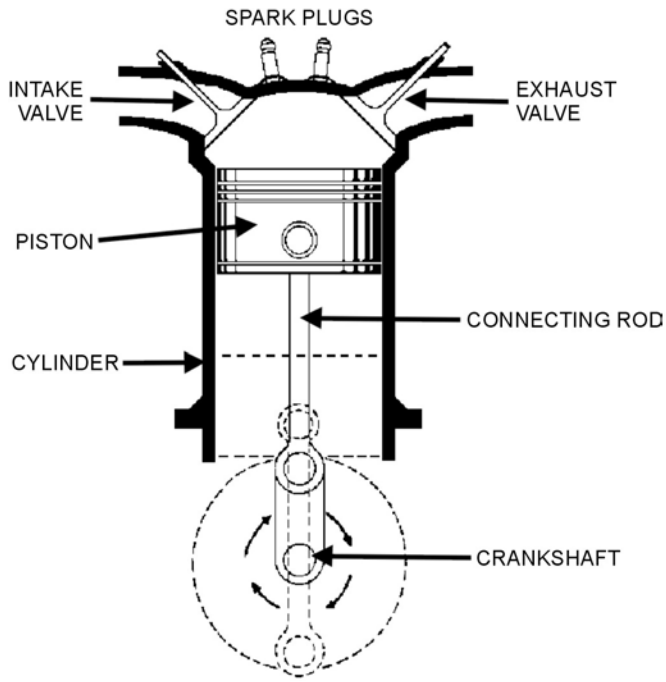
C3-086 NASA Glenn Research Center. *Engines 101.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html.

C3-087 NASA Glenn Research Center. *Propulsion Index.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

THIS PAGE INTENTIONALLY LEFT BLANK

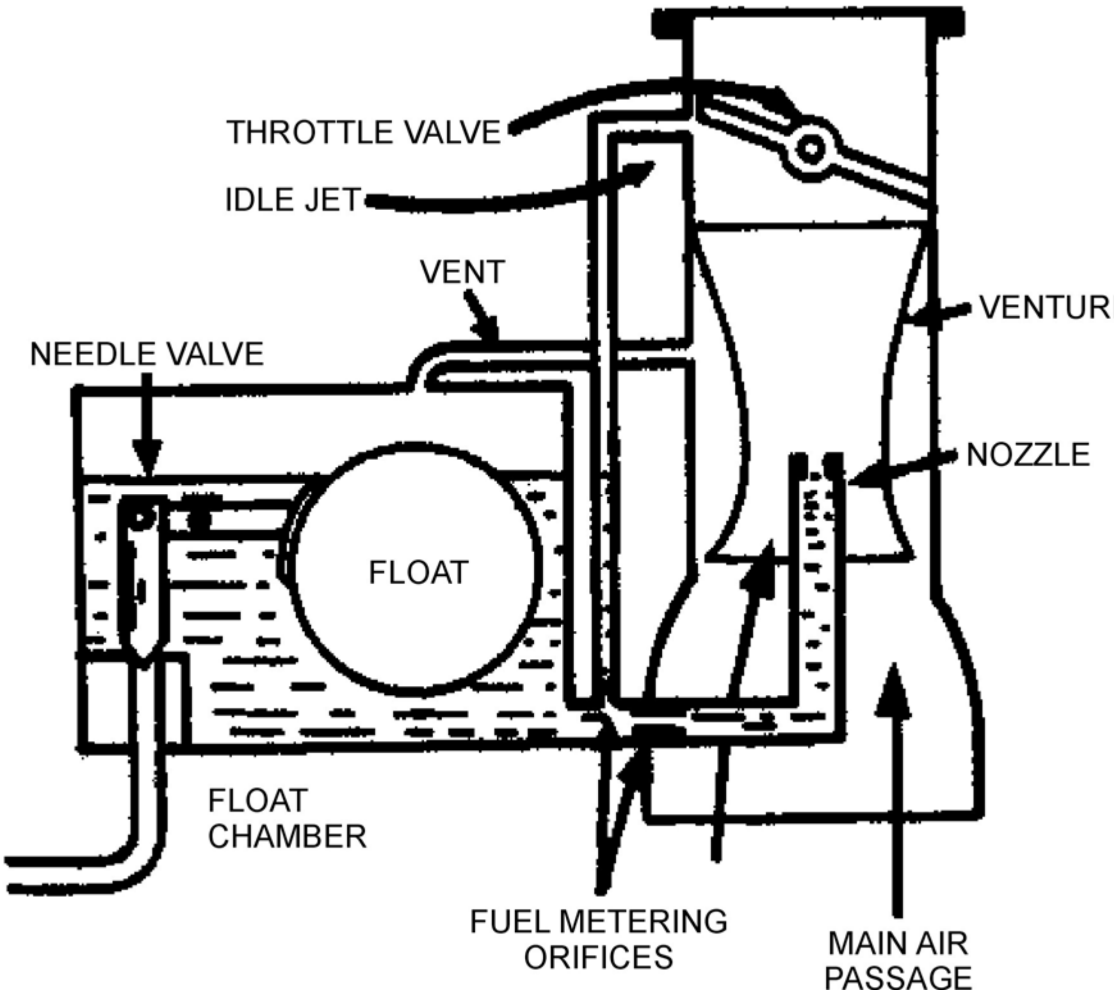
IDENTIFYING COMPONENTS OF PISTON-POWERED INTERNAL COMBUSTION ENGINES



A-CR-CCP-263/PT-001 (p. 53)

Figure A-1 Piston-powered Internal Combustion Engine

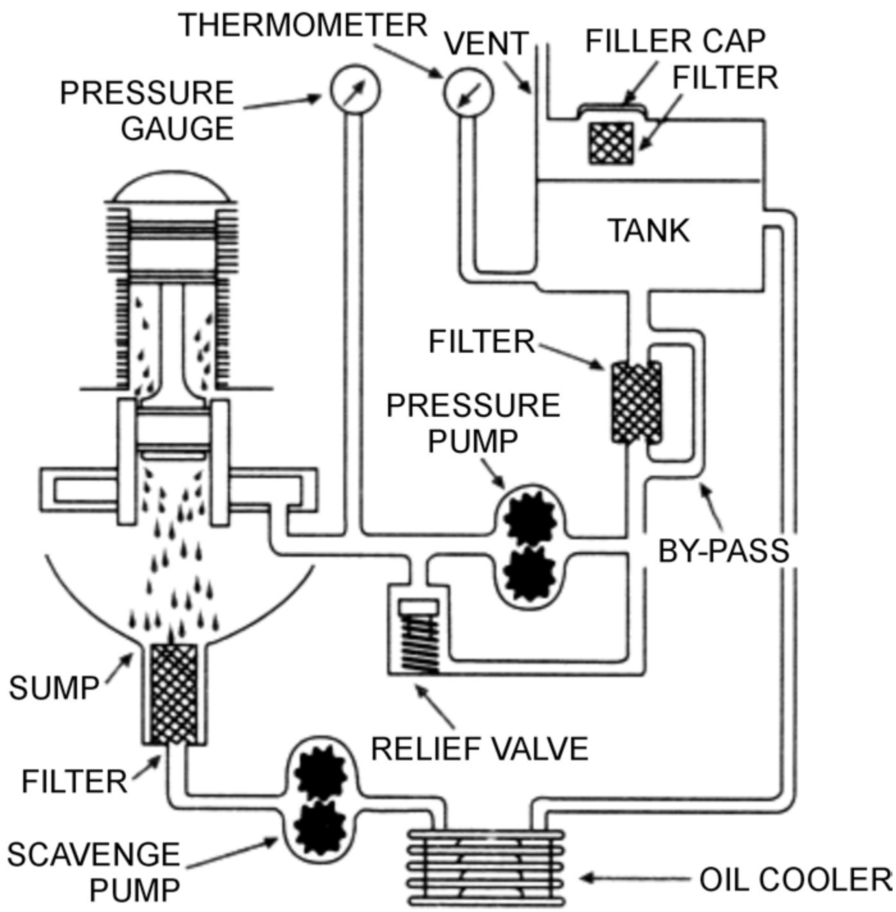
CARBURETOR



A-CR-CCP-263/PT-001 (p. 62)

Figure A-2 Carburetor Components

DRY-SUMP LUBRICATION SYSTEM

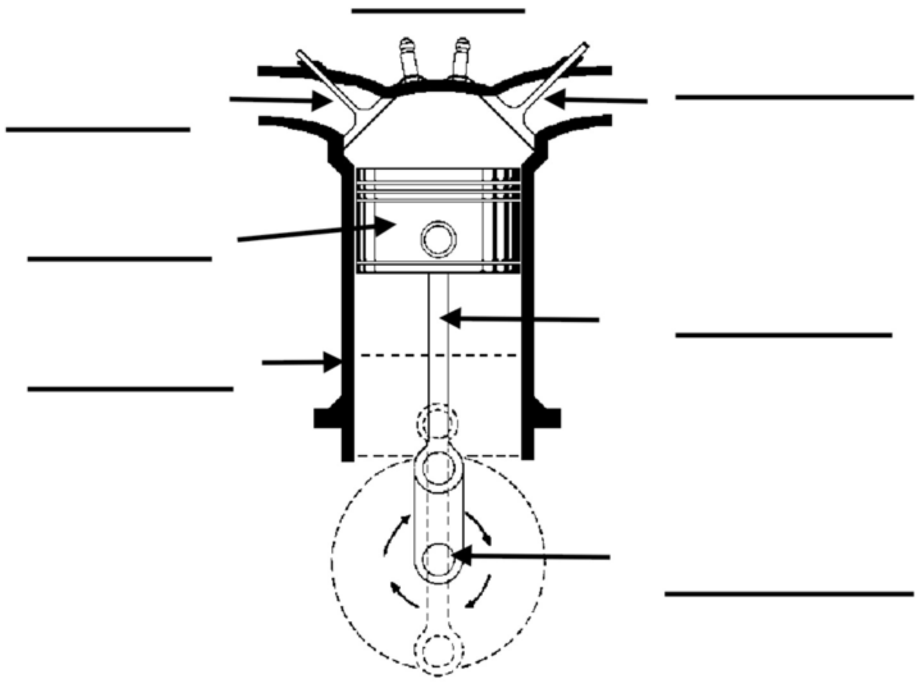


A-CR-CCP-263/PT-001 (p. 62)

Figure A-3 Engine Lubrication

FILL IN THE PARTS OF THE INTERNAL COMBUSTION ENGINE IN THE CORRECT SPACE.

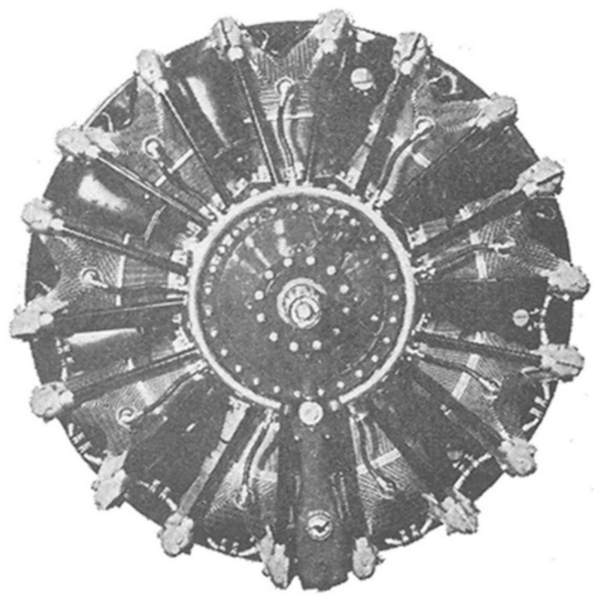
NAME: ______________



A-CR-CCP-263/PT-001 (p. 53)

Figure A-4 Engine Parts Identification

RADIAL ENGINE



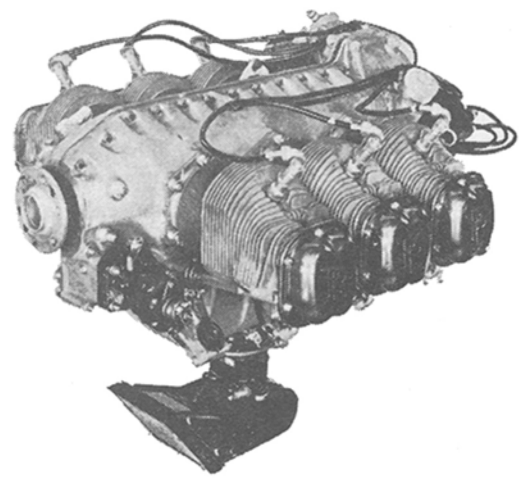
A-CR-CCP-263/PT-001 (p. 52)

Figure B-1 Radial Engine Configuration

THIS PAGE INTENTIONALLY LEFT BLANK

HORIZONTALLY OPPOSED ENGINE

HORIZONTALLY OPPOSED



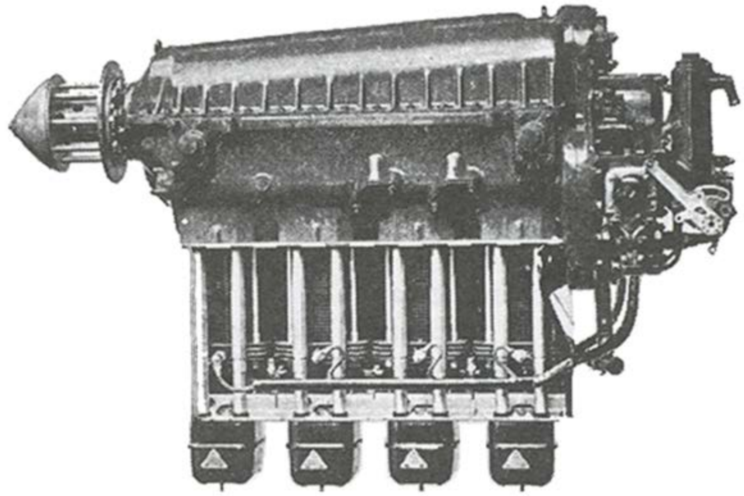
A-CR-CCP-263/PT-001 (p. 52)

Figure C-1 Horizontally Opposed Engine Configuration

THIS PAGE INTENTIONALLY LEFT BLANK

IN-LINE ENGINE

IN-LINE



A-CR-CCP-263/PT-001 (p. 52)

Figure D-1 In-line Engine Configuration

THIS PAGE INTENTIONALLY LEFT BLANK

QUESTIONS AND ANSWERS FOR TP4 PISTON-POWERED BASEBALL

QUESTIONS

Q1. Where does combustion take place in a piston-powered engine?

Q2. What two valves does a piston-powered engine have?

Q3. Why does the piston go up and down?

Q4. In a rotary engine which part rotates and which part is stationary?

Q5. Why was rotary engine design abandoned for aircraft?

Q6. How were the stationary cylinders arranged in an aircraft's radial engine?

Q7. How are the cylinders arranged in an in-line engine?

Q8. How are the cylinders arranged in a horizontally opposed engine?

Q9. Why are horizontally opposed engines the favoured design for small aircraft engines?

ANTICIPATED ANSWERS

A1. In a piston-powered engine, combustion takes place in the cylinder.

A2. Piston-powered engines have an intake valve and an exhaust valve.

A3. The detonation of the air and fuel mixture drives the pistons up and down.

A4. In a rotary engine the cylinders rotate and the driveshaft is stationary.

A5. Rotary engine design was abandoned for aircraft because the great weight of the rotating cylinders was found to interfere with turning the aircraft in flight.

A6. In radial engines the cylinders were arranged in a circle at the front of the engine with the cylinder tops pointed outwards.

A7. In an in-line engine, the cylinders are lined up in a row from the front of the engine to the back.

A8. A horizontally opposed engine has two banks of cylinders lying flat, directly opposite each other.

A9. The horizontally opposed engine's flat shape generates less form drag.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO M232.03 – EXPLAIN THE CYCLES OF A FOUR-STROKE PISTON-POWERED ENGINE

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 or photocopy handouts of Figures A-1 to A-6 for each cadet.

Photocopy handouts of Figure B-1 for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to TP4 to introduce the cycles of a four-stroke piston-powered engine and give an overview of them.

An in-class activity was chosen for TP5 as it is an interactive way to provoke thought and stimulate an interest among the cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to explain the cycles of a four-stroke piston-powered engine.

IMPORTANCE

It is important for cadets to learn about the cycles of a four-stroke piston-powered engine so that they will understand the process by which an aircraft operates.

Teaching Point 1	Explain the Purposes of the Strokes of a Four-stroke Piston
Time: 15 min	Method: Interactive Lecture

CYCLES OF A FOUR-STROKE PISTON-POWERED ENGINE

The parts of an engine work together in a cycle to turn the aircraft's propeller. In most aircraft engines, this cycle has four distinct stages called strokes:

- the intake stroke draws fuel and air into the cylinder;
- the compression stroke forces the fuel and air into the combustion chamber;
- the power stroke transmits the energy of the exploding fuel to the crankshaft; and
- the exhaust stroke cleans the cylinder of exhaust fumes and prepares it for the next intake stroke.

The piston travels four strokes (two up and two down) to complete one cycle. During this operation, the crankshaft goes through two complete revolutions.

The Intake (Induction) Stroke

Show the cadets a slide or distribute the handout of the intake stroke in Figure A-1.

During the first (intake) stroke, the intake valve opens to let the gasoline and air mixture into the cylinder and the piston moves down to draw the mixture into the cylinder. The exhaust valve is closed during this stroke.

The Compression Stroke

Show the cadets a slide or distribute the handout of the compression stroke in Figure A-2.

In the second (compression) stroke, both valves are closed while the piston moves up to compress the mixture.

The Power (Combustion) Stroke

Show the cadets a slide or distribute the handout of the power stroke in Figure A-3.

In the third (power) stroke, both valves remain closed while the spark plug ignites the gas, which burns, expands and forces the piston down again.

The Exhaust Stroke

Show the cadets a slide or distribute the handout of the exhaust stroke in Figure A-4.

In the fourth (exhaust) stroke, the exhaust valve is open to let the burnt gases out while the intake valve is closed. The piston moves up again to force the burned gases out through the open exhaust valve.

Show the cadets a slide or distribute the handout of the four strokes of a piston-powered engine in Figure A-5.

After the exhaust stroke, the whole process repeats itself thousands of times per minute, causing the crankshaft to turn the propeller on the aircraft.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What must happen between the power stroke and the exhaust stroke?

Q2. What must happen before the power stroke can take place?

Q3. How many complete revolutions of the crankshaft are in four strokes?

ANTICIPATED ANSWERS

A1. Between the power stroke and the exhaust stroke, the exhaust valve must open.

A2. Fuel and air must be taken in, all valves must close and the spark plug must ignite.

A3. The crankshaft goes through two complete revolutions in four strokes (two down and two up).

Teaching Point 2	**Identify and Explain the Operation of Valves and Camshafts**
Time: 5 min	Method: Interactive Lecture

Other important components of piston-powered four-stroke internal combustion engines are the cam systems, which operate the valves.

Show the cadets a slide or distribute the handout of the cam and valve mechanism in Figure A-6.

Since the crankshaft rotates in time with the piston movements, its rotation is used to provide signals to the valves, telling them when to open. The usual method is to arrange for the crankshaft to turn a secondary shaft (camshaft) that has lobes, or cams, raised on its surface. The shape of the cam is such that it mechanically pushes its associated valve open – there are many ways to mechanically arrange this – just the right amount at just the right time.

> The crankshaft provides the timing information to the valves by using cams on a camshaft to push the valves open. The camshaft is usually connected to the crankshaft through gears.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. From what engine component is the valve timing first taken?

Q2. What pushes the valve open the right amount at the right time?

Q3. How does the timing information usually get from the crankshaft to the cam?

ANTICIPATED ANSWERS

A1. The valve timing is taken first from the crankshaft.

A2. A cam on a rotating camshaft pushes the valve open the right amount at the right time.

A3. The crankshaft provides the timing information to the valves by using cams on a camshaft to push the valves open. The camshaft is usually connected to the crankshaft through gears.

Teaching Point 3 — **Explain the Timing of Electrical Ignition Spark Distribution**

Time: 10 min — Method: Interactive Lecture

Efficient, complete burning takes time. Even though an explosive detonation like that found in a piston-powered engine cylinder seems to happen in an instant, time is actually required. The engine turns very fast, thousands of revolutions per minute, so time is short. To ensure that the fuel is burned completely and that all energy is recovered from the fuel, the spark that sets off the detonation must be delivered while the piston is still rising on the compression stroke. If the spark arrives during the power stroke there is not enough time to burn the fuel completely and unburned fuel is exhausted. This would be an inefficient waste of fuel and it would contribute to environmental pollution in the form of blue smoke. Therefore, the timing of the spark plug’s electrical signal must be exact.

> Each spark plug of each cylinder must get its electrical signal as the piston is rising, before the end of the compression stroke.

The timing for spark distribution also originates from the crankshaft through a system of gears, which provide coarse, or rough, timing. The need for precision timing is so great that a technician usually measures spark timing with electronic tools to ensure precision during engine tune-ups.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Why is the spark delivered to the cylinder early, during the compression stroke?

Q2. Where is the timing of the spark taken from?

Q3. How many revolutions per minute does a working engine complete?

ANTICIPATED ANSWERS

A1. The spark is delivered early because complete burning of the fuel takes time.

A2. Timing of the spark comes from the crankshaft.

A3. A working engine completes thousands of revolutions per minute.

Teaching Point 4	**Explain That all Engine Operations Must Proceed in Order**
Time: 10 min	Method: Interactive Lecture

Engine operations must proceed precisely in order. Often, more than one operation must happen simultaneously. For example, the spark must be delivered to the cylinder while both valves are closed. A spark delivered to a charged cylinder when a valve is open results in a "backfire". Power is lost and a valve will be burned – or perhaps even broken.

Show the cadets a slide or distribute the handout of the four strokes of a four-stroke piston-powered engine in Figure A-5.

The engine operation must proceed as follows:

- Fuel and air mixture must be available for all cylinders, all the time, in a multi-cylinder engine.
- The intake stroke of the piston must take place with the intake valve open and the exhaust valve closed.
- The compression stroke of the piston must take place with both valves closed.
- Electrical signals must be delivered to spark plugs just before the piston completes the power stroke, when both valves are closed.
- The power stroke of the piston must take place with both valves closed.
- The exhaust stroke of the piston must take place with the exhaust valve open and the intake valve closed.
- The camshaft must push each valve open and closed at the right times.

For smooth operation, the valve and spark timing must be precise for all the cylinders.

Distribute copies of Figure B-1 and have the cadets fill in the names of the strokes pictured.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. On which strokes are both valves closed?

Q2. On which strokes is one valve open?

Q3. What causes an engine to backfire?

ANTICIPATED ANSWERS

A1. Both valves are closed on the compression stroke and on the power stroke.

A2. On the intake stroke the intake valve is open; on the exhaust stroke the exhaust valve is open.

A3. A backfire can be caused by a spark delivered to a charged cylinder when a valve is open.

Teaching Point 5	Enact the Performance of the Four-stroke Piston-powered Engine
Time: 15 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets apply their knowledge of the cycles of a four-stroke piston-powered engine by enacting the cycles in order.

RESOURCES

N/A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Organize the cadets into teams of six, consisting of:

- One cadet acting as the piston,
- One cadet acting as the crankshaft,
- One cadet acting as the intake valve,
- One cadet acting as the exhaust valve,
- One cadet acting as the camshaft, and
- One cadet acting as the spark plug.

Have the cadets enact the cycles of a four-stroke piston-powered engine in the following way:

1. Have five cadets form a standing circle around the sitting piston.

2. As the crankshaft calls the stroke in sequence (intake, compression, power and exhaust), the piston lowers and raises both hands accordingly.
3. The camshaft points at each valve, while that valve is supposed to be open.
4. Each valve opens their arms wide when the valve is open and places arms at their sides when the valve is closed.
5. The spark plug claps hands over the piston's head just before the end of the compression stroke (before the piston's hands are completely raised), when both valves are closed.
6. The entire sequence is repeated as fast as possible until a mistake is made.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 5

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What is the first stroke of a four-stroke piston-powered engine and what does it do?

Q2. What is the second stroke of a four-stroke piston-powered engine and what does it do?

Q3. What is the third stroke of a four-stroke piston-powered engine and what does it do?

Q4. What is the fourth stroke of a four-stroke piston-powered engine and what does it do?

ANTICIPATED ANSWERS

A1. The intake stroke draws fuel and air into the cylinder.

A2. The compression stroke forces the fuel and air into the combustion chamber.

A3. The power stroke transmits the energy of the exploding fuel to the crankshaft.

A4. The exhaust stroke cleans the cylinder of exhaust fumes and prepares it for the next intake stroke.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The four-stroke piston-powered engine has the most complex operation of all the engines that are studied in the Air Cadet Program. This engine type is, by far, the most common that cadets will encounter at the airfield and in many other places, such as in lawn mowers, automobiles and boats.

INSTRUCTOR NOTES/REMARKS

If the squadron has access to a computer and projector, software to demonstrate engine operation can be found at the Website listed under reference C3-086.

REFERENCES

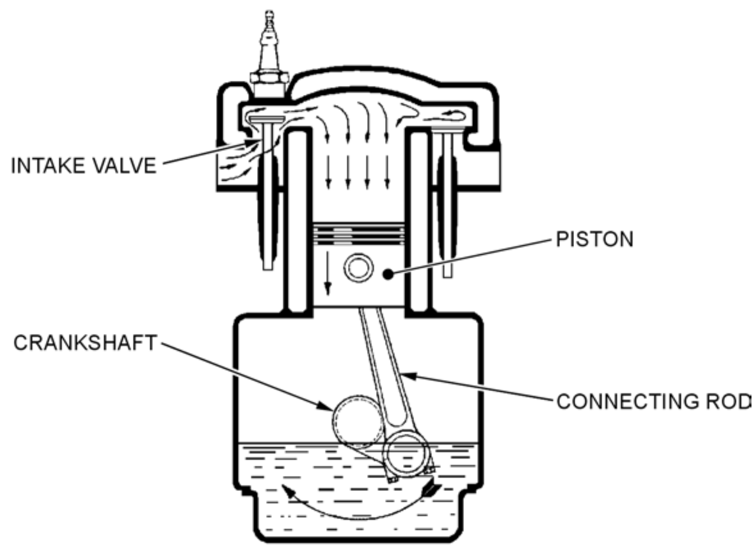
C3-086 NASA Glenn Research Center. *Engines 101.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html.

C3-087 NASA Glenn Research Center. *Propulsion Index.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

ENGINE STROKES

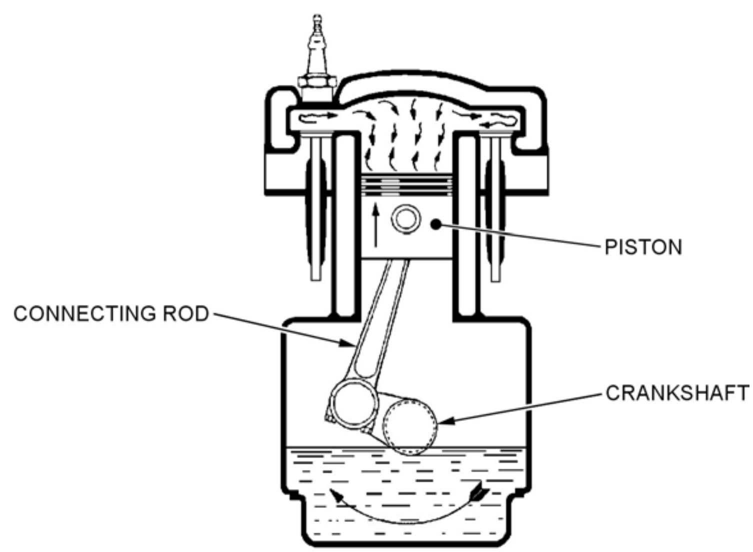
INTAKE STROKE



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

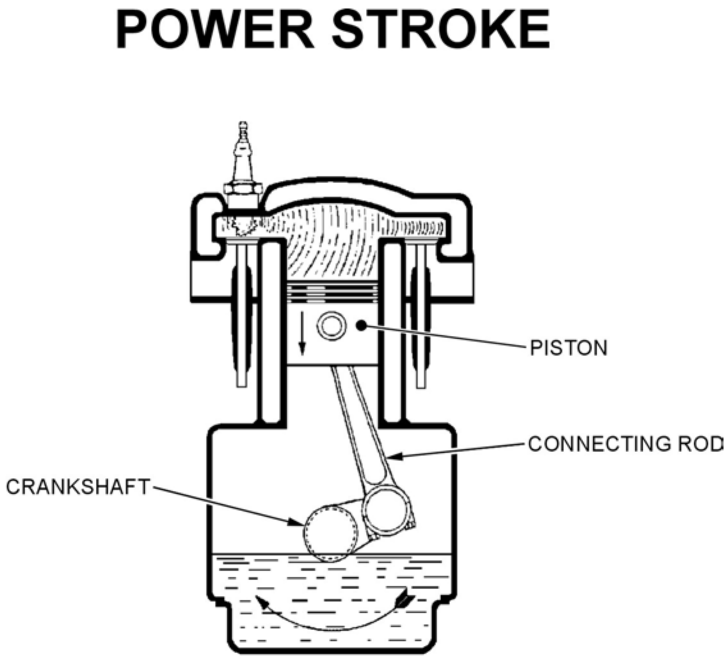
Figure A-1 Intake Stroke

COMPRESSION STROKE



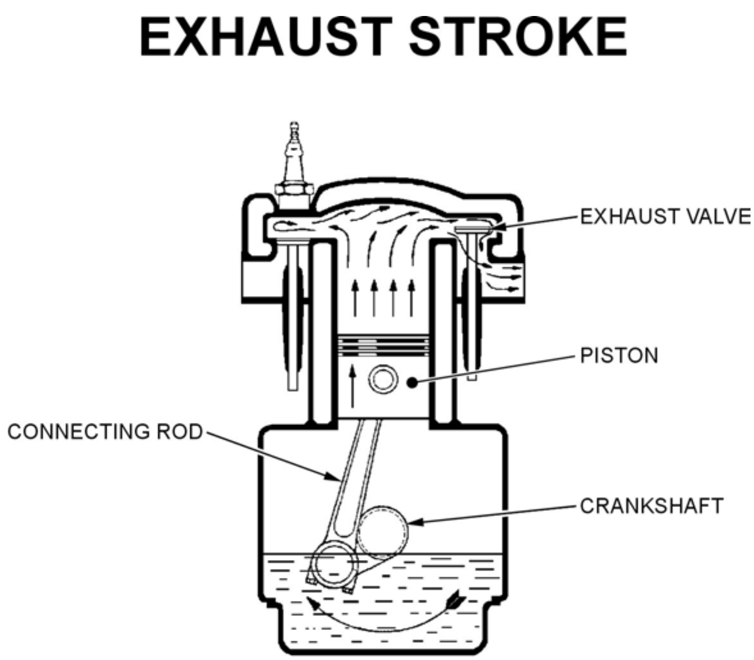
Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-2 Compression Stroke



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

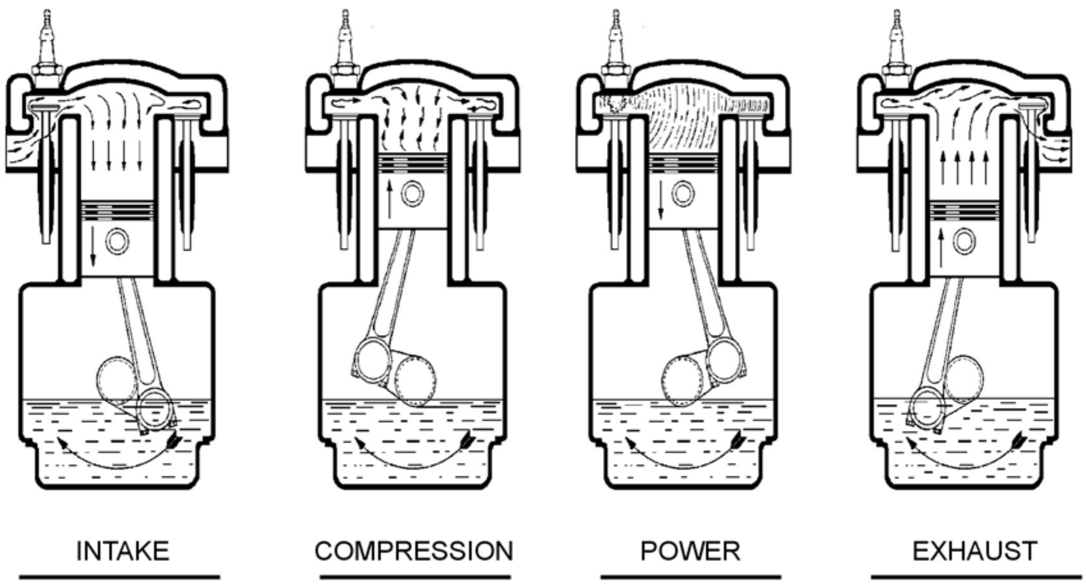
Figure A-3 Power Stroke



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-4 Exhaust Stroke

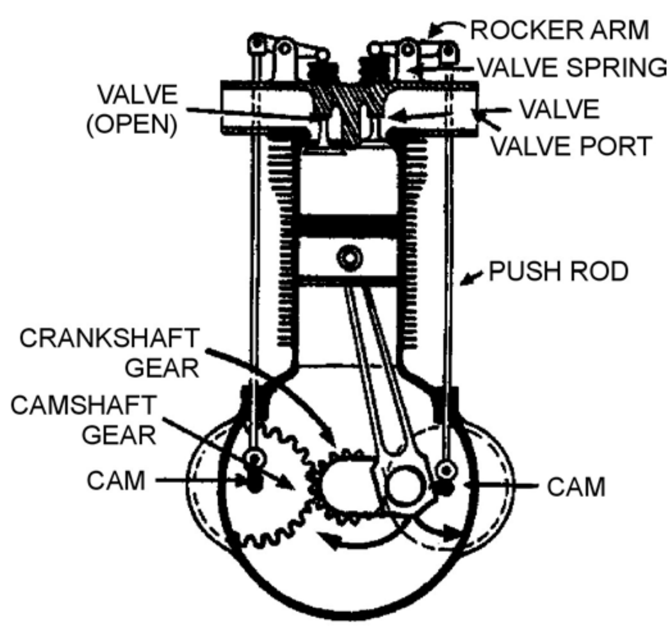
FOUR-STROKE CYCLES



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-5 Cycles of a Four-stroke Piston-powered Engine

VALVE MECHANISM



A-CR-CCP-263/PT-001 (p. 56)

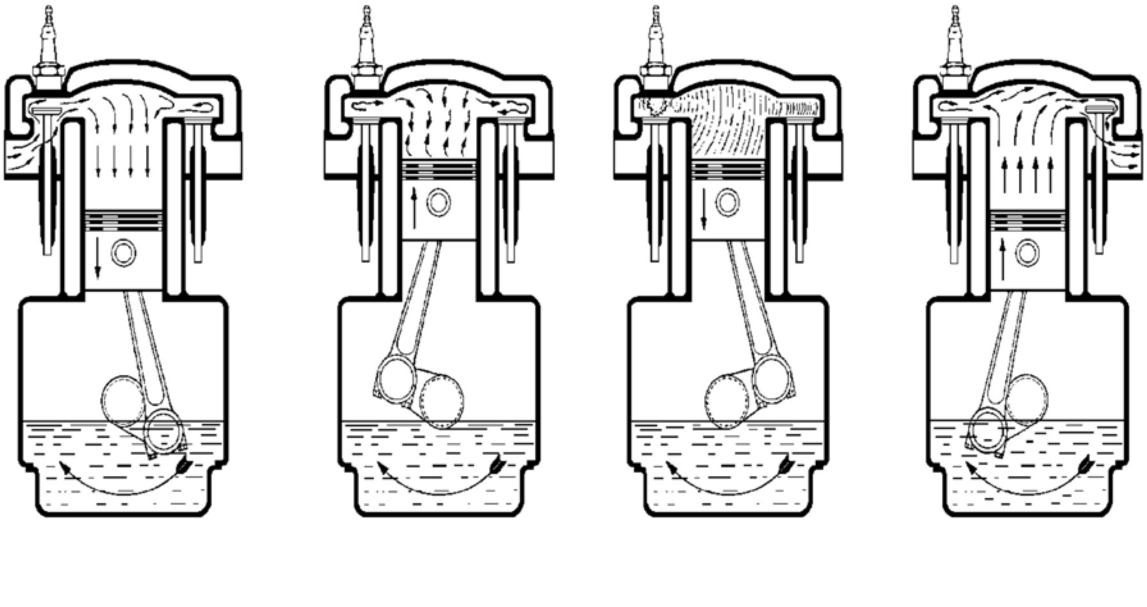
Figure A-6 Valve Mechanism

THIS PAGE INTENTIONALLY LEFT BLANK

ACTIVITY IDENTIFYING DIFFERENT STROKES

FILL IN THE NAME OF EACH STROKE IN THE CORRECT SPACE.

NAME: ________________



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure B-1 Identify the Cycles

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO M232.04 – RECOGNIZE THE FUNCTIONS OF OIL IN A FOUR-STROKE PISTON-POWERED ENGINE

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-802/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 or handout of Figure A-1.

Copy handouts of Figure B-1 for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP3 to TP5 to introduce the functions of oil in a four-stroke piston-powered engine and to give an overview of them.

An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to recognize the functions of oil in a four-stroke piston-powered engine.

IMPORTANCE

It is important for cadets to learn about the four functions of oil because specific oil is required for the efficient operation and maintenance of engines that are so critical to aviation.

Teaching Point 1 | **Explain That Oil Lubricates the Engine**

Time: 5 min | Method: Interactive Lecture

Show the cadets a slide or handout of the functions of oil located at Annex A.

Oil plays an important role in the functioning of an aircraft engine. Oil fulfills four important functions:

- Lubricating,
- Sealing,
- Cooling, and
- Flushing.

LUBRICATING

Oil lubricates the engine by creating a smooth surface between parts that rub together, such as the piston when it moves up and down in the cylinder.

Oil is manufactured in different grades and viscosities. The grade of a particular sample of oil is a measure of its ability to maintain its viscosity, or resistance to flow, under extreme temperatures.

The viscosity, or resistance to flow, affects the oil's stickiness. Low-viscosity oil flows more easily than high-viscosity oil. Oil thins as its temperature is raised so the correct grade of oil must be selected for the intended condition when the engine is at operating temperature. Oil that is too thin (too low a viscosity number) at operating temperature will result in low oil pressure and will not protect the engine component surfaces adequately. Oil that is too thick will result in too high an oil pressure and will not be delivered in sufficient quantity when the engine is cold.

A good grade of oil is one in which the changes in viscosity, due to widely varying operating temperatures, are small.

The engine manufacturer specifies what oil to use and this direction must be followed to avoid engine wear.

Cold oil is often too thick to be delivered to the engine component's metal surfaces in sufficient quantity so when an engine is cold it should not be run fast or given a load. An aircraft will often be seen sitting still with the engine and propeller running while the engine oil comes up to temperature, just like a car in the winter.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. How does oil lubricate an engine?

Q2. Who specifies the correct oil for an engine?

Q3. What does the viscosity number of oil mean?

ANTICIPATED ANSWERS

A1. Oil lubricates the engine by creating a smooth surface between parts that rub together.

A2. The manufacturer of the engine specifies the correct oil to use.

A3. The viscosity number indicates the oil's resistance to flow; the higher the number the greater the resistance.

Teaching Point 2 — **Compare Friction and Heat**

Time: 5 min — Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets experience the effects of lubrication.

RESOURCES

Hand cream.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Have the cadets rub their hands together firmly to generate heat and friction.
2. Place a drop of hand cream on the palm of one of the cadets' hands and have them repeat the rubbing exercise.
3. Discuss the experience.
4. Ask cadets if their hands slid easier and felt cooler with hand cream.

Conduct a brief discussion to allow the cadets to share their experience with the class and to reflect on it:

- Did hands slide easier with hand cream? The answer should be yes.
- Did hands feel cooler with hand cream? The answer should be yes.

If a cadet does not agree that hands slide easier and that hot spots disappear when hand cream is applied, have them repeat the experiment. Ensure that hands are rubbed vigorously before hand cream is applied and apply hand cream generously.

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 That Oil Seals the Combustion Chamber**
Time: 5 min	Method: Interactive Lecture

SEALING

Oil seals the combustion chamber by preventing the expanding gases from leaking out during the power stroke. It does this by creating a barrier between the engine components so that air and other gases cannot get through. This is especially important in the cylinder, so that the exploding gasoline and air mixture does not escape.

Oil has conflicting demands to meet. A high viscosity (resistance to flow) provides the best seal for the combustion chamber but a low viscosity enables the oil to be delivered in greater quantity to bearing surfaces. The same oil must do both jobs and so the engine manufacturer must consider both of these competing requirements when specifying the viscosity and grade of oil to be used.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What part of the engine does oil help seal and why?

Q2. How does oil provide a seal?

Q3. What conflicting demands must oil meet?

ANTICIPATED ANSWERS

A1. Oil seals the combustion chamber to prevent the expanding gases from leaking out.

A2. Oil seals engine parts by creating a barrier between them.

A3. Oil must be thin enough to flow to bearing surfaces but it must also be thick enough to seal the combustion chamber.

Teaching Point 4	**Explain That Oil Cools Hot Spots in the Engine**
Time: 5 min	Method: Interactive Lecture

COOLING

Some parts of the engine get hotter than other parts. Areas near the combustion chamber get particularly hot and need to be cooled. Oil cools hot spots in the engine by carrying heat away and equalizing temperature within the engine. This equalization of temperature also helps to bring a cold engine up to operating temperature quickly.

Oil must maintain its viscosity while near the heat of the combustion chamber and so manufacturers of oil have developed viscosity modifiers that lessen the change of viscosity that results from temperature change. Engine manufacturers take this into consideration when specifying what oil to use.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What engine parts get particularly hot?

Q2. How does oil cool hot spots in the engine?

Q3. What must oil be able to do near the combustion chamber?

ANTICIPATED ANSWERS

A1. Engine parts near the combustion chamber get particularly hot.

A2. Oil cools hot spots in the engine by carrying heat away and equalizing temperature.

A3. Oil must maintain its viscosity while near the heat of the combustion chamber.

Teaching Point 5	Explain That Oil Removes and Holds Particles Harmful to the Engine
Time: 5 min	Method: Interactive Lecture

FLUSHING

Oil flushes the engine. It removes and holds tiny particles and grit, which are harmful to the engine. This means the oil carries away dirt and debris from the engine as it flows through. This is why it is important to change oil at frequent intervals as specified by the engine manufacturer.

As the oil is continuously circulated around the engine it passes through an oil filter. This filter fills with debris and must also be changed at regular intervals to remain effective, just as in a car.

Distribute handouts of Figure B-1 and have the cadets fill in the four functions of oil.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS

Q1. How does oil clean the engine?

Q2. Who specifies oil change intervals?

Q3. What component must be changed regularly, as well as the oil, to remain effective?

ANTICIPATED ANSWERS

A1. Oil removes and holds tiny particles and grit, which are harmful to the engine.

A2. The engine manufacturer specifies oil change intervals.

A3. The oil filter must be changed regularly to remain effective.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What are the functions of oil in an engine?

Q2. Why must oil be changed according to the engine manufacturer's instruction?

Q3. What conflicting demands must oil meet?

ANTICIPATED ANSWERS

A1. The functions of oil in an engine are lubricating, sealing, cooling and flushing.

A2. Oil must be changed according to the engine manufacturer's instruction to extend engine life.

A3. Oil must be thin enough to flow to bearing surfaces but it must also be thick enough to seal the combustion chamber.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

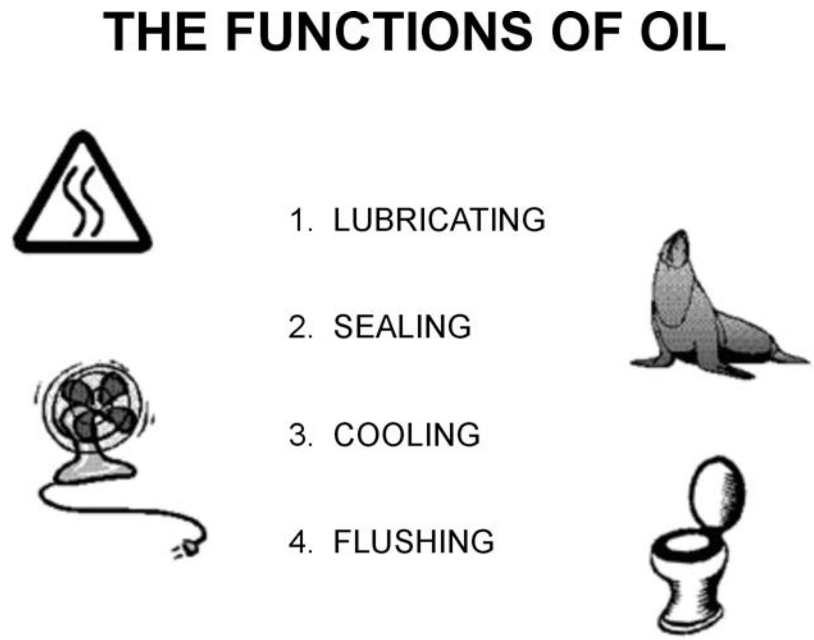
Oil is of first importance to engine operation and maintenance and, if the manufacturer's directions are followed, it will prolong engine life.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.



Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure A-1 Oil's Functions

THIS PAGE INTENTIONALLY LEFT BLANK

NAME OIL'S FUNCTIONS

NAME THE FOUR FUNCTIONS OF OIL.

NAME:________________

1.

2.

3.

4.

Cadets Canada: RCSU Pacific, 2007, Air Cadet Master Lesson Plans. Retrieved 7 March 2007, from http://www.regions.cadets.ca/pac/aircad/resources/mlp_air_e.asp

Figure B-1 Name Oil's Functions

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 5

EO C232.01 – IDENTIFY THE CHARACTERISTICS OF GAS TURBINE ENGINES

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 or photocopy the handouts located at Annexes A, B, C and D for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP3 to TP5 to introduce the characteristics of gas turbine engines and give an overview of them.

An in-class activity was chosen for TP2 and TP6 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

Review EO M232.01 (Identify Types of Aircraft Engines), to include:

- turbojet engines,
- turbofan engines, and
- turboshaft engines.

OBJECTIVES

By the end of this lesson the cadet shall identify the characteristics of gas turbine engines.

IMPORTANCE

It is important for cadets to know about the characteristics of gas turbine engines because this knowledge will enable them to recognize a variety of propulsion applications and to recognize reasons for the performance differences between various classes of aircraft.

Teaching Point 1	**Explain That a Jet Engine Is a Reactive Engine**
Time: 5 min	Method: Interactive Lecture

A jet engine is a reactive engine, which propels itself by ejecting material to create a force, as described by Newton's third law of motion.

Newton's third law states that for every action there is an equal and opposite reaction. All propulsion systems rely on this fact in some way. A jet engine propels itself in one direction by ejecting a fluid (hot gas) in the opposite direction.

The amount of thrust developed by ejecting hot gas depends on the mass and velocity of the material ejected. To develop a lot of thrust, a lot of material must be ejected or else it must be ejected at high velocity. Most of the mass ejected by a jet engine comes from the air, which is scooped up from the atmosphere that the jet is passing through. That scooped air is raised to a high velocity by burning fuel.

Since the jet engine can always get more air, its thrust duration is limited only by the amount of fuel that it has available.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is Newton's third law of motion?

Q2. What determines the amount of thrust developed by a jet engine?

Q3. What determines the possible duration of a jet engine's thrust?

ANTICIPATED ANSWERS

A1. Newton's third law of motion states that for every action there is an equal and opposite reaction.

A2. The mass and the speed of the ejected material determine the amount of thrust.

A3. A jet engine's thrust duration is determined by the amount of fuel that it has available.

Teaching Point 2	**Make and Operate a Pop Can Hero Engine**
Time: 15 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets build and operate a pop can Hero engine to learn that an equal and opposite reactive force, as described by Newton, can cause an object to spin.

RESOURCES

- Instructions for making a pop can Hero engine located at Annex A.
- Empty pop can with the opener-lever still attached (one per group of four cadets),
- Common nail - one per group,
- String (very light, or dental floss), and
- Bucket or tub of water (one per group).

ACTIVITY LAYOUT

This activity is to be carried out in an area with a waterproof floor covering.

ACTIVITY INSTRUCTIONS

1. Fill tubs half-full of water to refill an empty pop can.
2. Give each group one empty pop can which still has the opening lever attached and bent straight up from the centre.
3. Give each group a metre of very fine string or dental floss.
4. Lay the pop can on its side as shown at Annex A.
5. Using a nail, punch a hole in the side of the pop can near the bottom as shown in Step 1 of Figure A-1 (ensure the holes are punched straight).
6. Rotate the pop can and punch one hole every 90 degrees, making four equally spaced holes.
7. Thread the string through the pop can opener-lever.
8. Have the cadets fill their pop can Hero engines with water and suspend them above the tub of water so the water drains into the tub.

The pop can Hero engine is unfinished at this point. The pop can Hero engine should not rotate as the water drains.

9. Now, have the cadets insert the nail back into each hole and bend each hole as shown at step 2 of Figure A-1. The holes should all be bent in the same direction, either clockwise or counterclockwise, so that the pop can Hero engine will spin under the equal and opposite reaction of the water draining.
10. Have the cadets refill their pop can Hero engines with water from their buckets and suspend the pop can Hero engines above the buckets with string. This time, while the water drains, the pop can Hero engine will spin.

The velocity of the spin should increase as long as the water continues to drain, if very fine string is used for suspension.

SAFETY

Avoid spilling water on the floor as it may become dangerously slippery.

CONFIRMATION OF TEACHING POINT 2

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

Teaching Point 3 **Describe the History of Reaction Engine Development**

Time: 10 min Method: Interactive Lecture

A SHORT HISTORY OF TURBINE ENGINES

150 BC – Hero. An Egyptian philosopher and mathematician, invented a toy (Aeolipile) that used steam to rotate on top of a boiling pot of water. The escaping steam caused a reaction that moved several nozzles arranged on a wheel.

1232 – Battle of Kai-Keng. Chinese soldiers used rockets as weapons to repel the Mongols at the Battle of Kai-Keng. Burning gunpowder and the reaction principle were used to propel the rockets. After Kai-Keng, the Mongols used rockets and it is believed that they brought the technology to Europe.

1500 – Leonardo da Vinci. He drew a sketch of a device, the chimney jack, which rotated due to the movement of smoke and hot gases flowing up a chimney. This device used hot air to rotate a shaft, which turned a spit. The hot air from the fire rose upward to pass through a series of fanlike blades that turned a shaft, which turned the roasting spit.

1629 – Giovanni Branca. He developed a stamping mill for bending metal. His stamping mill used jets of steam to spin a turbine, which rotated a shaft to operate the machinery.

1872 – Dr. F. Stolze. He designed the first true gas turbine engine. His engine used a multi-stage turbine section and a flow compressor. This engine never ran under its own power.

1930 – Sir Frank Whittle. He designed a gas turbine for jet propulsion in England. The first successful use of this engine was in April, 1937. His early work on the theory of gas propulsion was based on the contributions of most of the earlier pioneers of this field.

1939 – Heinkel Aircraft Company. This company flew the first gas turbine jet, the HE178.

1941 – Sir Frank Whittle. He designed the first successful turbojet airplane, the Gloster Meteor. Whittle improved his jet engine during World War II and in 1942, he shipped an engine prototype to General Electric in the United States. America's first jet aircraft was built the following year.

1942 – Dr. Franz Anslem. He developed the axial-flow turbojet, which was used in the Messerschmitt Me 262, the world's first operational jet fighter.

After World War II, the development of jet engines was directed by a number of commercial companies. Jet engines soon became the most popular method of powering high-performance aircraft.

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets construct a simple gas turbine that will convert axial gas flow into rotary motion.

RESOURCES

- Instructions for making a single-element reaction turbine located at Annex B,

- Scissors,
- Straight pin, and
- Pencil with eraser.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Cut out the rectangle shown in Figure B-1. Next, cut along each dotted line stopping about two centimetres from the hole in the centre of the square.
2. Take a straight pin and punch a hole in the top left corner of each of the four flaps. (No two holes should be next to each other.)
3. Pick up a flap at a punched corner and carefully curve it over toward the centre hole, securing it with the pin. Repeat this for the other flaps.
4. When all four flaps are held by the pin, carefully lift the paper without letting the flaps unfurl.
5. Lay the pencil flat on a table and carefully push the point of the pin into the side of the eraser.

Cadets can make the turbine spin by blowing directly into the centre of the blades. This action converts the axial movement of the air into rotary motion of the turbine blades.

The rotary motion of the turbine can be used for many purposes such as operating an air compressor or an electrical generator.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What was the earliest known use of hot gases to produce rotary motion?

Q2. What did Leonardo da Vinci use hot gases to produce rotary motion for?

Q3. What aircraft was the first to fly with a gas turbine jet?

ANTICIPATED ANSWERS

A1. In 150 BC, Hero, an Egyptian philosopher and mathematician, used hot gases in a rotary toy.

A2. Leonardo da Vinci used hot gases to produce rotary motion for cooking food on a spit.

A3. The Heinkel HE178 was the first to fly with a gas turbine jet.

Teaching Point 4	Explain the Advantages of Using a Turbine
Time: 5 min	Method: Interactive Lecture

Show the cadets a slide or distribute a handout of Figure C-1.

The earliest jet to fly was a ramjet, the simplest jet engine, which has no moving parts. The speed of the aircraft forces air into the small volume of the engine, increasing air pressure and density. Ramjet application is restricted by the fact that its air compression depends on forward speed. The ramjet develops no static (stationary) thrust and very little thrust in general when travelling below the speed of sound. As a consequence, a ramjet vehicle requires some form of assisted takeoff, such as another aircraft, and so it has been used primarily in guided-missile systems.

In 1930, Sir Frank Whittle's ingenious idea of placing a turbine into the stream of hot exhaust gases allowed the operation of a compressor to solve the problem of running the engine at low speeds or static conditions. This is the secret of the turbojet engine and of all other refinements of the design, such as turboprops, turbofans and turboshafts.

Point out to the cadets the turbine shown in Figure C-2 and the absence of a turbine in Figure C-1.

Another benefit of turbines in jet engines is that they provide power for all sorts of ancillary flight instruments and other systems. In a modern airliner, turbine power provides everything from radio communications with the air traffic control tower to hot water for the passengers.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What was the first type of jet to fly?

Q2. What is the principle difference between a turbojet and a ramjet?

Q3. What additional use has been found for turbine power on aircraft besides compressing air?

ANTICIPATED ANSWERS

A1. The first type of jet to fly was a ramjet, which relied on high speed to compress air for combustion.

A2. A turbojet can run at low speed or even under static conditions but a ramjet cannot.

A3. In addition to compressing air, turbines are used to power ancillary systems such as radios.

Teaching Point 5	**Identify and Describe the Parts of a Gas Turbine Turbofan Engine**
Time: 5 min	Method: Interactive Lecture

Show the cadets a slide or distribute a handout of Figure D-1.

The four basic parts of any gas turbine jet engine are the compressor, combustor, turbine, and nozzle, all of which process air, or core air, which travels through the engine. In the most common gas turbine aircraft engine, the turbofan, there is also the fan, which provides bypass air as well as core air, and a mixer, which combines the core airflow with the bypass airflow. The reduced engine noise levels and the excellent fuel efficiency of the turbofan engine have made it the engine design of choice for most modern commercial applications. Examples of varied turbofan applications are the CF-18's two GE F404 low bypass turbofan engines and the A380 Airbus's four Rolls-Royce Trent 900 high bypass turbofan engines; two dissimilar applications that both favour turbofan technology.

PARTS OF A TURBOFAN ENGINE

Fan. The fan is the first component in a turbofan. The fan pulls air into the engine. The air then splits it into two parts. One part continues through the "core" or centre of the engine, where it is acted upon by the other engine components. The second part "bypasses" the core of the engine, travelling through a duct to the back of the engine where it produces much of the force that propels the aircraft forward.

Compressor. The compressor is the first component in the engine core. The compressor squeezes the air into a smaller volume, increasing its pressure. The air is then forced into the combustor.

Combustor. In the combustor the air is mixed with fuel and ignited, producing high temperature, expanding gases.

Turbine. The high-energy airflow coming out of the combustor goes through the turbine, causing the turbine blades to rotate. The task of the turbine is to convert the linear gas motion into rotary mechanical work to drive the compressor, which then feeds the combustor with high-pressure air.

Nozzle. The nozzle is the engine's exhaust outlet. The hot, high-pressure gases that have passed through the turbine, combined with the colder air that bypassed the engine core, produce a force when exiting the nozzle that acts to propel the engine, and therefore the aircraft, forward. The nozzle may be preceded by a mixer, which combines the high temperature air coming from the engine core with the lower temperature air that was bypassed in the fan. The mixer results in a quieter engine.

Afterburner. In addition to the basic components of a gas turbine jet engine, one other process is occasionally employed to increase the thrust of a given engine. Afterburning consists of the introduction and burning of raw fuel between the engine turbine and the jet nozzle, utilizing the unburned oxygen in the exhaust gas to support combustion. The increase in the temperature of the exhaust gases further increases their velocity as they leave the propelling nozzle, which thereby increases the engine thrust. This increased thrust could be obtained by the use of a larger engine, but this would increase the weight and overall fuel consumption.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS

Q1. What are the four basic parts of any gas turbine jet engine?

Q2. In addition to the four basic parts, what two parts are found in a turbofan jet engine?

Q3. What are two features of the turbofan that make it attractive for modern commercial aircraft?

ANTICIPATED ANSWERS

A1. The four basic parts of any gas turbine jet engine are compressor, combustor, turbine, and nozzle.

A2. In addition to the four basic gas turbine jet parts, a turbofan has a fan and a mixer.

A3. Two features of the turbofan that make it attractive for modern commercial aircraft are noise reduction and fuel efficiency.

Teaching Point 6	**Conduct a Crossword Game Based on Jet Power**
Time: 15 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to provide the cadets with an opportunity to use the terminology and definitions that have been learned in this lesson.

RESOURCES

- Coin,
- Flip chart, and
- Markers.

ACTIVITY LAYOUT

In the centre of a flipchart, print the word “combustion”.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into two teams.
2. Determine the order of play by flipping a coin.
3. The first team must make a word from terminology presented in this lesson, using a letter from the word “combustion” written on the flipchart in crossword manner.
4. For each letter in the new word the team will get one point.
5. Before the word can be written on the flipchart, the definition for the word must be provided by the team and the instructor must accept both the word and the definition.
6. Subsequent plays can utilize any letters on the flipchart.

7. Any letter reused is worth two points.
8. The object of the game is to get the most points for the most letters in the time allowed.

Ensure that both teams get an equal number of turns.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 6

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

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What determines the amount of thrust developed by a jet engine?

Q2. What is the principle difference between the operations of a turbojet and those of a ramjet?

Q3. What are the four basic parts of any gas turbine jet engine?

ANTICIPATED ANSWERS

A1. The mass and the speed of the ejected material determine the amount of thrust.

A2. A turbojet can run at low speed or even under static conditions but a ramjet cannot.

A3. The four basic parts of any gas turbine jet engine are the compressor, combustor, turbine, and nozzle.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

The gas turbine engine has proven so effective and adaptable that it has become one of the most popular solutions for aviation; Air Cadets will see gas turbines used in many applications.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-003 (ISBN 0-943210-44-5) Pike, B. and Busse, C. (1995). *101 More Games for Trainers.* Minneapolis, MN: Lakewood Books.

C3-016 EG-2003-01-108-HQ NASA. (2003). *Rockets: A Teacher's Guide With Activities in Science, Mathematics, and Technology.* Washington, DC: NASA.

C3-057 (ISBN-10 1-59647-055-0) Sobey, E. (2006). *Rocket-powered Science.* Tucson, AZ: Good Year Books.

C3-084 NASA Glenn Research Center. *Engines 101 – Ultra-Efficient Engine Technology (UEET).* Retrieved 21 February 2007, from http://www.ueet.nasa.gov/Engines101.html#Aeronautics.

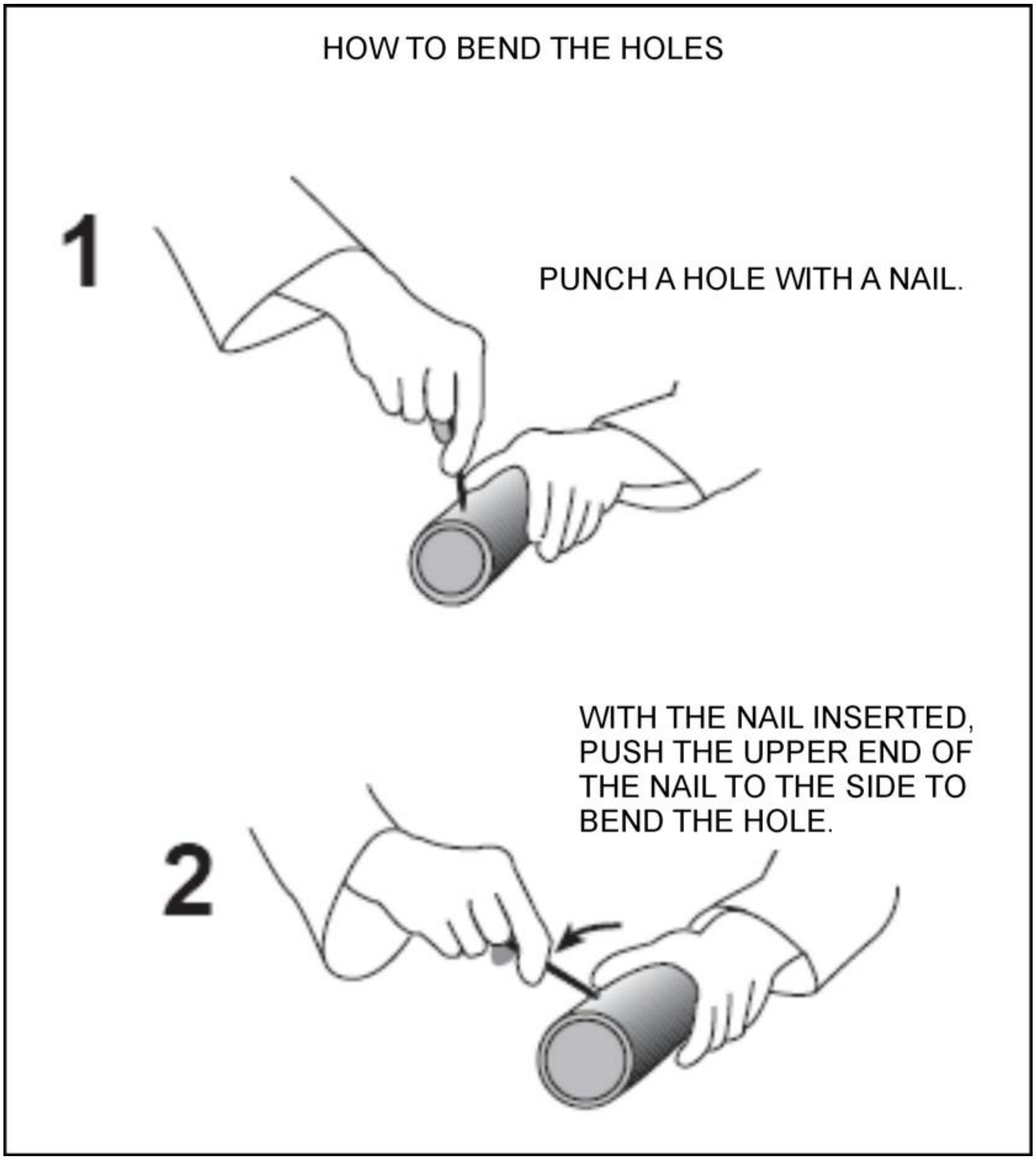
C3-086 NASA Glenn Research Center. *Engines 101.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/icengine.html.

C3-087 NASA Glenn Research Center. *Propulsion Index.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html.

C3-088 NASA Glenn Research Center. *Beginner's Guide to Rockets.* Retrieved 21 February 2007, from http://exploration.grc.nasa.gov/education/rocket/bgmr.html.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Limited.

MAKING A POP CAN HERO ENGINE

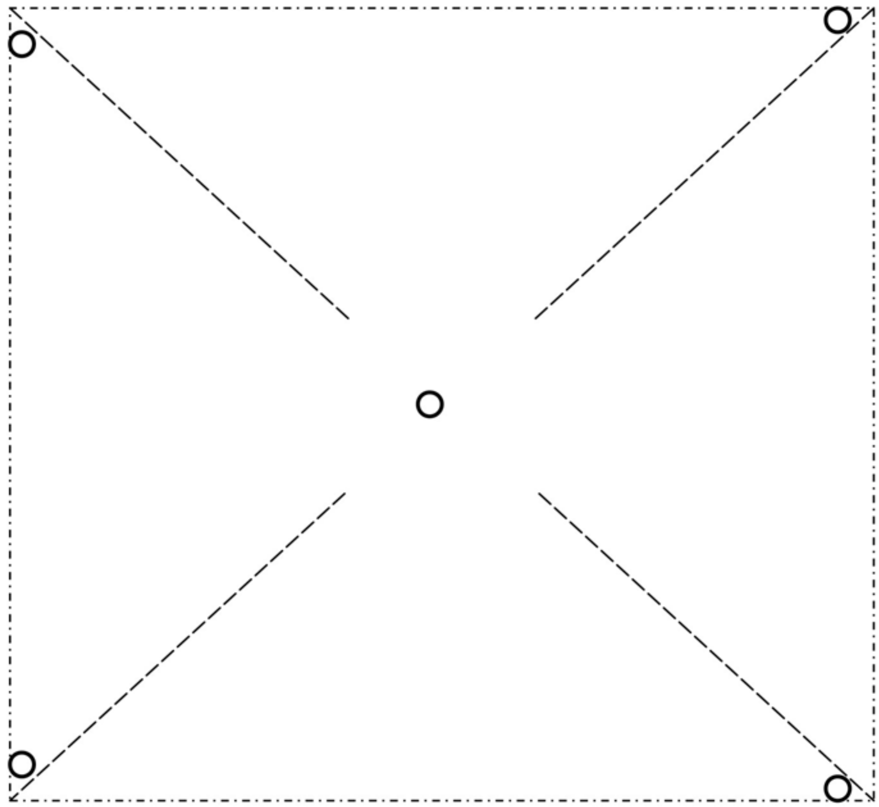


NASA, Rockets: A Teacher's Guide with Activities in Science, Mathematics and Technology, NASA (p. 30)

Figure A-1 Making a Pop Can Hero Engine

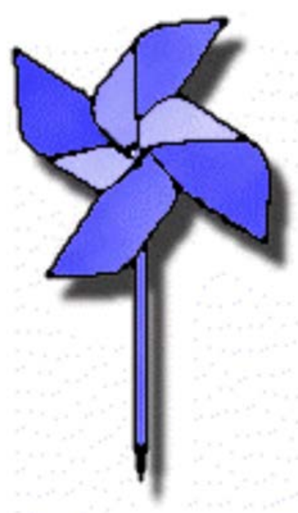
THIS PAGE INTENTIONALLY LEFT BLANK

SINGLE-ELEMENT REACTION TURBINE



D Cdts 3, 2007 Ottawa, ON: Department of National Defence

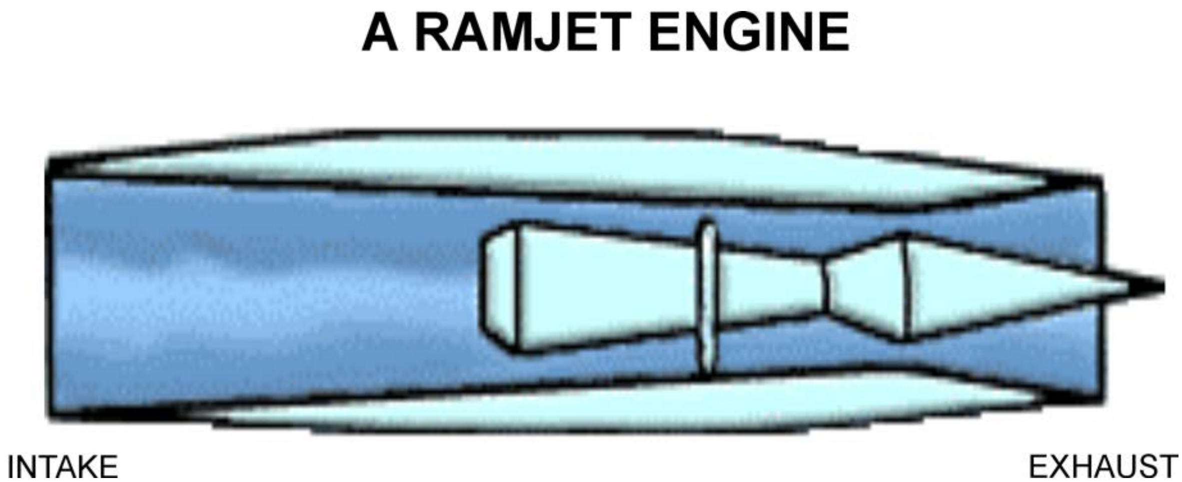
Figure B-1 Single-element Reaction Turbine Template



The Franklin Institute. "Resources for Science Learning" Pinwheel Wind Collector. Retrieved 21 February 2007, from http://sln.fi.edu/tfi/units/energy/pinwheel.html

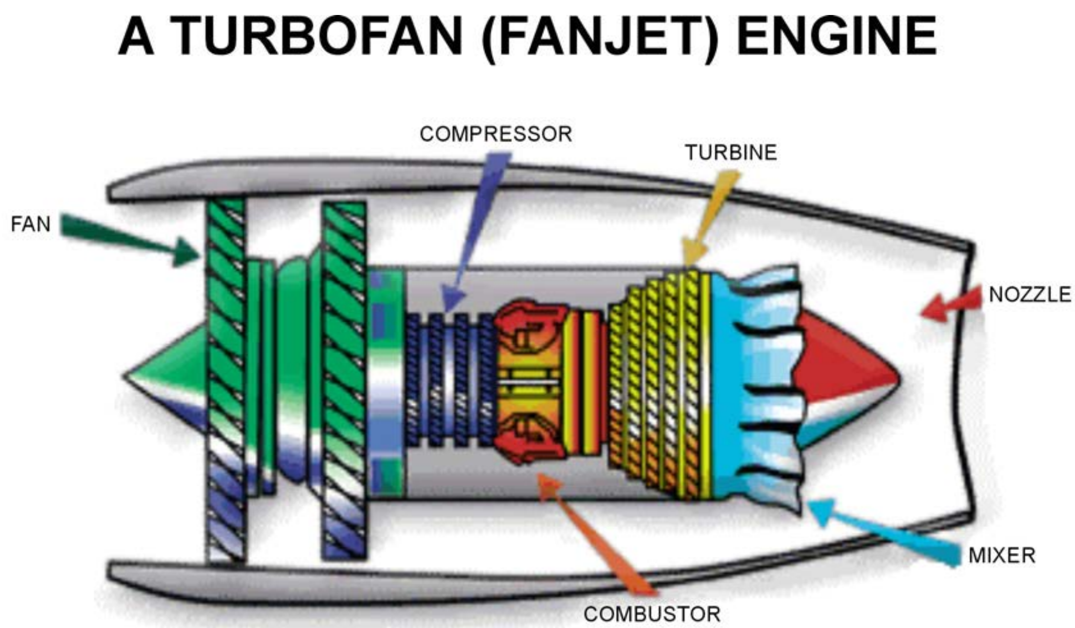
Figure B-2 Single-element Reaction Turbine

THIS PAGE INTENTIONALLY LEFT BLANK



*NASA "Engines 101". Ultra Efficient Engine Technology (UEET). (2001).
Retrieved 17 March 2007, from http://www.ueet.nasa.gov/Engines101.html*

Figure C-1 A Ramjet Engine

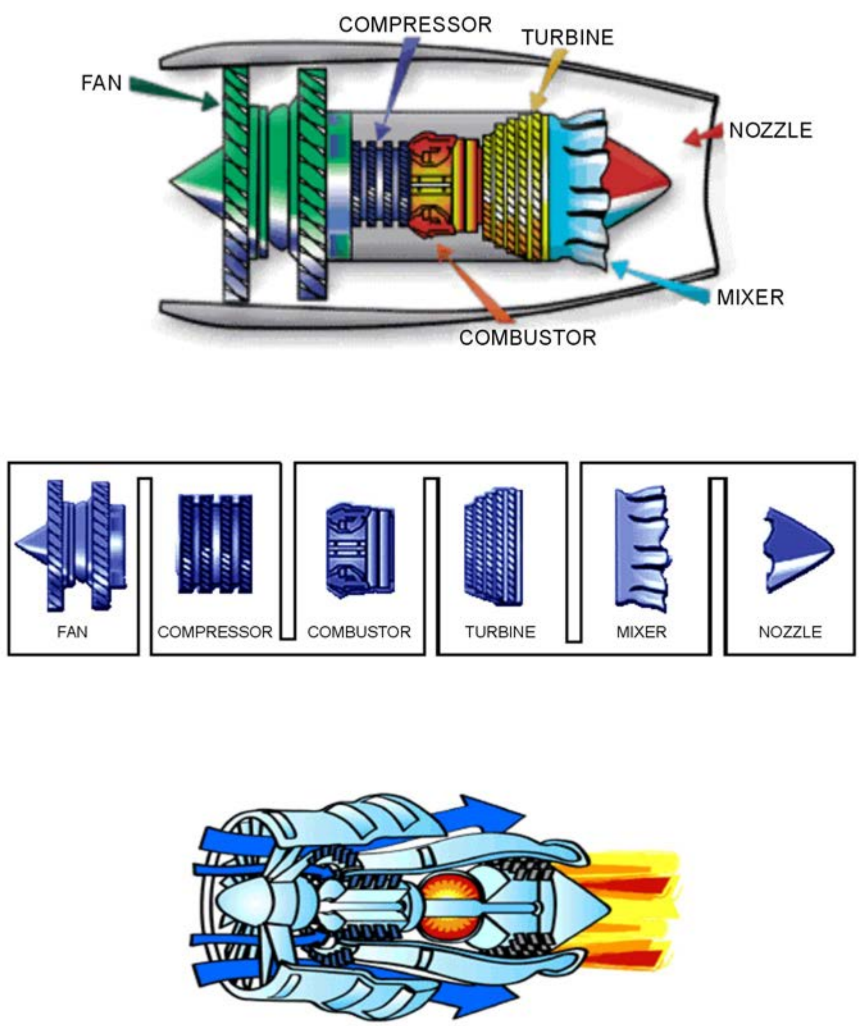


*NASA "Engines 101". Ultra Efficient Engine Technology (UEET). (2001).
Retrieved 17 March 2007, from http://www.ueet.nasa.gov/Engines101.html*

Figure C-2 A Fanjet (Turbofan) Engine

THIS PAGE INTENTIONALLY LEFT BLANK

PARTS OF A TURBOFAN (FANJET) ENGINE



NASA "Engines 101". Ultra Efficient Engine Technology (UEET). (2001).
Retrieved March 17, 2007, from http://www.ueet.nasa.gov/Engines101.html

Figure D-1 Turbofan Parts

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 6

EO C232.02 – IDENTIFY THE CHARACTERISTICS OF ROCKET ENGINES

Total Time:	90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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 or photocopy the handouts located at Annexes A, B, C, D and Annex A to EO C232.03.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1, TP3, TP4 and TP5 to introduce rocket engines and give an overview of them.

An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify the characteristics of rocket engines.

IMPORTANCE

It is important for cadets to know about the characteristics of rockets so that they can understand the Canadian Space Agency's mission to promote the peaceful use and development of space, to advance the knowledge of space through science and to ensure that space science and technology provide social and economic benefits for Canadians.

Teaching Point 1	Explain Aspects of Reactive Thrust Used in Propulsion
Time: 5 min	Method: Interactive Lecture

Every method of propulsion relies on Newton's third law, which states that for every action there is an equal and opposite reaction. This is most obvious when the original action affects an object that is close in size to the object that the reaction affects, such as when a swimmer pushes a floating object. In that case, the swimmer is pushed backward when the object is pushed forward.

However, when the object to be pushed is as large as the Earth, as in the case of a person taking a step forward, it is not so obvious that the Earth moves in the opposite direction when the step is taken. Yet the tiny motion of the Earth is in the opposite direction. The difference in the amount moved is proportional to the difference in weight between the Earth and the walker, so that the reaction is equal, as well as opposite.

In that same way, a wheeled vehicle such as an automobile pushes on the Earth when it begins its journey. Since the automobile is much smaller than the Earth, the smaller mass of the automobile moves much more than the great mass of the Earth. The swimmer, the person walking and the wheeled automobile are all relying on traction to propel them forward.

Newton's third law of motion also dictates the movement of propeller-driven aircraft and jet aircraft. The forward motion of aircraft depends on pushing gases backward instead of pushing the Earth backward. A propeller pushes air backwards and this is called prop wash. A jet engine ejects hot exhaust gases backwards. To move in any direction, all objects and all creatures, whether living or artificial, must push matter of some sort in the opposite direction.

Newton's third law of motion states that for every action there is an equal and opposite reaction. The third law can be correctly interpreted to mean that for every desired reaction there must be an equal and opposite action.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What does Newton's third law of motion state?

Q2. Why does the Earth not seem to move backwards when a person steps forward?

Q3. What does a propeller-driven aircraft create to move forward?

ANTICIPATED ANSWERS

A1. Newton's third law of motion states that for every action there is an equal and opposite reaction.

A2. The Earth does move when a person steps forward, but the ratio of the weight of the Earth versus the weight of the person is so great that the movement of the Earth is too small to be seen.

A3. A propeller-driven aircraft creates prop wash to move forward.

Teaching Point 2 — **Explore Newton's Third Law of Motion by Operating Balloon Rockets**

Time: 20 min — Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets explore Newton's third law of motion by staging and operating balloon rockets.

RESOURCES

- Instructions for staging balloon rockets located at Annex A,
- Balloons,
- String,
- Straw,
- Tape, and
- Paper or Styrofoam cup.

ACTIVITY LAYOUT

This activity requires a large area to suspend a string guidance system. Place the string through two drinking straws and suspend the string horizontally about 1-1/2 metres above the floor with the ends as far apart as possible. Tighten the string.

ACTIVITY INSTRUCTIONS

1. Tape two inflated but untied balloons to the two drinking straws as shown in Figures A-1 and A-2.
2. Cut off the bottom of the paper or Styrofoam cup and place it over the junction between the two balloons so that air cannot escape from the second stage until the first stage is spent and jettisoned.
3. Release the first stage balloon and allow the two-stage rocket to travel as far as possible down the guidance string.

Point out to the cadets that the air ejected from the balloon causes the balloon to accelerate forward according to Newton's third law of motion. Point out that the energy involved came from cadets when they puffed hard to inflate the balloons.

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 How Rocket Systems Operate in Space**

Time: 5 min Method: Interactive Lecture

A balloon rocket would work in outer space. The air that is ejected from the balloon would produce the same opposite and equal reaction in space that it does in the Earth's atmosphere, except that form drag from the atmosphere would not slow the balloon's travel. The balloon rocket's performance would be improved in space, without the form drag of air.

A reactive propulsion system can operate by ejecting any material. However, the higher the speed of the ejected material, the greater the resulting propulsive force will be. To raise the velocity of ejection, material is most often heated to create pressure. This has been the preferred solution since Hero used steam to operate his toy Aeolipile (pronounced A – O – lipile).

> Show the cadets a slide or distribute handouts of Aeolipile in Figure B-1.

Hero of Alexandria invented a rocket-like sphere called an Aeolipile, in about 150 BC, which used steam as a propulsive gas. Hero mounted it on top of a water kettle. A fire below the kettle turned the water into steam, which travelled through pipes to the Aeolipile. Two L-shaped tubes on opposite sides of the sphere allowed the steam to escape and so gave thrust to the sphere that caused it to rotate.

Heating of the material to be ejected most often involves combustion in contemporary rockets although other methods could be used. Rocket combustion systems operate in space because they are self-contained and require no atmospheric oxygen.

> Show the cadets a slide or distribute handouts of Combustion in Figure B-2.

Combustion in a rocket engine or a jet engine requires the rapid oxidization of fuel. A jet engine gets access to oxygen by drawing it from the surrounding air, so that a jet's range is limited to the atmosphere. A rocket develops thrust in much the same way as a jet, but a rocket carries its own oxygen supply. Rocket engines and jet engines both have nozzles to generate thrust.

> Show the cadets a slide or distribute handouts of a rocket nozzle in Figure B-3.

A rocket engine uses a nozzle to accelerate hot exhaust to produce thrust as described by Newton's third law of motion. The amount of thrust produced by the engine at any given moment depends on both the amount of gas ejected each second and its velocity. These are determined by the rocket nozzle design.

> A rocket works in outer space because it brings everything it needs with it.

The Earth's atmosphere is mostly nitrogen. Oxygen is only a fifth of the atmosphere's composition. Therefore, simply storing air for combustion would waste most of the storage space on unreactive nitrogen. To make good use of storage space, oxygen is stored in more pure forms, including liquid oxygen, or LOX. This gives the rocket engine the ability to operate for a longer period in outer space.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What must a reactive propulsion system eject to move forward?

Q2. Why is oxygen stored for a rocket's combustion instead of just air?

Q3. Why does a contemporary rocket engine heat the material to be ejected?

ANTICIPATED ANSWERS

A1. A reactive propulsion system can eject any material to move forward.

A2. Oxygen is stored for combustion instead of air because air is mostly nitrogen.

A3. A rocket engine heats the material to be ejected to create pressure to raise the velocity of the ejected material.

Teaching Point 4	**Explain the Differences Between Solid-fuel and Liquid-fuel Rocket Engine Systems**
Time: 10 min	Method: Interactive Lecture

CONSTRUCTION

There are three main categories of rocket engines; liquid rockets and solid rockets.

Liquid rocket propellants, the fuel and the oxidizer, are stored separately as liquids and are pumped into the combustion chamber of the nozzle where burning occurs.

Solid rocket propellants, both fuel and oxidizer, are mixed together to form a composite fuel and then packed into a solid cylinder. Under normal temperature conditions the solid rocket propellants do not burn until exposed to a source of heat provided by an igniter. Once the burning in a solid rocket starts, it proceeds until all the propellant is exhausted.

With a liquid rocket the pilot can stop or modify the thrust by turning off the flow of propellants; but with a solid rocket, the casing must be destroyed to stop the engine.

Liquid rockets tend to be heavier and more complex because of the pumps and storage tanks. The propellants are loaded onto the rocket just before launch. A solid rocket is much easier to handle and can sit for years before firing.

Show the cadets a slide or distribute handouts of Figure C-1 (Solid Rocket) and Figure C-2 (Liquid Rocket).

VEHICLE APPLICATIONS

Solid rocket engines are used on air-to-air and air-to-ground missiles, on model rockets and as boosters for satellite launchers, including the space shuttle's two solid rocket boosters (SRBs).

Liquid rocket engines are used in the Space Shuttle's main engines to place humans in orbit, on many robot missiles to place satellites in orbit and on several high-speed research aircraft.

FUELS AND OXIDIZATION

In a solid rocket, the fuel and oxidizer are mixed together into a solid propellant, which is packed into a solid cylinder. A hole through the cylinder serves as a combustion chamber. When the mixture is ignited, combustion takes place on the surface of the propellant. A flame front is generated which burns into the mixture. The combustion produces great amounts of exhaust gas at a high temperature and pressure. The amount of exhaust gas that is produced depends on the area of the flame front and engine designers use a variety of hole shapes to control the change in thrust for a particular engine. The hot exhaust gas is passed through a nozzle, which accelerates the flow. Thrust is then produced according to Newton's third law of motion.

In a liquid rocket, stored fuel and stored oxidizer are pumped into a combustion chamber where they are mixed and burned. The combustion produces great amounts of exhaust gas at high temperature and pressure. The hot exhaust is passed through a nozzle, which accelerates the flow. Thrust is produced according to Newton's third law of motion.

Show the cadets a slide or distribute handouts of Figure C-3 (Liquid System Rocket).

There are many parts that make up a liquid-fuelled rocket. For design and analysis, engineers group parts which have the same function into systems. There are four major systems in a full scale rocket: the structural system, the payload system, the guidance system and the propulsion system.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What does the term "composite" solid rocket fuel mean?

Q2. What operational advantages does a solid rocket have over a liquid rocket?

Q3. What great operational advantage does a liquid rocket have over a solid rocket?

ANTICIPATED ANSWERS

A1. A composite rocket fuel has both fuel and oxidizer mixed together.

A2. A solid rocket weighs less and is less complex.

A3. A liquid rocket can be controlled and shut off after ignition.

Teaching Point 5 — **Discuss American, Russian, European and Chinese Launch Vehicles**

Time: 15 min — Method: Interactive Lecture

Although space-age rocketry is often considered to be in its early stages, there are many launch vehicles to explore. One example each of American, Russian, European and Chinese launchers follow:

American Launch Vehicle – Ares

NASA currently has many launchers that they can match to particular missions. For manned space flight after the space shuttle program, the Ares series of rockets has been developed.

Show the cadets a slide or distribute handouts of Figure D-1 (Ares I Launch Vehicle).

Ares I is an in-line, two-stage rocket configuration topped by the Orion crew vehicle and its launch abort system. In addition to the vehicle's primary mission – carrying crews of four to six astronauts to Low Earth Orbit (LEO) – Ares I may also use its 22.5-tonne payload capacity to deliver resources and supplies to the International Space Station, or to "park" payloads in orbit for retrieval by other spacecraft bound for the Moon or other destinations.

The Ares I first stage is a single, five-segment Reusable Solid Rocket Booster (RSRB) derived from the Space Shuttle Program's reusable solid rocket motor, which burns a specially formulated and shaped solid propellant.

The Ares I second, or upper, stage is propelled by a J-2X main engine fuelled with liquid oxygen and liquid hydrogen.

Show the cadets a slide or distribute handouts of Figure D-2 (Ares V Launch Vehicle).

The first stage of the Ares V vehicle relies on two, five-segment reusable solid rocket boosters for lift-off. The twin solid rocket boosters of the first stage flank a single, liquid-fuelled central booster element.

The central booster tank delivers liquid oxygen and liquid hydrogen fuel to five RS-68 rocket engines. The RS-68 engines serve as the core stage propulsion for Ares.

Atop the central booster element is an interstage cylinder, which includes booster separation motors and a newly designed forward adapter that mates the first stage with the Earth Departure Stage. A J-2X main engine fuelled with liquid oxygen and liquid hydrogen propels the Earth Departure Stage, the same J-2X engine as is used in the Ares I upper stage.

Russian Launch Vehicle – Proton

Show the cadets a slide or distribute handouts of Figure D-3 (Proton Launch Vehicle).

The Proton engines burn a liquid fuel called hydrazine (UDMH) with an oxidizer called Nitrogen Tetroxide. Nitrogen Tetroxide and UDMH burn when they come in contact, without any ignition, so they are said to be hypergolic.

The Proton launch vehicle is currently used for national programs and commercial launches of foreign satellites. Proton is designed as a tandem launch vehicle available in three-stage and four-stage options.

European Launch Vehicle – Ariane 5

Show the cadets a slide or distribute handouts of Figure D-4 (Ariane Launch Vehicle).

Ariane 5's cryogenic main stage is referred to as the EPC from its title in French, *Etage Principal Cryotechnique.* The EPC is essentially composed of an aluminum tank with two compartments: one for liquid oxygen and one for liquid hydrogen. Both propellants are produced at plants located inside Europe's Spaceport in French Guiana.

Weighing 37 tonnes each when empty, the SRBs (Solid-Rocket Boosters) provide 1100 tonnes of thrust, roughly 92% of the total thrust at liftoff.

Chinese Launch Vehicles – Changzheng (Long March) Rockets

Show the cadets a slide or distribute handouts of Figure D-5 (Changzheng [Long March] Launch Vehicles).

The main stages and the booster rockets of Long March rockets use liquid storable propellants with hydrazine (UDMH) as fuel and nitrogen tetroxide as the oxidizing agent—the same hypergolic system used by the Proton rocket discussed above. The upper stages of Long March CZ-3A and CZ-3B use liquid hydrogen (LH2) as fuel and liquid oxygen (LOX) as oxidizer.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS

Q1. What family of spacecraft does the Ares family replace?

Q2. Where are the Ariane 5's LOX and liquid hydrogen produced?

Q3. What fuel oxidization system does the Proton rocket share with the Long March rockets?

ANTICIPATED ANSWERS

A1. The Ares rockets replace the Space Shuttle.

A2. Both propellants are produced at plants located inside Europe's Spaceport in French Guiana.

A3. Both the Proton and the Long March rockets use hydrazine fuel with nitrogen tetroxide oxidizer.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What does Newton's third law of motion state?

Q2. Why is oxygen stored for a rocket's combustion instead of just air?

Q3. What great operational advantage does a liquid rocket have over a solid rocket?

ANTICIPATED ANSWERS

A1. Newton's third law of motion states that for every action there is an equal and opposite reaction.

A2. Oxygen is stored for combustion instead of air because air is mostly unreactive nitrogen.

A3. A liquid rocket can be controlled and shut off after ignition.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Of all the methods of propulsion, rockets have the longest history. They also have the most exciting future in helping fulfill the Canadian Space Agency's mission.

INSTRUCTOR NOTES/REMARKS

Website references should be made available for cadets to explore on their own time.

REFERENCES

C3-016 EG-2003-01-108-HQ NASA. (2003). *Rockets: A Teacher's Guide With Activities in Science, Mathematics, and Technology.* Washington, DC: NASA.

C3-037 *Space Exploration.* (2006). Retrieved 25 May 2006, from http://www.space.gc.ca/asc/eng/exploration/exploration.asp.

C3-057 (ISBN 10-1-59647-055-0) Sobey, E. (2006). *Rocket-powered Science.* Tucson, AZ. Good Year Books.

C3-087 NASA Glenn Research Center. *Propulsion Index.* Retrieved 21 February 2007, from http://www.grc.nasa.gov/WWW/K-12/airplane/shortp.html.

C3-088 NASA Glenn Research Center. *Beginner's Guide to Rockets.* Retrieved 21 February 2007, from http://exploration.grc.nasa.gov/education/rocket/bgmr.html.

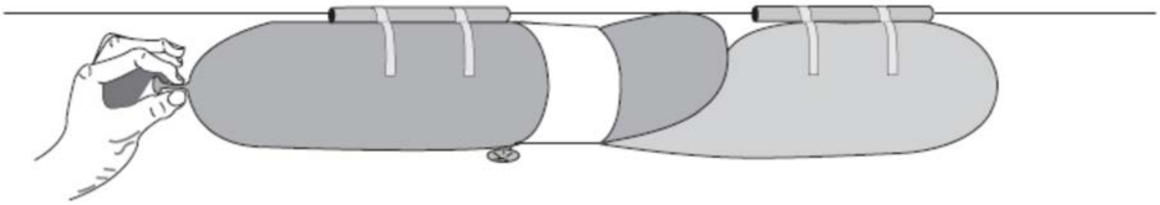
C3-100 China In Space. *The Long March Space Rockets.* Retrieved 26 February 2007, from http://www.spacetoday.org/China/ChinaRockets.html.

C3-112 Federal Space Agency. *Roket1Show.* Retrieved 26 February 2007, from http://www.roscosmos.ru/RoketsMain.asp.

C3-113 European Space Agency. *ESA Launch Vehicles.* Retrieved 26 February 2007, from http://www.esa.int/esaCP/index.html.

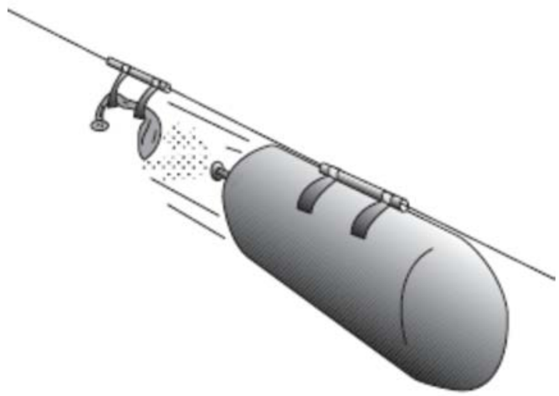
C3-114 NASA. *Countdown! NASA Launch Vehicles and Facilities.* Retrieved 27 February 2007, from http://www-pao.ksc.nasa.gov/kscpao/nasafact/count1.htm#nasa.

STAGING BALLOON ROCKETS INSTRUCTIONS



NASA, Rockets: A Teacher's Guide with Activities in Science, Mathematics and Technology, NASA (p. 64)

Figure A-1 Staging Balloon Rockets



NASA, Rockets: A Teacher's Guide with Activities in Science, Mathematics and Technology, NASA (p. 63)

Figure A-2 Jettisoning the First Stage

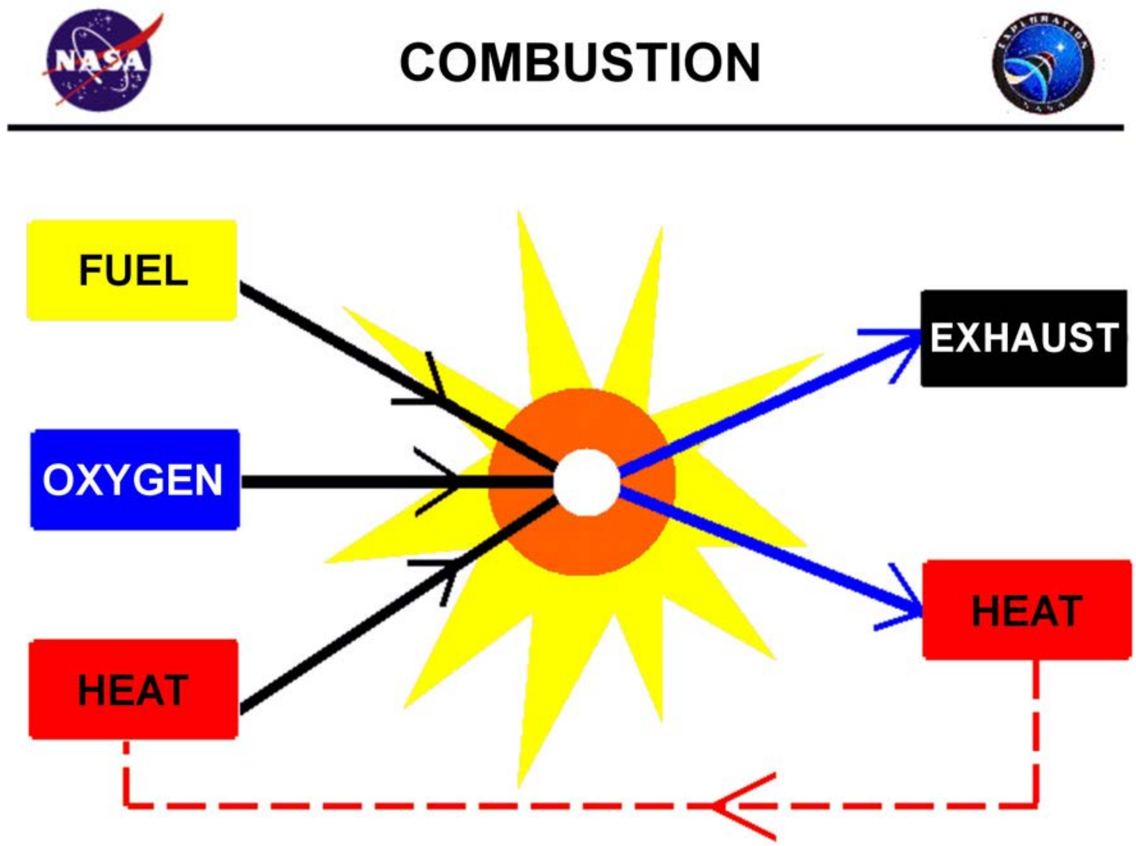
THIS PAGE INTENTIONALLY LEFT BLANK

ROCKET SYSTEM OPERATION IN SPACE

HERO ENGINE

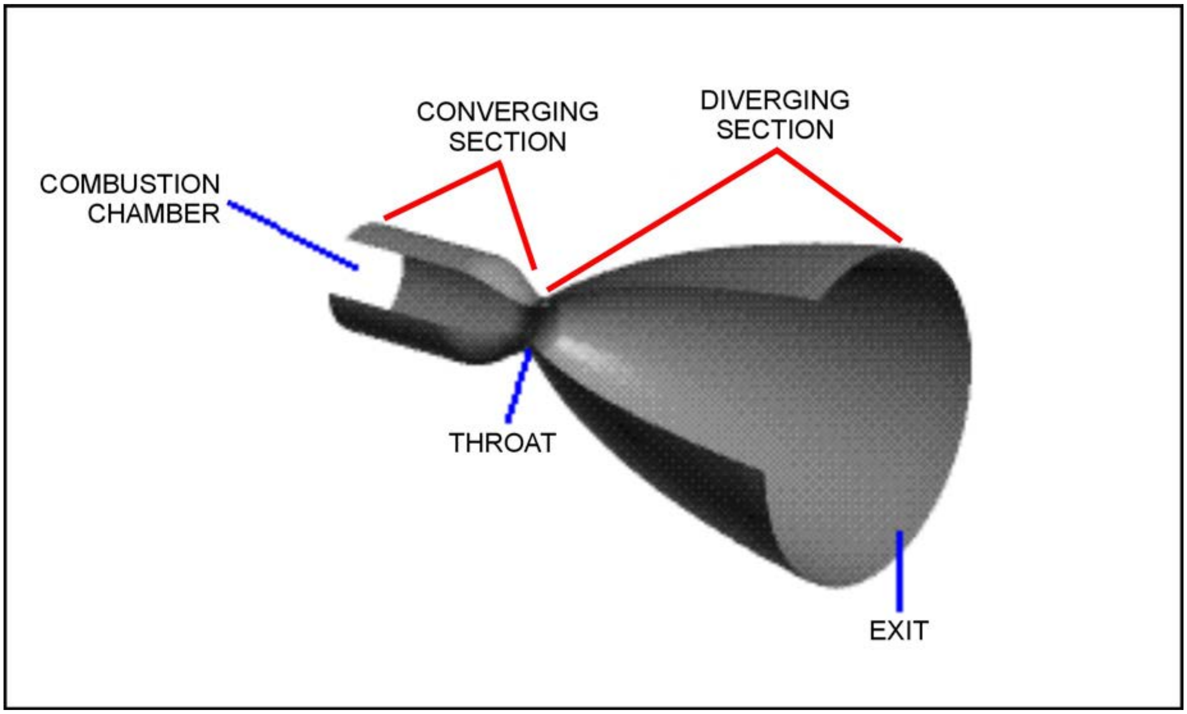
"Rockets" A Brief History of Rockets. Retrieved 24 March 2007, from http://www.grc.nasa.gov/WWW/K-12/TRC/Rockets/history_of_rockets.html

Figure B-1 The First Reactive Engine



"Beginner's Guide to Rockets" Combustion. Retrieved 25 March 2007, from http://exploration.grc.nasa.gov/education/rocket/combst1.html

Figure B-2 Combustion

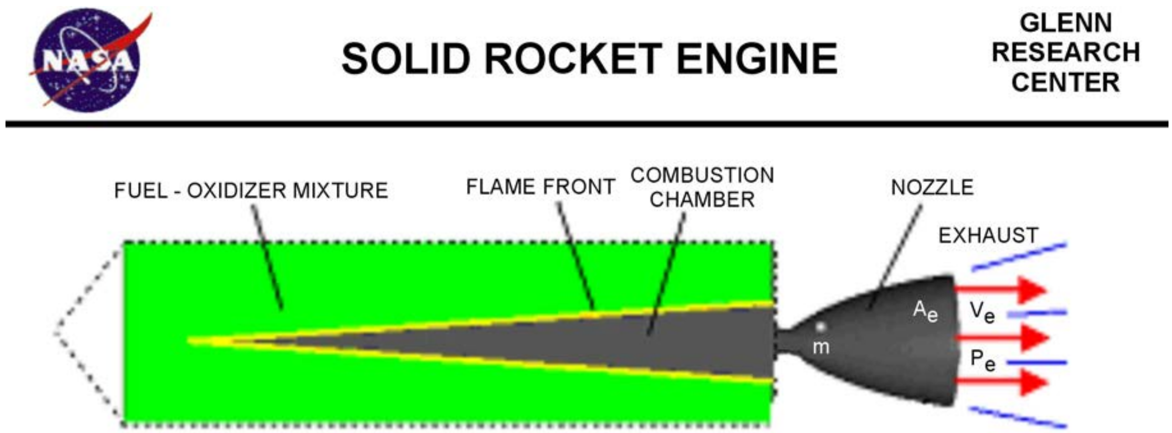


"Beginner's Guide to Rockets" Combustion. Retrieved 25 March 2007, from http://exploration.grc.nasa.gov/education/rocket/nozzle.html

Figure B-3 A Rocket Nozzle

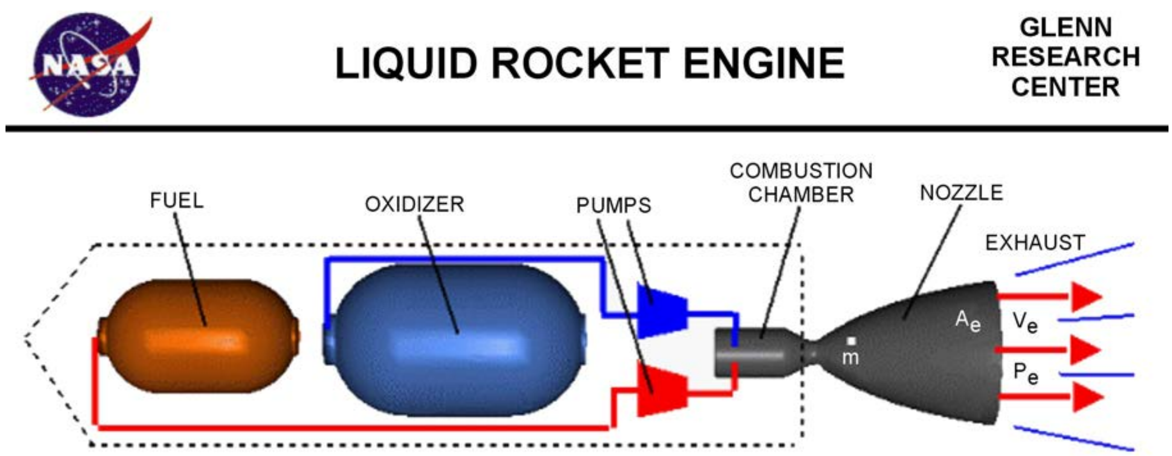
THIS PAGE INTENTIONALLY LEFT BLANK

SOLID AND LIQUID ROCKET ENGINES



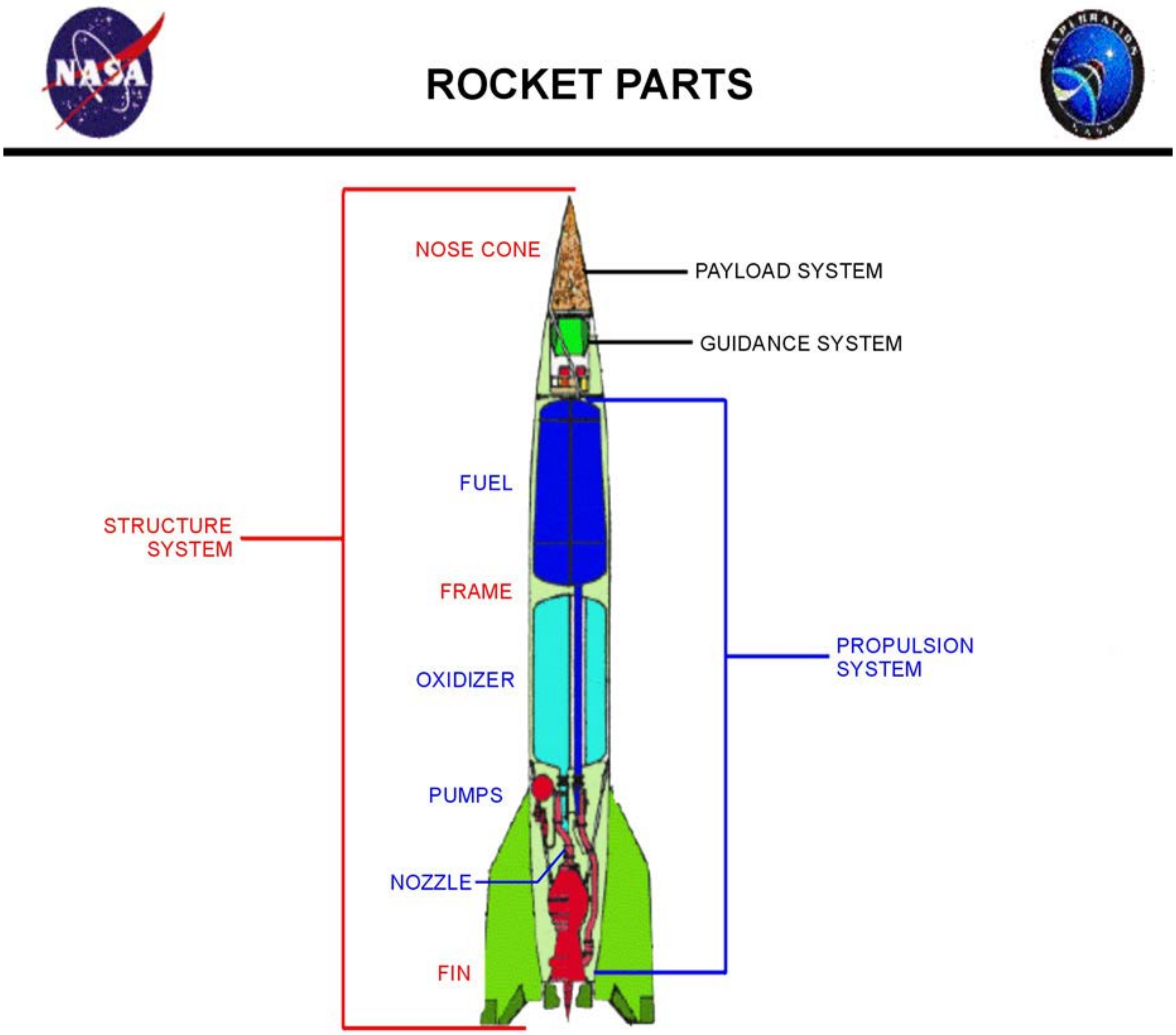
"Beginner's Guide to Rockets" Solid Rockets. Retrieved 25 March 2007, from http://exploration.grc.nasa.gov/education/rocket/lrockth.html

Figure C-1 Solid Rocket Design



"Beginner's Guide to Rockets" Liquid Rockets. Retrieved 25 March 2007, from http://exploration.grc.nasa.gov/education/rocket/lrockth.html

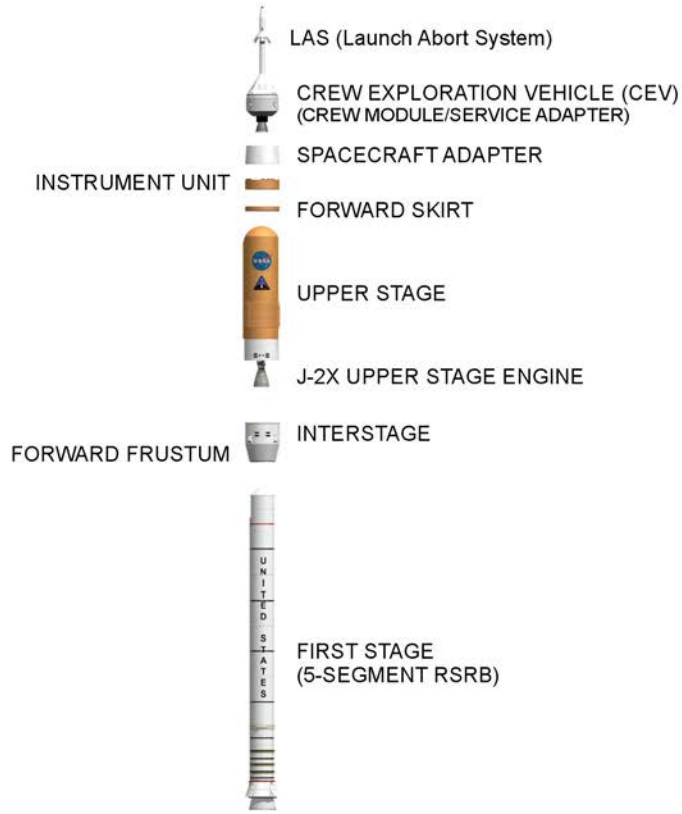
Figure C-2 Liquid Rocket Design

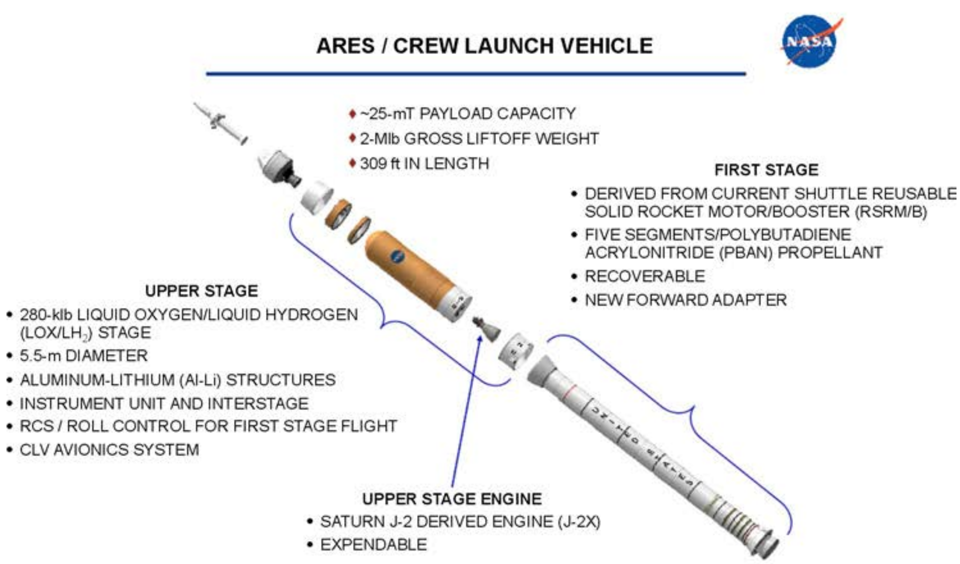


"Beginner's Guide to Rockets" Rocket Parts. Retrieved 25 March 2007, from http://exploration.grc.nasa.gov/education/rocket/rockpart.html

Figure C-3 Liquid System Rocket

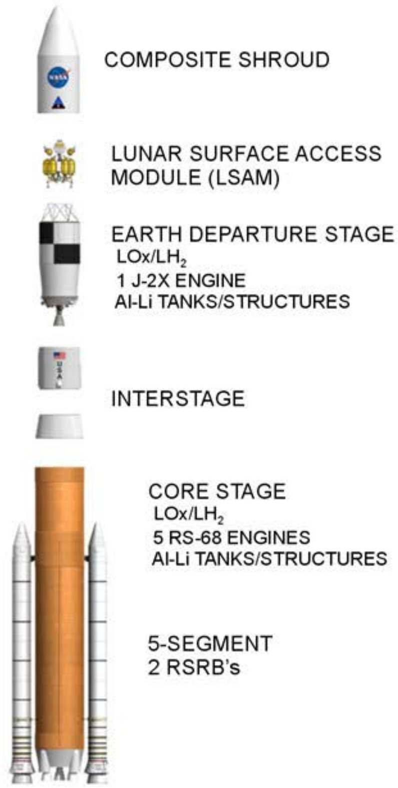
LAUNCH VEHICLES

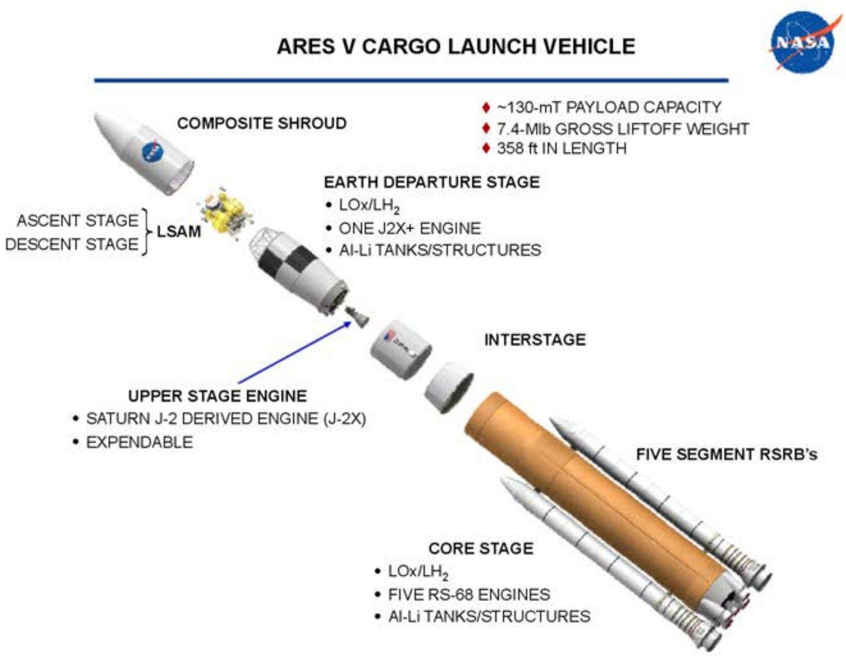




NASA "Constellation Program" Ares Launch Vehicles. Retrieved 24 March 2007, from http://www.nasa.gov/mission_pages/constellation/ares/aresI.html

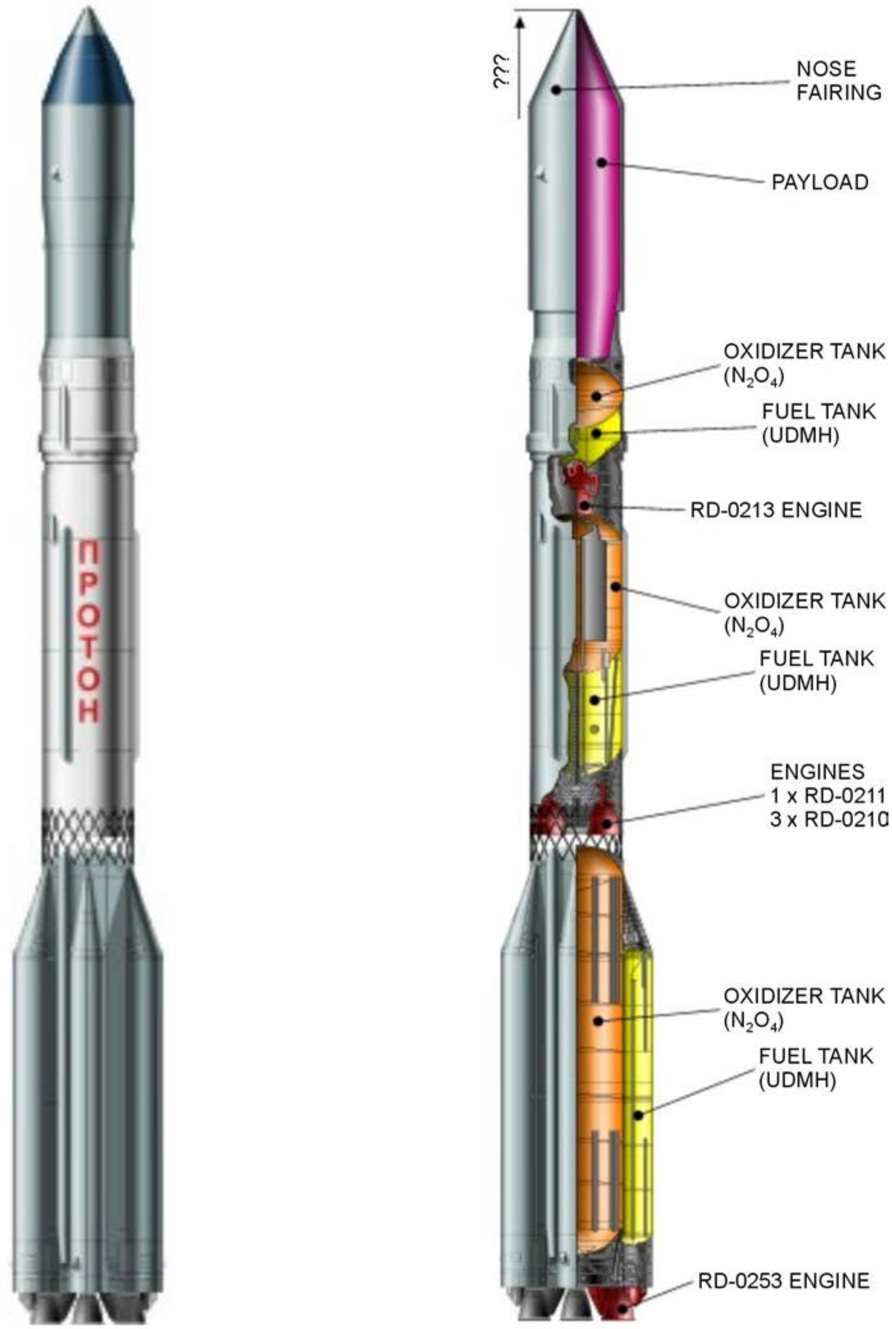
Figure D-1 Ares 1 Launch Vehicle





NASA "Constellation Program" Ares Launch Vehicles. Retrieved 24 March 2007, from http://www.nasa.gov/mission_pages/constellation/ares/aresV.html

Figure D-2 Ares V Launch Vehicle



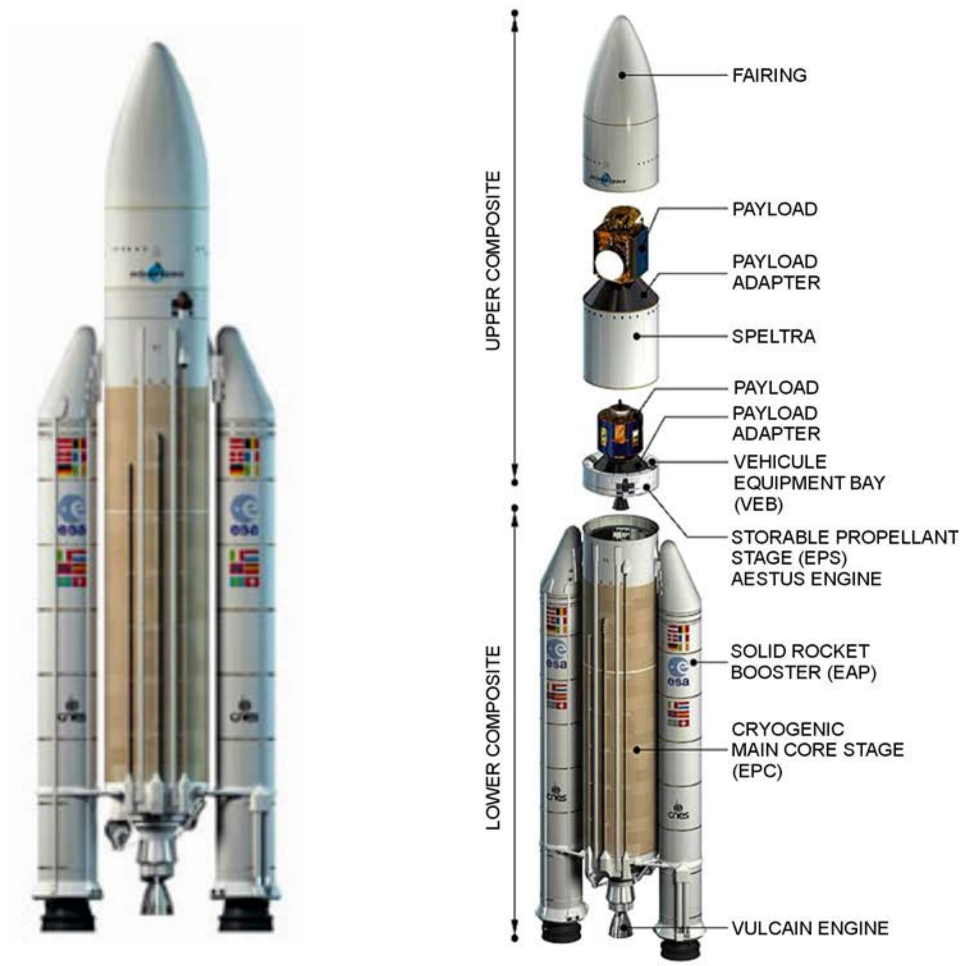
From "Roscosmos Rocket Families" Proton. Retrieved 27 March 2007, from http://www.roscosmos.ru/RoketsMain.a

Figure D-3 Proton – Federal Space Agency Launch Vehicle

THE ARIANE 5 BOOSTER (SRB) PROPELLANT FUEL IS SOLID.

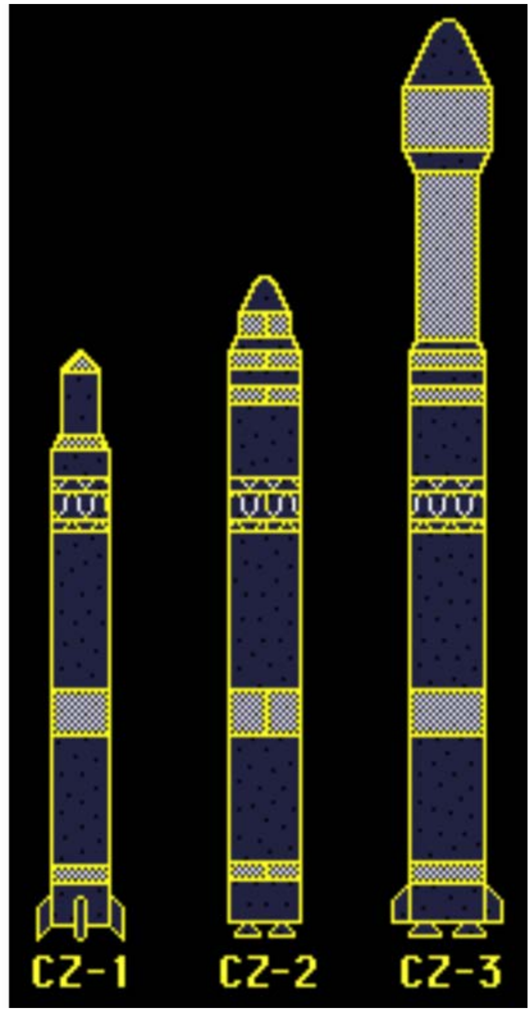
MAIN ENGINES BURN LIQUID OXYGEN AND LIQUID HYDROGEN.

MAIN DATA:	ARIANE 5G
HEIGHT:	46 TO 52 m
DIAMETER:	UP TO 5.4 m
LIFTOFF MASS:	746 TONNES



From "European Space Agency" Launch Vehicles. Retrieved 24 March 2007, from http://www.esa.int/SPECIALS/Launchers_Access_to_Space/SEMH3E67ESD_0.html

Figure D-4 Ariane 5 – European Space Agency



"China in Space" China's Space Rockets. Retrieved 24 March 2007, from http://www.spacetoday.org/China/ChinaRockets.html#LongMarchRockets

Figure D-5 Long March (Changzheng) Rockets

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 7

EO C232.03 – IDENTIFY THE CHARACTERISTICS OF HELICOPTER ENGINES

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Photocopy the handouts located at Annexes A to D for each cadet. Slides may also be created of the figures in Annexes A to D.

Photocopy handouts of the paper helicopter construction templates and instructions shown in Figures A-2 and A-3 for each cadet.

Obtain a helium-filled balloon for use in TP3.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TPs 3-6 to introduce characteristics of helicopter engines and give an overview of them.

An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

The review for this lesson is from EO M232.01 (Identify Types of Aircraft Engines), to include characteristics of turboshaft gas turbine engines.

OBJECTIVES

By the end of this lesson the cadet shall identify the characteristics of helicopter engines.

IMPORTANCE

It is important for cadets to know about the characteristics of helicopter engines because helicopters form a significant part of the Canadian Forces' lift, tactical manoeuvring and Search and Rescue capabilities.

Teaching Point 1 — **Explain Technological Developments That Made Helicopters Viable**

Time: 5 min — Method: Interactive Lecture

Important challenges limited early experiments with helicopters. In particular, suitable engines did not exist in the early years. This was a problem that was not to be overcome until the beginning of the 20^{th} century by the development of internal combustion (gasoline) powered engines. Even then, it was not until the mid-1920s that engines with sufficient power, and with the high power-to-weight ratios suitable for vertical flight became more widely available.

Early engines were made of cast iron and were too heavy for helicopters. Aluminum, a common material used on modern aircraft, was available commercially around 1890, but was extremely expensive. Aluminum was not widely used in aeronautical applications until 1920.

While many additional factors contributed in some way to the lack of progress in achieving successful vertical flight, the development of a practical helicopter had to wait until engine technology could be refined to the point that lightweight engines with considerable power could be built. By 1920, gasoline powered piston engines with higher power-to-weight ratios were more widely available. It then became possible to begin to solve the control problems of vertical flight. The era after 1920 is marked by the development of a vast number of prototype helicopters throughout the world.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Why were early piston-powered engines too heavy for helicopter applications?

Q2. What material helped make helicopters and helicopter engines practical in 1920?

Q3. When did the work to solve vertical flight control problems begin?

ANTICIPATED ANSWERS

A1. Early piston-powered engines were too heavy because they were made of cast iron.

A2. In 1920, aluminum allowed frames and engines to be light enough for helicopters.

A3. The work to solve vertical flight control problems began when effective engines became available after 1920.

Teaching Point 2 — **Make and Fly a Paper Helicopter**

Time: 20 min — Method: In-Class Activity

When a helicopter engine loses power under flight, the pilot can auto-rotate the aircraft to the ground.

Show the cadets a slide or distribute a handout of auto-rotation flight versus normal flight in Figure A-1.

Auto-rotation is the state of flight where the main rotor is being turned by the action of the wind passing up through the rotor disc instead of being turned by engine power.

To do this the rotor must be released from the engine. This release is provided by a free-wheeling device which allows the rotor to turn even if the engine is not running.

To successfully change the downward flow of air to an effective upward flow during auto-rotation, the pitch angle of the main rotor blades must be reduced. This can be compared to lowering the nose and changing the pitch attitude of a fixed-wing aircraft in order to establish a glide.

ACTIVITY

Time: 15 min

OBJECTIVE

The objective of this activity is to have the cadets fold paper helicopters and then auto-rotate them to the ground to demonstrate that loss of engine power does not necessarily lead to a crash.

RESOURCES

Instructions and the template for folding a paper helicopter shown in Figures A-2 and A-3.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Distribute the instructions and template for paper helicopter construction to each cadet.
2. Have the cadets cut out the paper helicopter and then fold it into shape.
3. Have the cadets stand and drop the helicopters.

Give the paper helicopter a spin before releasing it. This will help establish effective rotor action because, as stated by Newton's first law of motion, every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it.

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 Why Helicopters Have a Top Speed and Why Helicopter Rotors Have Constant Speed**

Time: 10 min | Method: Interactive Lecture

The most defining characteristic of a helicopter engine is the need to maintain constant rotor speed, or a constant number of revolutions per minute (RPM), as specified by the manufacturer.

If the rotor goes too fast, lift will be lost and damage will result as the blade tips approach the speed of sound and shock waves develop. This is more significant with the long blades associated with rotary wings than it is with the shorter blades of fixed-wing aircraft propellers.

On the other hand, a rotor under load cannot be allowed to slow below the design speed because the blades rely on centrifugal force to stay horizontally extended. Because they are wings, rotor blades experience lift. The lift will cause the rotors to rise to form a “cone” if centrifugal force is insufficient to keep them horizontally extended. As the dangerously slowing rotor blades “cone” upward, lift is lost and a crash becomes imminent.

Using a helium-filled balloon, demonstrate to the cadets that centrifugal force is necessary to flatten the rotor disc as shown in Figure B-1.

When the helicopter is at rest, the outer tips of the rotor travel at a speed determined by the length of the blade and the RPM. In a moving helicopter, however, the speed of the blades relative to the air depends on the speed of the helicopter as well as on their rotational velocity. The airspeed of the rotor blade in the forward moving, or advancing, part of its rotation is much higher than that of the helicopter itself. It is possible for this blade tip to exceed the speed of sound, and thus produce vastly increased drag and vibration.

In a moving helicopter, the velocity of the blade tips relative to the air depends on the speed of the helicopter itself, as well as the speed of the blade.

Why the Rotor Can Never Be Allowed To Go Too Fast. If the rotor goes too fast, the tips of the long blades will approach the speed of sound and sonic shock waves will cause both equipment damage and loss of lift.

Why the Rotor Under Load Can Never Be Allowed To Go Too Slow. A rotor under load cannot be allowed to drop below the design speed because the blades rely on centrifugal force to stay horizontally extended. Rotor blades under load are experiencing lift and will rise to form a “cone” if centrifugal force is insufficient to keep them horizontally extended. As the dangerously slowing rotor blades “cone” upward, lift is lost and a crash becomes imminent.

Using the model helicopter, demonstrate to the cadets that one blade is retreating while the other blade is advancing at the same speed. Explain that while the helicopter is motionless on the ground or hovering, the airspeed of the advancing blade will be the same as the airspeed of the retreating blade so that each blade will develop equal lift.

Why a Helicopter Has a Never-Exceed Velocity (VNE). As the helicopter flies faster, the true airspeed of the advancing blade's tip will increase toward the speed of sound and sonic shock waves will cause both equipment damage and loss of lift.

Background Knowledge for the Instructor Only. As well, a moving helicopter experiences a difference in lift between halves of the rotor disc because the airspeed over the advancing blade is greater than the airspeed over the retreating blade. The faster the helicopter flies, the greater this difference of lift, because the true airspeed difference of the blade-tips is twice the helicopter's airspeed. That is, to calculate the true airspeed of each blade, the helicopter's speed must be added to the airspeed of the advancing blade and subtracted from the airspeed of the retreating blade. So, increasing helicopter airspeed causes an increasing dissymmetry of lift, which will cause the machine to roll toward the loss of lift unless it is somehow corrected. This is further complicated by precession of the spinning rotor, which converts the undesired roll into undesired pitch. The usual method of equalizing lift over the advancing and retreating blades is to have greater angle of attack on the retreating blade and less angle of attack on the advancing blade, via "cyclic" pitch control. However, the blades' angle of attack adjustment has obvious limits and can only compensate for very limited airspeed. Therefore, the helicopter's airspeed design limit V_{NE} must never be exceeded, even if the machine is very powerful.

Cyclic pitch control changes the angle of attack of the blades separately, to control the helicopter's flight. Collective pitch control changes the angle of attack of both blades simultaneously to deliver more or less lifting power to the rotary wing.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Why must a helicopter rotor never be allowed to go too fast?

Q2. Why must the rotor under load never be allowed to go too slow?

Q3. Why does a helicopter have a never-exceed speed limit?

ANTICIPATED ANSWERS

A1. If the rotor goes too fast, the tips of the long blades will approach the speed of sound and sonic shock waves will cause both equipment damage and loss of lift.

A2. If a rotor goes too slow, it will "cone" due to the lift of the rotary wing.

A3. A helicopter has a never-exceed speed limit to prevent sonic shock at the blade tips.

Teaching Point 4 | **Explain How Lift of the Main Rotor Is Changed During Flight**

Time: 5 min | Method: Interactive Lecture

To increase the lift of a fixed-wing aircraft, the wing's angle of attack is increased. This is also true of a rotary wing.

Changing the pitch angle on the blades changes the blade angle and lift. With a change in angle of attack and lift comes a change in drag and, therefore, the speed or RPM of the rotors could be affected. As the blades' angle of attack is increased, drag increases and so the rotor speed would decrease if it were allowed. Decreasing the blades' angle of attack decreases drag, and so rotor speed would increase if it were allowed.

To maintain a constant rotor speed, which is essential in helicopter operation, a proportionate change in power is required to compensate for the change in drag. A correlator and/or governor is the most common way to accomplish this. The engine is allowed to speed up or slow down according to the load on the rotor, but the rotor speed remains unchanged.

This feature of rotary-wing flight imposes requirements on helicopter engine design. In the turboshaft engines used on most helicopters, the turbine powering the engine's compressor is separate from the turbine powering the shaft that drives the main rotor.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. How is lift increased with a rotary wing?

Q2. What else increases when the wing's angle of attack is increased?

Q3. How does a helicopter engine prevent the rotor from slowing when drag increases?

ANTICIPATED ANSWERS

A1. Increasing the wing's angle of attack increases lift with a rotary wing.

A2. Drag increases when the wing's angle of attack is increased.

A3. A proportionate change in power is required to compensate for the increase in drag.

Teaching Point 5 | **Explain That Most Helicopters Use Turboshaft Engines**

Time: 5 min | Method: Interactive Lecture

Although piston-powered engines are still used in some general-aviation helicopters, most helicopters produced are for military or commercial use and feature gas turbine engines, which have high power-to-weight ratios.

Show the cadets a slide or distribute a handout of the turboshaft engine schematic in Figure C-1.

Gas turbines can maintain constant rotor speed separate from the speed of the engine itself and in this configuration they are referred to as turboshaft engines. In particular, an engine designed for turboshaft use will generally have one turbine for the engine's own air compressor and a second, separate turbine for powering the drive shaft, which turns the main rotor. The engine itself, because it has a separate compressor turbine, can speed up or slow down as necessary to provide the right amount of high-velocity exhaust gases for the second turbine, keeping the rotor speed constant.

Turboshaft engines are also used to power tanks and ships as well as having stationary applications.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS

Q1. Who uses helicopters?

Q2. What type of engine is found in most helicopters?

Q3. How many turbines does a turboshaft engine have?

ANTICIPATED ANSWERS

A1. Most helicopters are used in the military or commercially.

A2. Most helicopters have gas turbine engines configured as turboshafts.

A3. A turboshaft engine has two turbines; one for its own compressor and one for the main rotor.

Teaching Point 6	**Identify CF Helicopters and Discuss Their Associated Engines**
Time: 10 min	Method: Interactive Lecture

Show the cadets slides of the CF helicopters in Figures D-1 to D-5. Discuss these machines with them, including the following application information.

CH-149 CORMORANT

The Cormorant has been chosen as Canada's new Search and Rescue (SAR) helicopter. The first of these aircraft entered squadron service in 2002 at 19 Wing Comox, and by Spring of 2004, the entire fleet of 15 Cormorants became fully operational. It has three powerful engines, long-range capability and a large cargo area. Its ice protection system, allowing it to operate in continuous icing conditions, and its ability to withstand high winds, make it ideal for Canada's demanding geography and climate.

The Agusta-Westland CH-149 Cormorant is a fully certified off-the-shelf civilian utility helicopter. It includes search and rescue-specific equipment and physical characteristics and performance requirements to meet Canada's SAR responsibilities. This modification provided reduced procurement costs, a rear-fuselage ramp, a single rescue door with both hoists on one side, and eliminated unnecessary military equipment. Shaped rotor blades, strengthened by titanium strips along the leading edge, allow the CH-149 to improve lift and increase speed, lowering the stall speed and reducing vibration. This enables it to withstand high winds (exceeding 50 knots) and provide superior gust response while carrying out routine tasks of hoisting, starting and stopping.

- Quantity in the CF: 15

- Locations:
  - 9 Wing Gander, NF,
  - 8 Wing Trenton, ON,
  - 14 Wing Greenwood, NS, and
  - 19 Wing Comox, BC.

CH-148 CYCLONE

After a thorough pre-qualification and bid evaluation process, the Government of Canada has selected the H92 proposed by Sikorsky as the winner of the Maritime Helicopter Project. Sikorsky will be awarded two separate, but interrelated contracts. The first contract will cover the acquisition of 28 fully integrated, certified and qualified helicopters with their mission systems installed, and will also include modifications to the 12 Halifax Class ships. The second contract will be for a 20-year in-service support contract that includes a training building, and a simulation and training service.

CH-146 GRIFFON

As Canada's Utility Transport Tactical Helicopter (UTTH), the Griffon provides a robust, reliable and cost-effective capability to conduct: airlift of equipment and personnel, command and liaison flights, surveillance and reconnaissance, casualty evacuation, logistic transport, search and rescue, counter-drug operations, and domestic relief operations.

Griffons are used by Combat Support Squadrons at 3, 4 and 5 Wings to support fighter operations by providing a search and rescue capability and utility transportation support to fighter training and operations.

- Quantity in the CF: 85
- Locations:
  - Bagotville, QC,
  - Cold Lake, AB,
  - Gagetown, NB,
  - Valcartier, QC,
  - Goose Bay, NL,
  - Edmonton, AB,
  - Petawawa, ON, and
  - Borden, ON.

CH-139 JET RANGER

The 14 CH-139 Jet Rangers were purchased in 1981 for use by 3 Canadian Forces Flying Training School at CFB Portage la Prairie, in southern Manitoba, now the Southport Aerospace Centre. They are still in use today by 3 Canadian Forces Flying Training School (3 CFFTS), with upgraded avionics and air conditioning, and are maintained by the Allied Wings consortium which provides the aircraft used by 3 CFFTS.

The CH-139 Jet Ranger is a single-engine, five-seat light helicopter. It is configured with a two-bladed, semi-rigid main rotor and a two-bladed anti-torque tail-rotor. The Jet Ranger is powered by an Allison Model 250-C20B gas-turbine engine de-rated to deliver 317 shaft horsepower at sea-level.

- Quantity in the CF: 14
- Locations: 3 CFFTS Portage la Prairie

CH-124 SEA KING

The Sea King is a ship-based helicopter with both day and night flight capabilities, and is carried aboard many Canadian Maritime Command destroyers, frigates and replenishment ships. The Sea King carries detection, navigation and weapons systems as part of its primary mandate of searching for, locating and destroying submarines. With its subsurface acoustic detection equipment and homing torpedoes, it is also a versatile surveillance helicopter.

Domestically, Sea Kings have increasingly become responsible for search and rescue operations, disaster relief, and assisting other government departments in carrying out counter-narcotic operations, fisheries and pollution patrols.

The Sea King has also been instrumental in peacekeeping operations. For example, during the deployment of forces to Somalia, the CH-124 provided troops with logistical, medical and ammunition support along with flying overland reconnaissance and convoys. It was, in effect, the only link soldiers had with the ships especially during the initial stages of the deployment.

The Sea King fleet has been heavily committed to the campaign against terrorism, deploying aboard Canadian Navy ships to the Persian Gulf since the autumn of 2001. Sea Kings have conducted hundreds of missions ranging from logistics flights to move personnel and cargo to hailing and boarding suspicious vessels.

- Quantity in the CF: 27
- Locations:
  - 12 Wing Shearwater, NS, and
  - Patricia Bay, BC.

CONFIRMATION OF TEACHING POINT 6

QUESTIONS

Q1. What engine type is common to all CF helicopters?

Q2. What is the designation of Canada's new Maritime Helicopter?

Q3. How many engines does the CH-149 Cormorant have?

ANTICIPATED ANSWERS

A1. CF helicopters all use turboshaft engines.

A2. Canada's new Maritime Helicopter is the CH-148 Cyclone.

A3. The CH-149 Cormorant has three turboshaft engines.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What material helped make helicopter engines practical in 1920?

Q2. Why must a helicopter rotor never be allowed to go too fast?

Q3. How does a helicopter engine prevent the rotor from slowing when drag increases?

ANTICIPATED ANSWERS

A1. Aluminum helped make helicopter engines practical in 1920.

A2. If the rotor goes too fast, the tips of the long blades will approach the speed of sound and sonic shock waves will cause both equipment damage and loss of lift.

A3. A proportionate change in power is required to compensate for the increase in drag.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Rotary wing aircraft present special challenges for aviation but they offer special capabilities as well, which enable them to make important contributions to the Canadian Forces' lift, tactical manoeuvring and Search and Rescue operations.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-050 Department of National Defence. (2006). *Canada's Air Force, Aircraft Main Page.* Retrieved 11 October 2006, from http://www.airforce.forces.gc.ca/equip/equip1_e.asp.

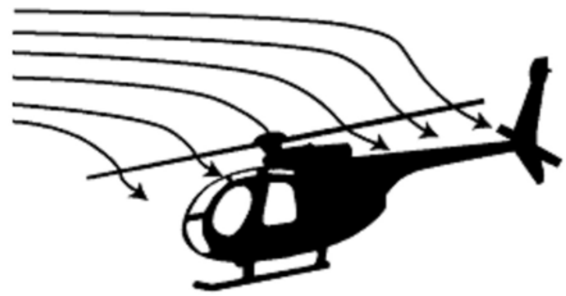
C3-054 Frost, M. (2004). *Force and Movement: Making a Helicopter.* Retrieved 11 October 2006, from http://www.teacherresourcesgalore.com/physics_files/helicopter.doc.

C3-055 University of Sydney. *Helicopters. (2006).* Retrieved 12 October 2006, from http://alex.edfac.usyd.edu.au/blp/websites/Machan/heli.htm.

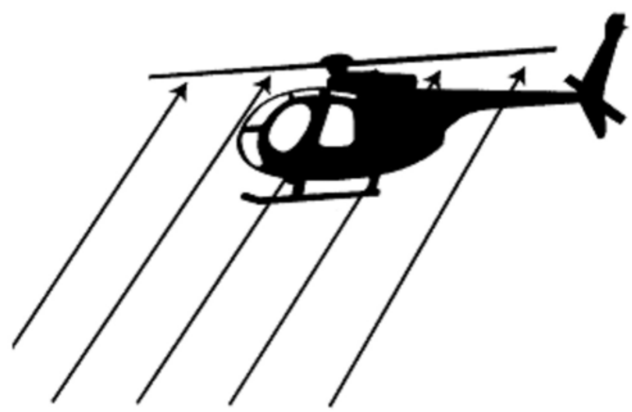
C3-056 US Centennial of Flight Commission. *Helicopters. (2003).* Retrieved 12 October 2006, from http://www.centennialofflight.gov/essay/Dictionary/helicopter/DI27.htm.

C3-061 Leishman, J.G. (2000). *A History of Helicopter Flight.* Retrieved 1 November 2006, from http://www.glue.umd.edu/~leishman/Aero/history/html.

INSTRUCTIONS AND TEMPLATE FOR FOLDING A PAPER HELICOPTER



NORMAL POWERED FLIGHT



AUTO-ROTATION FLIGHT

Jeppesen Standard Training Products, A&P Technician General Textbook, Jeppesen Sanderson Training Systems (p. 2-66)

Figure A-1 Auto-rotation Flight vs. Normal Powered Flight

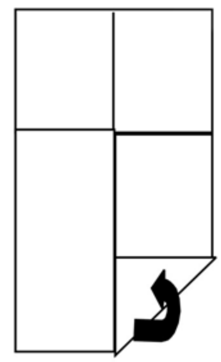
MAKE A HELICOPTER

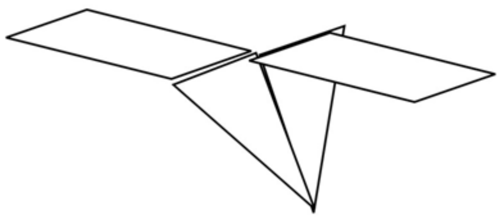
AIM: TO MAKE A TWIRLING HELICOPTER.

YOU WILL NEED: A HELICOPTER SHEET, SCISSORS, COLOURING PENCILS, PAPER CLIPS FOR WEIGHTS

WHAT TO DO:

1. COLOUR THE HELICOPTER SHEET.
2. CUT ALONG THE DOTTED LINES.
3. FOLD CORNERS A AND B TO MEET THE CENTRE LINE
4. FOLD E AND F IN THE OPPOSITE DIRECTIONS.





5. TEST YOUR HELICOPTER BY DROPPING IT FROM A HIGH PLACE (E.G. STANDING ON A RAISED PLATFORM).
6. DISCUSS WHAT HAPPENS.

THINGS TO TRY

DOES THE WAY THE FLAPS ARE BENT MAKE A DIFFERENCE TO THE HELICOPTER'S FALL?

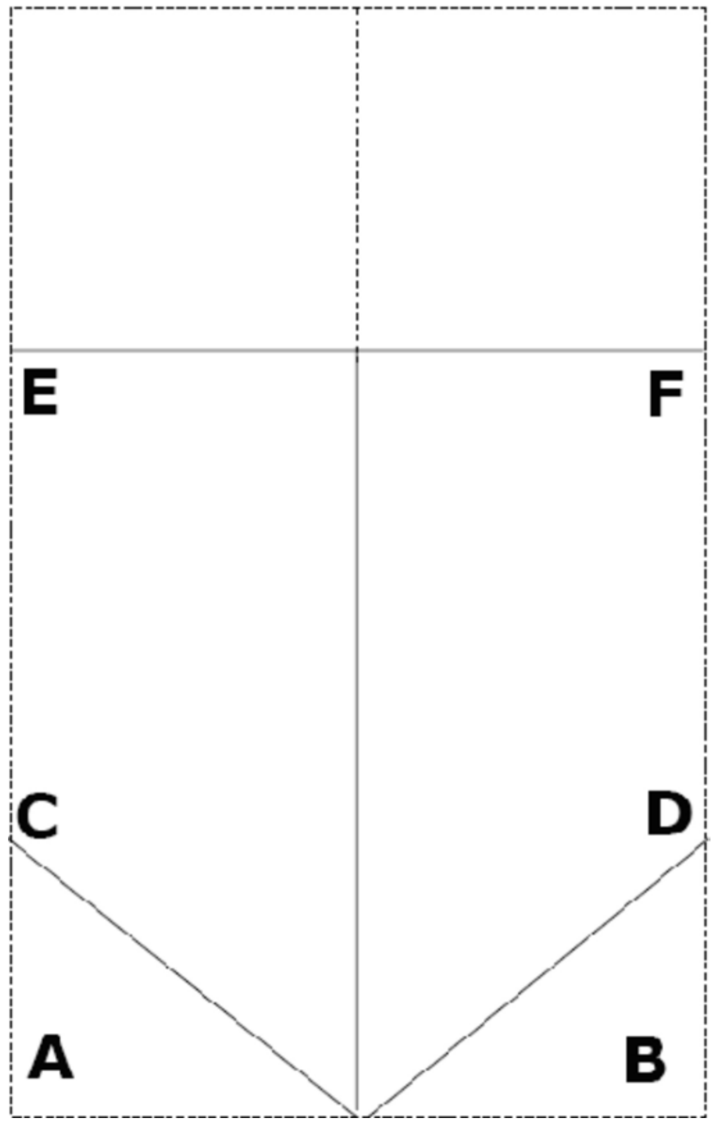
ADD EXTRA WEIGHT TO YOUR HELICOPTER. DOES THIS MAKE A DIFFERENCE.

MAKE A NEW HELICOPTER WITH LONGER BLADES. HOW DOES IT WORK?

"Force and Movement" Making a Helicopter. Retrieved 11 October 2006, from http://www.teacherresourcesgalore.com/physics_files/helicopter.doc

Figure A-2 Instructions for Paper Helicopter Construction

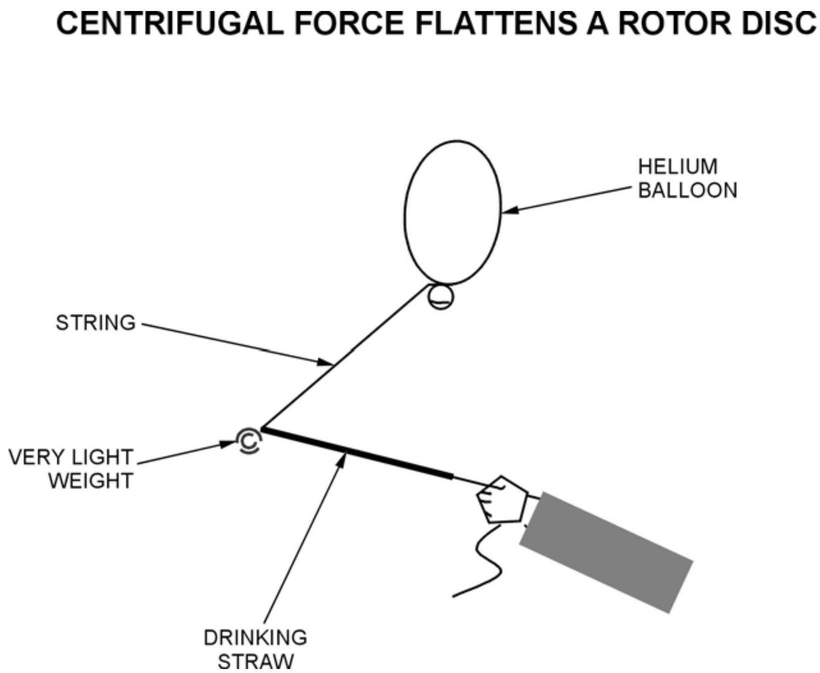
PAPER HELICOPTER TEMPLATE



"Force and Movement: Making a Helicopter". Retrieved 11 October 2006, from http://www.teacherresourcesgalore.com/physics_files/helicopter.doc

Figure A-3 Template for Paper Helicopter Construction

THIS PAGE INTENTIONALLY LEFT BLANK

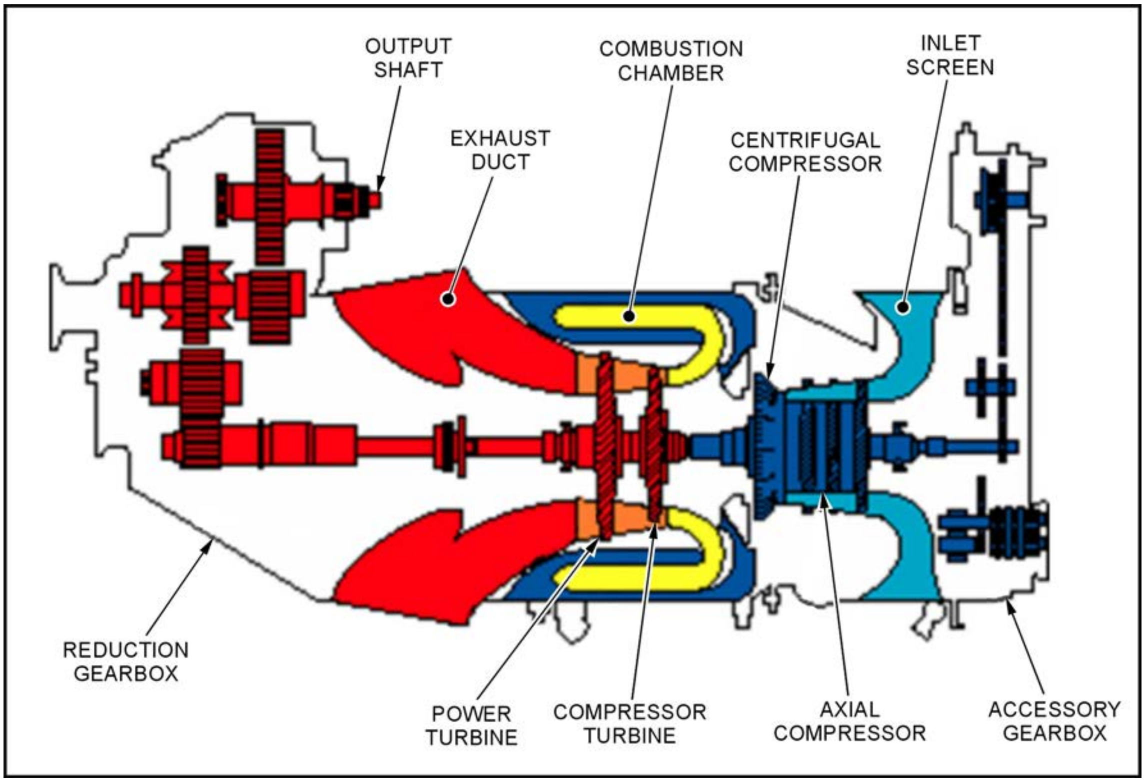


D Cdts 3, 2007 Ottawa, ON: Department of National Defence

Figure B-1 Centrifugal Force Prevents Lift from Coning the Rotor Disc

THIS PAGE INTENTIONALLY LEFT BLANK

TURBOSHAFT ENGINE SCHEMATIC



Imagine the Power, Pratt & Whitney Canada. Retrieved 16 March 2007, from http://www.pwc.ca/en/3_0/3_0_3/3_0_3_3_1.asp

Figure C-1 Turboshaft Engine Schematic – Separate Turbines

THIS PAGE INTENTIONALLY LEFT BLANK

CF HELICOPTERS

FACTS AND FIGURES - CH-149 CORMORANT

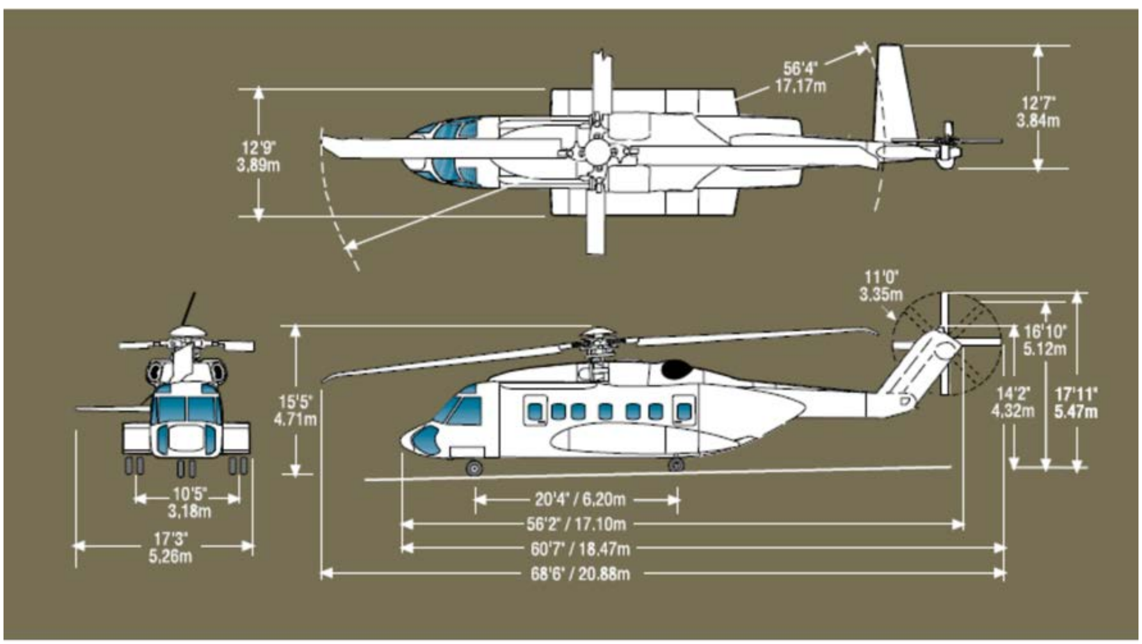
LENGTH:	22.8 m
ROTOR SPAN:	18.5 m
HEIGHT:	6.5 m
WEIGHT:	14 600 kg (MAXIMUM TAKE-OFF)
POWER:	THREE GENERAL ELECTRIC T700-T6A1 TURBOSHAFTS
SPEED:	278 km/h
RANGE:	1018 km

Canadian Forces. Aircraft. (2005). Retrieved 25 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure D-1 CH-149 Cormorant

Canadian Forces. Aircraft. (2005). Retrieved 25 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure D-2 CH-148 Cyclone



THE S-92 SUPERHAWK FEATURES TWO GENERAL ELECTRIC CT7-8A TURBOSHAFT ENGINES WITH INTEGRAL PARTICLE SEPARATOR AND PNEUMATIC STARTING SYSTEM. IN ADDITION, THE AIRCRAFT INCLUDES A HONEYWELL 36-150 AUXILIARY POWER UNIT FOR ON THE GROUND OR IN THE AIR EMERGENCY POWER.

Sikorsky. S-92 Superhawk Helicopter (2006). Retrieved 25 March 2007, from http://www.sikorsky.com/details/0,,CLI1_DIV69_ETI2280,00.html

Figure D-3 Sikorsky S-92 Superhawk

FACTS AND FIGURES - CH-146 GRIFFON

LENGTH:	17.1 m
ROTOR SPAN:	14 m
HEIGHT:	4.6 m
WEIGHT:	5355 kg
POWER:	PRATT AND WHITNEY'S PT6T-3D TURBOSHAFT ENGINE
SPEED:	220 km/h
RANGE:	656 km

Canadian Forces. Aircraft. (2005). Retrieved 25 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure D-4 CH-146 Griffon

FACTS AND FIGURES - CH-139 JET RANGER

EMPTY WEIGHT:	839 kg
MAX WEIGHT:	1451 kg
HEIGHT:	3.53 m
LENGTH:	(INCLUDING MAIN ROTOR) 11.9 m
SPEED:	130 knots
WIDTH:	(FUSELAGE AND SKID GEAR) 1.92 m
DIAMETER OF MAIN ROTOR:	10.16 m
MAX OPERATING ALTITUDE:	6100 m
ENGINE:	ALLISON MODEL 250-C20B TURBOSHAFT ENGINE

Canadian Forces. Aircraft. (2005). Retrieved 25 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure D-5 CH-139 Jet Ranger

FACTS AND FIGURES - CH-124 SEA KING

WEIGHT:	9299 kg
POWER:	TWO 1500 SHP GENERAL ELECTRIC T-58-GE-8F/-100 TURBOSHAFTS
SPEED:	144 km/h MAX SPEED 181 km/h
CEILING:	3048 m
RANGE:	450 km
LOAD:	2268 kg

Canadian Forces. Aircraft. (2005). Retrieved 25 March 2007, from http://www.airforce.gc.ca/equip/equip1_e.asp

Figure D-6 CH-124 Sea King

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 14

PO 240 – PARTICIPATE IN AEROSPACE ACTIVITIES

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M240.01 – EXPLORE CURRENT ADVANCEMENTS IN AEROSPACE TECHNOLOGY

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-802/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.

Research current advancements in aerospace technology and collect information for this lesson from newspapers, magazine, journals or Websites. The following Websites may be useful for this research:

- www.space.gc.ca.
- www.space.com.
- www.nasa.gov.
- www.cbc.ca.
- www.ctv.net.

The instructor is not limited to the suggested list for Website research.

Copy information cards located at Annex A.

PRE-LESSON ASSIGNMENT

On the parade night before the instruction of this EO, ask the cadets to research current advancements in aerospace technology and bring their findings to the class the following week. Encourage them to collect information from the news, magazines, journals and/or Websites.

APPROACH

An in-class activity was chosen for this lesson as it is an interactive way to present advancements in aerospace technology and stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have explored current advancements in aerospace technology.

IMPORTANCE

It is important for cadets to know how aerospace technology has impacted what we observe and continue to learn about space and how this technology has aided in the development of inventions on Earth. Exploring current advancements in aerospace technology may allow cadets to further broaden their knowledge of space and future technologies.

Teaching Point 1 — **Conduct an Activity To Explore Current Advancements in Aerospace Technology**

Time: 25 min — Method: In-Class Activity

We have all heard that technology developed for the space program has affected our lives. But ask ten people on the street what advancements in space technology have had the most impact on Earth-bound humans, and many will likely recall commercials for an orange-flavoured breakfast drink. A few more may remember other commercials for ballpoint pens that can write upside down.

You might be surprised to learn that you actually have seen commercials for more far-reaching space-based technologies or perhaps had the life of a loved-one saved by another spun-off space technology item.

You might have even received some of them as holiday gifts.

For this activity the cadets shall present their findings that they collected over the past week. Cadets may also brainstorm new advancements that they may have heard about in the media over the past year.

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadet explore current advancements in aerospace technology.

RESOURCES

Information cards.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide cadets into groups of no more than four.

In addition to the cadets' findings see Annex A for advancements from the past or use information that was researched and brought to class.

2. Have cadets take two minutes to share with their groups information they were able to find about current advancements in aerospace technology.

3. Each group must take five minutes to choose and review an advancement they have researched or an advancement from Annex A to present to the whole class.

4. Each group will have 3 minutes to present their advancement to the class.

After the activity, if time allows, identify additional advancements from the past using the information cards located at Annex A.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is a current advancement in aerospace technology that has impacted Earth today?

Q2. What advancement in aerospace technology is of most interest to you and why?

Q3. What is a current technology item in use today designed by the Canadian Space Agency?

ANTICIPATED ANSWERS

A1. A current advancement in aerospace technology that has impacted Earth today is (any of the following):

- satellite radio,
- video image stabilization and registration,
- satellite TV,
- DeBakey blood pump,
- global positioning system (GPS),
- temper foam,
- advanced communications technology,
- fire-resistant aircraft seats,
- excimer angioplasty system, and
- liquid-cooled garments, etc.

A2. This response can be any advancement in aerospace technology that is of interest to the cadet.

A3. A technology item designed by the Canadian Space Agency is:

- The Canadarm,
- The Canadarm2, or
- Any other technology designed by the Canadian Space Agency.

END OF LESSON CONFIRMATION

The cadets' participation in the exploration of current advancements in aerospace technology activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Exploring advancements in aerospace technology will familiarize the cadets with technology developed for space that has had an impact on Earth. The knowledge gained in this lesson will assist in stimulating an interest in aerospace technology in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-110 Space.com. (2006). *Space on Earth: How Technology Transfer Benefits Humanity.* Retrieved 27 February 2007, from http://www.space.com/businesstechnollogy/technology/tech_halloframe_030101-1.html.

INFORMATION CARDS

"Google Images", CNN.net, Satellite Radio. Retrieved 14 March 2006, from http://i.a.cnn.net/cnn/2006/SHOWBIZ/Music/07/20/terrestrial.radio/story.satelitte.radio.jpg

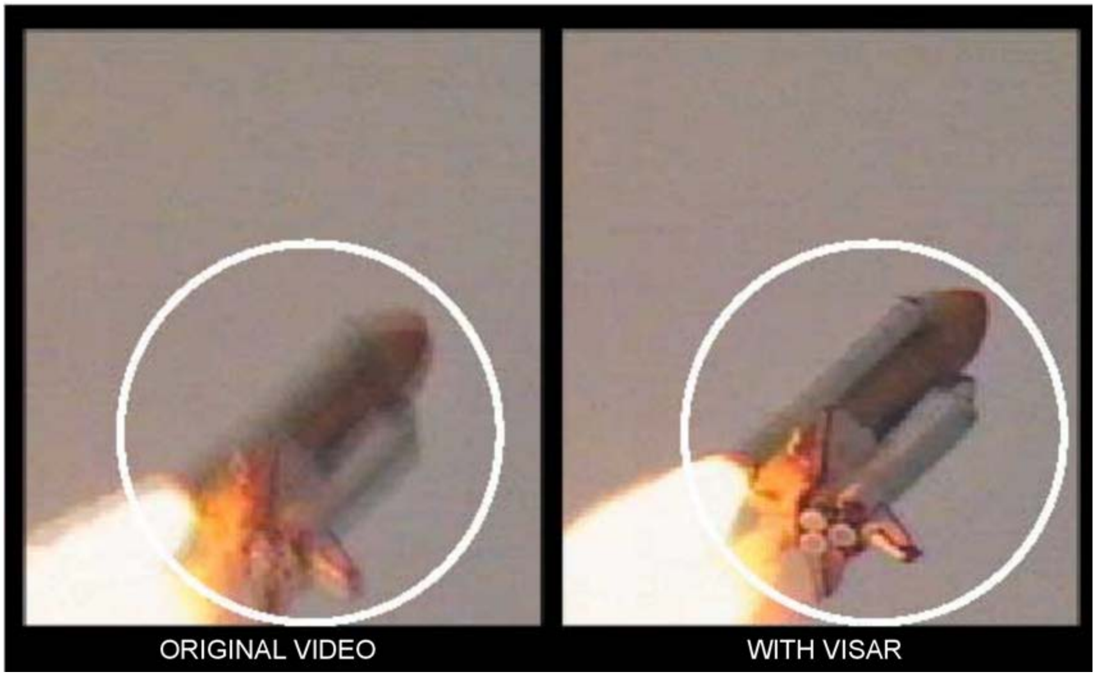
Figure A-1 Satellite Radio

Satellite Radio: Inducted into the Space Technology Hall of Fame in 2002

In 1997, two companies launched new services to help frustrated listeners find the right radio station for them, and when we say "launched," we mean as in rockets going up.

Sirius Satellite Radio and XM Satellite Radio were two companies that launched satellites to offer improved radios service for frustrated listeners. They were the winners in a Federal Communications Commission (FCC) bandwidth auction that allowed them to lay claim to the ultimate in broadcast antenna height. Broadcasting from the Earth's orbit, the two stations' satellites provide hundreds of digital-quality channels to all of North America. This service is offered with no commercials, but you need to pay to subscribe and use their proprietary receivers.

The innovation could set the standard for broadcasting in the future. Unlike satellite TV services, you do not need a stationary dish antenna aimed at a point in the sky. You can even listen in your car during long trips without ever touching the dial or fine tuning controls.



"Space.com", VISAR. Retrieved 14 March 2007, from http://www.space.com/php/multimedia/imagedisplay/img_display.php?pic=h_visar_02,0.jpg&cap=The%20VISAR%20system%20is%20a%20revolutionary%20way%20of%20stabilizing%20and%20refining%20images

Figure A-2 Video Image Stabilization and Registration (VISAR)

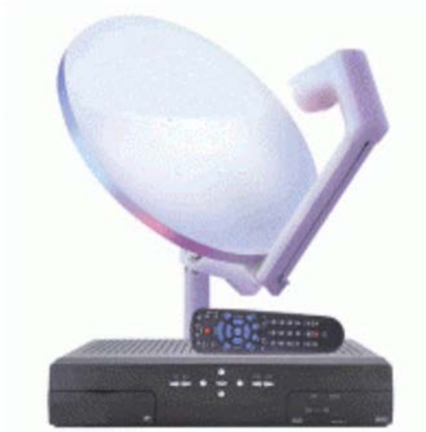
Video Image Stabilization and Registration (VISAR): Inducted into the Space Technology Hall of Fame in 2001

Video cameras seem to be everywhere these days. For law enforcement officers however, the recordings made on security cameras can often be a mixed blessing. Since the cameras are low-cost and often quite old, and the tapes reused repeatedly, the images can often be frustratingly muddy.

A great leap forward in solving this problem occurred in 1996 as a result of the bombing at the Olympic Games in Atlanta. At the request of the FBI, two NASA scientists, David Hathaway and Paul Meyer, took the skills they had honed studying the Sun and Earth's weather and used them to fight crime.

Their invention, called VISAR, brings order out of video chaos by correcting for a host of camera problems. A computer uses the VISAR software to "wash" the video until it is nearly free of static, blurring from camera movement, and the jagged edges of distant objects.

The software is beginning to see regular use by law enforcement and may soon be available for home computers. VISAR-equipped camcorders may be hitting the market in a few years, helping users to avoid pretending that their blurry, fuzzy vacation videos are cutting edge.



"Google Images", CNN.net, Satellite TV. Retrieved 14 March 2006, from http://gfx.download-by.net/screen/304/304217-satellite-tv-pro.jpg

Figure A-3 Satellite TV

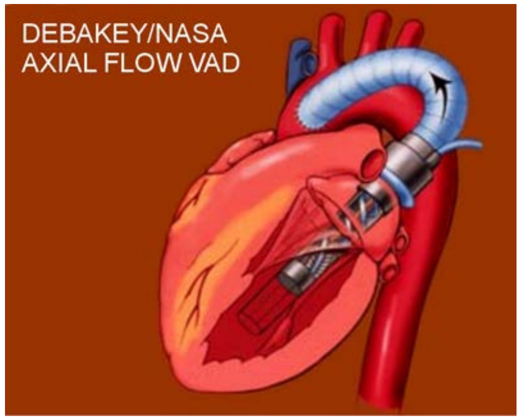
DirecTV: Inducted into the Space Technology Hall of Fame in 2000

It took an effort worthy of building a Mars exploration probe to bring you HBO, Showtime and Cinemax using a dish that does not cover your backyard and block out the sun.

The idea for TV-by-satellite began percolating inside the minds of Hughes Electronics researchers back in 1984. This was a time when TV viewing options were limited to your local VHF and UHF stations, and perhaps a cable service showing selections of other towns' local stations. This was also a time when kids played Atari (the first home video game system).

After getting permission from the Federal Communications Commission (FCC), Hughes spent $750 million to launch three satellites and build a broadcast centre. But it was their "under the hood" innovations that made it possible for subscribers to receive a clear signal with a dish no bigger than a large pizza.

There was no way an old-style analog TV signal beamed from orbit could be picked up by anything less than a network affiliate's two metre dish. So Hughes' satellites were designed to be extremely high-powered, to transmit the signal digitally, and to be highly compressed.



"Google Images", NASAexplores, Debakey Blood Pump. Retrieved 14 March 2006, from http://media.nasaexplores.com/lessons/01-005/images/heart9-12ajpg

Figure A-4 DeBakey Blood Pump

DeBakey Blood Pump: Inducted into the Space Technology Hall of Fame in 1999

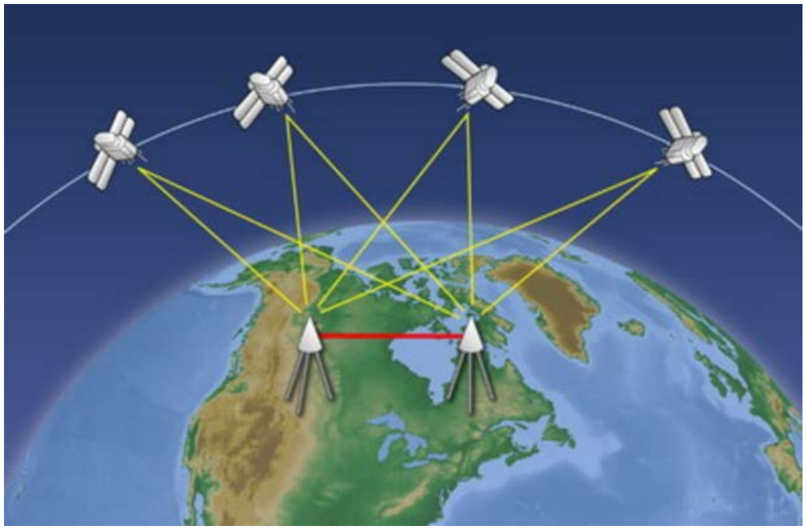
Some heart patients may soon find themselves fused with space shuttle technology.

You might not think that the human heart and the monstrously powerful rocket engines that carry astronauts into orbit have much in common. However they do share a critical trait—they both depend on a steady flow of fluid to work.

While developing the shuttle's engines, NASA researchers pushed the envelope in turbo pump design. To understand and regulate the rapid gushing of millions of litres of super-cold rocket fuel through engines that needed to be reused, NASA created revolutionary software for analyzing fluid dynamics.

But it was not until a group of doctors, lead by Dr. Michael DeBakey, teamed up with NASA that these advances were applied to medicine. The results of their work resulted in a miniaturized, extremely gentle pump that could push human blood through an artery without chopping up the life-bearing blood cells.

The pump is currently entering clinical trials for use as a temporary heart for patients awaiting a transplant, and to take some of the load off a newly transplanted heart during recovery.



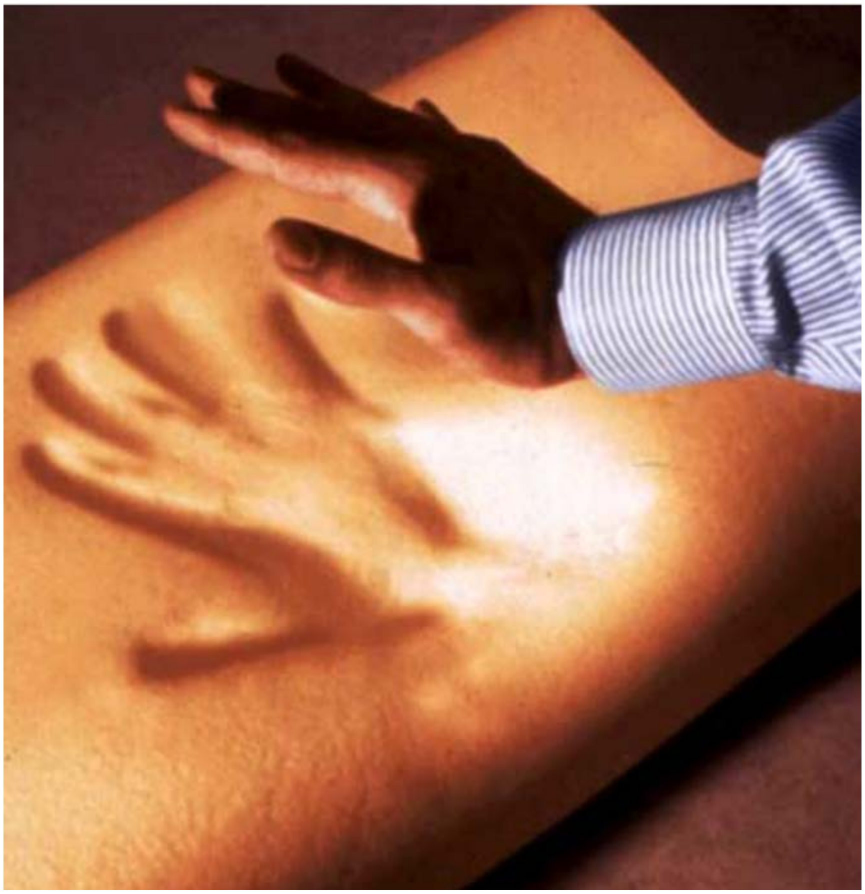
"Google Images", Par Lap Top, GPS. Retrieved 14 March 2006, from http://www.parslaptop.com/images/helmer-gps.jpg

Figure A-5 Global Positioning System (GPS)

Global Positioning System (GPS): Inducted into the Space Technology Hall of Fame in 1998

Originally developed to help the military to track things like ships at sea and the locations of groups of soldiers, it is now regularly used to track things as simple as lost pets.

The true genius of the GPS system is its simplicity. No matter where you are on Earth, or what time it is, there are always several GPS satellites overhead. A constellation of 24 operating satellites (along with five spares) parade in strictly specified orbits 20 200 km (10 900 miles) high. Together they beam a global "dial tone" of sorts which GPS devices use to determine their location by determining the signal lag from each detected satellite.



"Space.com", Temper Foam. Retrieved 14 March 2007, from http://www.space.com/php/multimedia/imagedisplay/img_display.php?pic=h_temperfoam_02,0.jpg&cap=Developed%20for%20the%20space%20program,%20Temper%20Foam%20is%20being%20used%20on%20Earth%20for%20bedding%20and%20seats

Figure A-6 Temper Foam

Temper Foam: Inducted into the Space Technology Hall of Fame in 1998

It might be hard to believe after sitting still for several hours, but the science of modern airline seats is revolutionary. Temper Foam, a NASA-developed cushioning material that is not only wonderfully shock absorbent, but also is softest where your body contacts it.

The resiliency of Temper Foam is astounding. The impact of an adult falling from a height of 3 m will be fully absorbed by a layer of Temper Foam only 7.6 cm thick. Its temperature sensitivity means it conforms to your body's contours while remaining firm at other points.

That is why it is used in the astronauts' seats on the shuttle. During launch they experience more violent shaking than most business travellers do in an entire year.

Temper Foam is not just used in well-travelled furniture. You will find it in sports helmets, orthopaedic supports, and home furnishings.

"Google Images", Encarta.msn.com, Advance Communication Technology (ACT). Retrieved 14 March 2006, from http://images.encarta.msn.com/xrefmedia/sharemed/targets/images/pho/t014/T014377A.jpg

Figure A-7 Advanced Communication Technology (ACT)

Advanced Communications Technology (ACT): Inducted into the Space Technology Hall of Fame in 1997

Think that the new cable modem with high bandwidth you got as a gift was high tech? Well, that is nothing compared to satellites using NASA's Advanced Communications Technology (ACT).

ACT helped pave the way for the latest generation of high-speed and high-bandwidth broadcast and communications satellites.

Most satellites broadcast in "shotgun" style, in a wide cone covering the Earth. This is wasteful if the data only needs to reach one small region.

The ACT satellite, launched in 1993, proved among other things that spot-beaming to selected areas of the Earth was possible. It also features a host of other satellite communications improvements, such as high-speed switching and gigabits of bandwidth capacity. These innovations have already been incorporated into satellite phone and TV services.

Back on Earth, another ACT innovation can even keep an antenna in a moving vehicle aimed at an appropriate satellite. So you might soon be spending those long flights watching satellite TV instead of listening to canned music.

"Google Images", Skylink, Fire-resistant Aircraft Seats. Retrieved 14 March 2006, from http://www.skylink.co.nz/aircraft/737-200-b.jpg

Figure A-8 Fire-resistant Aircraft Seats

Fire-resistant Aircraft Seats: Inducted into the Space Technology Hall of Fame in 1996

Unfortunately, it often takes a tragedy to wake people up to new dangers and find ways to avoid them.

So it was with the fire that took the lives of the crew of Apollo 1. During the long and painstaking investigation that followed, NASA found that there were far too many flammable materials in the capsule which contributed to the blaze. One major culprit was the very seat astronauts sat in.

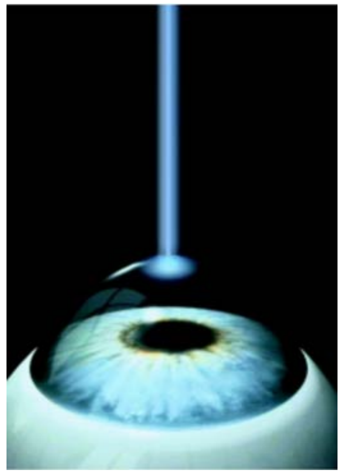
The cushioning was made of a flammable type of polyurethane. However there were no other materials that were as supportive and, just as importantly, lightweight.

So, to meet the exacting weight requirements without adding to the already dangerous business of space travel, NASA researchers developed a special coating for the seat cushions. The outer shell of the cushions in NASA's new seat consisted of a fire-retardant fabric that added little to the weight, yet could withstand extremely high temperatures and exposure to naked flame.

This fire-resistance system has been in use on commercial airlines for pilots and passengers since 1984 when the Federal Aviation Administration (FAA) issued new regulations regarding fire dangers on board aircraft.

So not only is your seat useful as a floatation device, it also blocks fire, and combined with Temper Foam, it can absorb a tremendous amount of impact.

That is a lot of space technology packed into the 60 cm^2 that you sit on.



"Google Images", ALZ Eye Laser Centre Munich, Excimer Laser. Retrieved 14 March 2006, from http://www.gutsehen.de/gfx/excimer.jpg

Figure A-9 Excimer Laser Angioplasty System

Excimer Laser Angioplasty System: Inducted into the Space Technology Hall of Fame in 1994

Coronary artery disease is one of the most common medical problems. When the arteries that feed freshly oxygenated blood to the heart become congested, it can result in a fatal heart attack. Treating the condition usually involves a costly and dangerous surgery. One common treatment, called balloon angioplasty, uses a tiny balloon to open up the artery by stretching it open as the balloon inflates.

Since 1992 a much less invasive procedure has been in use that owes its existence to studies of the Earth's atmosphere.

Developed by NASA's Jet Propulsion Laboratory to study the Earth's ozone layer, the excimer laser is a concentrated beam of ultraviolet light that never rises above 18 degrees Celsius, yet can be used as a super-fine scalpel. To clear a patient's arteries, the surgeon snakes a thin tube, with a specially-designed laser emitter on the tip, up into the patient's coronary arteries. The tip spreads the laser light out in a cone, which the surgeon uses to vaporize blockages without cutting healthy tissue. The excimer laser procedure is much easier to recover from than balloon angioplasty or bypass surgery.

Excimer lasers are also now widely used for correcting vision problems.

"Space.com", Liquid-cooled Garments. Retrieved 14 March 2007, from http://www.space.com/php/multimedia/imagedisplay/img_display.php?pic=h_sts113_spacesuit_02.jpg&cap=Astronaut% 0Michael%20E.%20Lopez-Alegria,%20STS-113%20mission%20specialist,%20works%20on%20the%20newly%20installed%20Port%20One%20(P1)%20truss%20on%20the%20International%20Space%20Station%20(ISS)%20during%20the%20mission's%20second%20scheduled%20session%20of%20extravehicular%20activity%20(EVA)%20on%20November%2028,%202002.%20The%20spacewalk%20lasted%206%20hours,%2010%20minutes

Figure A-10 Liquid-cooled Garments

Liquid-Cooled Garments: Inducted into the Space Technology Hall of Fame in 1993

Keeping astronauts cool and comfortable on the baking surface of the Moon presented NASA's designers with a formidable challenge. How do you get rid of excess heat when you are standing under an open sky with literally nothing between you and the blazing fury of the Sun? One certainly cannot open one's shirt and no matter how vigorously an astronaut waved a fan under his or her chin, there would never be a cooling breeze.

So NASA developed the liquid-cooled garment to keep the explorers as comfortable as possible on their jaunts.

Think of it like an electric blanket in reverse. A special set of long underwear in the suits contained a layer of thin water tubes that covered the astronauts literally from head-to-toe. A pump and refrigeration unit in the backpack regulated the temperature and kept the water circulating.

This technology is still in use in NASA suits today. When shuttle astronauts step outside to rescue a crippled satellite, or do construction work on the International Space Station (ISS), they are wearing the latest version of the cooling underwear first designed in the 60s.

Back on Earth, the special cooling system is worn by the likes of firefighters handling hazardous materials, race car drivers, and soldiers in the desert. People with medical conditions that make them prone to easy overheating also wear garments based on the technology, enabling them to be much more active than they would otherwise be.

"Google Images", www.island.net, Canadarm. Retrieved 14 March 2006, from http://www.islandnet.com/~pacific/arm002.jpg

Figure A-11 Canadarm

Canadarm Debut on November 13, 1981

Canada's most famous robotic and technological achievement made its space debut on November 13, 1981. The design and building of the Shuttle Remote Manipulator System marked the beginning of Canada's close collaboration with NASA in manned space flight. The Canadarm project remains a sterling example of successful international space cooperation.

Canadarm firmly established Canada's international reputation for robotics innovation and know-how. Its excellent performance record has inspired several generations of scientists and engineers as they develop new technologies for industry and medicine, such as medical robotics and automated robotics in the automotive industry.

Canadian Space Agency, Canadarm2. Retrieved 14 March 2006, from http://www.space.gc.ca/asc/app/gallery/results2.asp?session=&image_id=mss_spar2

Figure A-12 Canadarm2

Canadarm2

In April 2001, Space Shuttle Endeavour delivered a package that was Canada's key contribution to the International Space Station, now being assembled about 400 kilometres above Earth.

That package was the latest generation robotic arm—Canadarm2, the Space Station Remote Manipulator System (SSRMS), installed on the Station, with the aid of Canadian astronaut Chris Hadfield.

Like Canadarm, Canadarm2 is a unique Canadian contribution–an essential tool for the construction and maintenance of the Space Station. In fact, the Station could not even be built without Canadarm2.

Robotics was identified as a strategic technology for Canada. It was a self-contained package that Canada could afford, and it was a critical component of infrastructure which gave Canada a particular role and status in building the International Space Station (ISS).

Canadarm2 will play another essential role—it gives Canadian scientists access to the Station's laboratory facilities to conduct experiments. It also entitles Canada to send an astronaut to the Station every three years for a tour of duty lasting three to four months.

Although the Canadarm2 technology has not made it to everyday technology on Earth, one can expect that this advancement in technology will one day make it to everyday life on Earth.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M240.02 – INVENT A SPACE TECHNOLOGY ITEM

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to space technology and to give an overview of it.

An in-class activity was chosen for TP2 as it is an interactive way to provoke thought and stimulate an interest among cadets.

A group discussion was chosen for TP3 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about space technology.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson and in groups of no more than four, the cadet shall have invented a space technology item.

IMPORTANCE

It is important for cadets to learn about the characteristics of space to gain an appreciation for space technology. This lesson will assist in stimulating the cadets' interest in space technology, which forms a significant part of the Canadian Space Agency, and will lead to future summer training progression opportunities in the Air Cadet Program.

Teaching Point 1 | **Explain That There Are Many Challenges Astronauts Encounter While in Space**

Time: 5 min | Method: Interactive Lecture

Travelling to and From Space

One of the biggest challenges for astronauts is travelling to and from space. The astronaut's body and the space shuttle experience a large amount of stress through turbulence as they pass through the Earth's atmosphere. Temper Foam is a cushioning material that is shock absorbent and is also softest where the body contacts it. It is a NASA-developed technology that is used in the seats on the space shuttle to reduce the stress through turbulence that the astronauts experience during the violent shaking during launch.

Heat stress that occurs as they re-enter the Earth's atmosphere is also another challenge. Imagine a place with no air, with temperatures that vary from extreme hot to extreme cold, and where particles of dust travel at speeds that could kill you. These are just some of the situations astronauts have to cope with when they travel in space.

The Living Environment

The strangest condition in space is the lack of gravity. Gravity is a force that makes objects move toward each other. The Earth's gravity keeps your feet on the ground and makes objects fall down by pulling them toward Earth. On a spaceship, there is no gravity and everything floats in the air. Velcro is used to anchor objects and prevent them from floating around. It takes time for an astronaut's body to adjust to living in space and many astronauts suffer from space sickness for the first few days or weeks of a mission.

Astronaut apparel has evolved over the decades from Mercury's aluminium foil-looking outfits to the bulky, 275-pound whites now used on space walks outside the space station. The U.S. suits are easier to work in for long periods of time but their complexity causes more maintenance. The one-size-fits-all Russian suits are used a few times and thrown away, but they are also not easy to work in.

NASA is hoping to make new suits that are both high-tech and low-maintenance.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is one of the biggest challenges with space technology?

Q2. What is the strangest condition an astronaut experiences in space?

Q3. What do many astronauts suffer from for the first few days or weeks in space?

ANTICIPATED ANSWERS

A1. One of the biggest challenges with space technology is travelling to and from space.

A2. The strangest condition an astronaut experiences in space is the lack of gravity.

A3. Many astronauts suffer from space sickness for the first few days or weeks in space.

Teaching Point 2 | **Conduct an Activity Where Cadets Invent and Construct a Space Technology Item**

Time: 35 min | Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets invent a space technology item that would help overcome the challenges of living in space.

RESOURCES

Consumable items for construction.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Consumable items are items that are readily available (e.g. cereal boxes, egg cartons, milk cartons, pop cans, etc.) at no cost for construction of the space technology invention.

Cadets may draw diagrams of their space technology item as an alternative to the construction of a model.

- Divide cadets into groups of no more than four.
- Provide the groups with consumable items for construction of their invention.
- Groups will have 35 minutes to invent a space technology item using any of the consumable items provided for this activity.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

The cadets’ invention/construction of a space technology item will serve as the confirmation of this TP.

Teaching Point 3 — **Conduct a Group Discussion Where Cadets Share Their Space Technology Item With the Entire Group**

Time: 15 min — Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to discuss the cadets' space technology inventions and their applications using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. What is your space technology invention?

Q2. What challenge are you trying to overcome in space?

Q3. Explain how you see it overcoming a challenge in space.

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

The cadets' participation in the activity in TP2 and the group discussion in TP3 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Inventing a space technology item will help the cadet learn about the characteristics of space and gain an appreciation for space technology. Stimulating the cadets' interest in space technology will lead to future summer training opportunities in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-040 (ISBN 0-7787-1140-4) Goodman, P. (2002). *Arty Facts: Space and Art Activities.* St. Catharines, ON: Crabtree Publishing.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO M240.03 – PARTICIPATE IN A SPACE SURVIVAL SCENARIO

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-802/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.

Photocopy the survival scenario located at Annex A for each group.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 as it is an interactive way to provoke thought and to stimulate an interest in space survival among cadets.

A group discussion was chosen for TP2 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions, and feelings about survival in space.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson and in groups of no more than four, the cadets shall have participated in a space survival scenario.

IMPORTANCE

It is important for cadets to participate in a space survival scenario to understand the challenges astronauts face while living in space. Cadets will be able to use their knowledge about space survival in future space activities in the Cadet Program.

Teaching Point 1 | **Choose Five Survival Items to Survive in Space**

Time: 15 min | Method: In-Class Activity

Water on the Moon

On March 5, 1998, NASA scientists announced the discovery of water on the Moon.

Ice exists because the shadows on the moon are very frigid. The temperature in the shadow is approximately minus 140 degrees Celsius. Anywhere else on the Moon, water would be vaporized by the intense sunlight and lost to space.

Living in Space

Astronauts must learn to manage everyday activities in space. Simple hygenic tasks like brushing your teeth can prove to be a challenge in space. Everything floats in space unless it is tied down. Even the consumption of food can be a challenge. Astronauts stay away from crackers and bread because the crumbs go up their nostrils.

Astronauts are kept very busy while in space. Aside from continuing to build the International Space Station (ISS), another very important part of their mission while living in space is to perform several experiments. These experiments focus on developing technologies to improve not only life in space but also life on Earth.

ACTIVITY

OBJECTIVE

The objective of this activity is to introduce and develop the cadets' interest and understanding of living in a space environment.

RESOURCES

Survival scenario located at Annex A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into groups of no more than four.
2. Provide each group with a copy of the scenario.
3. Commence the activity by reading the scenario to the cadets.
4. Inform the cadets that they have 15 minutes to complete the activity.

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	**Have the Cadets Explain Why They Chose Their Items for Survival**
Time: 10 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to discuss the groups' reason for choosing their items to complete the survival scenario using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.

Sit the group in a circle, making sure all cadets can be seen by everyone else.

Ask questions that will provoke thought; in other words avoid questions with yes or no answers.

Manage time by ensuring the cadets stay on topic.

Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.

Give the cadets time to respond to your questions.

Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.

Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. What were the items that your group selected to survive in space?

Q2. Why did your group select these survival items?

Q3. What was the most important item on your list and why?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

The cadets' participation in the space survival scenario will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Participating in a space survival scenario may develop the cadets' interest in space by introducing elements of survival in space. Understanding the challenges astronauts face while living in space may be of use in future space activities in the Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-111 Lakeland Central School District. (2007). *Space Survival Challenge.* Retrieved 27 February 2007, from http://www.lakelandschools.org/EDTECH/leslie/space.htm.

SPACE SURVIVAL SCENARIO

Situation

You are a member of a shuttle crew scheduled to meet with the International Space Station (ISS). Due to a systems failure, you and three astronauts had to crash-land on the Moon. During the landing, much of the equipment aboard was damaged. Only eight items of equipment were left undamaged. Since survival depends on waiting for the arrival of a rescue shuttle from the ISS, the most critical items must be chosen to help you survive while waiting for the arrival of the shuttle.

Mission

You will be working in groups of four as a team of astronauts. Your survival depends on selecting a maximum of five items that you will need while waiting for the rescue shuttle to arrive. Your challenge is to rank, in order (most to least important), those items that have been left undamaged on your shuttle. Base your decisions on what you already know about conditions in space and on the Moon.

Items that Survived the Crash Landing

- a box of matches,
- 2 x 50 kg tanks of oxygen,
- 20 litre of water,
- 15 m of nylon rope,
- a magnetic compass,
- a stellar map of the Moon’s constellations,
- a solar-powered receiver-transmitter, and
- a reconstituted food package.

Instructions

1. Select five items from the list that your team will need to survive until the arrival of the rescue shuttle.
2. Rank your objects in order from most to least important.
3. Justify your choices within your group.
4. Prepare to present your findings to the class in a group discussion.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO C240.01 – PARTICIPATE IN A NON-VERBAL COMMUNICATION ACTIVITY

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-802/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.

Prepare a slide or handouts for each cadet of Figure A-1.

Prepare cue cards located at Annex B to be used during the in-class activity in TP3.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP2 to orient the cadets to the topic, generate interest and to give an overview of non-verbal communication.

An in-class activity was chosen for TP3 as it is an interactive way to provoke thought and stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have participated in a non-verbal communication activity to gain a familiarization with an alternate method of communication.

IMPORTANCE

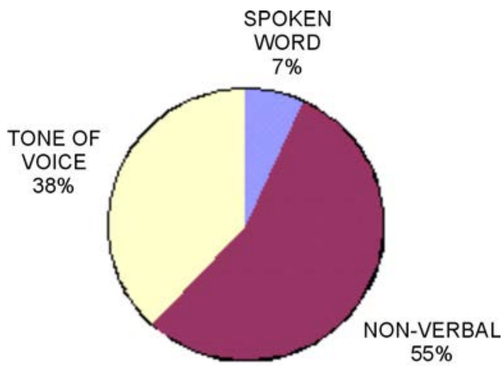
It is important for cadets to understand how to communicate using methods other than speech. If radio communication is lost in space, astronauts must still be able to communicate with one another. The cadets' participation in a non-verbal communication activity will help stimulate an interest in other methods of communication.

Teaching Point 1 | **Explain the Use of Body Language as a Form of Non-verbal Communication**

Time: 5 min | Method: Interactive Lecture

When people use spoken language to communicate, they do more than just listen to what is said in order to understand the message. They also look at the person who is speaking to see what their body is doing (body language), and listen to the way they are saying the words (tone) to understand their full message.

Studies have been done that show us the percentage of understanding that is gained from the spoken word. It is considerably less than the meaning that people gain from listening to a person's tone of voice and looking at their non-verbal communication.



"Department of Education Training and Youth Affairs", Non-verbal Communication. Retrieved 20 March 2007, from http://www.dest.gov.au/nwt/hospitality/comm_non.htm

Figure 1 Non-verbal Communication

Body Language. Includes the way people walk, talk, how they stand and their facial features (shown by a person's body attitude or movements).

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. When people use spoken language to communicate, what other things do people do besides listening, to understand what is being said?

Q2. What is the percentage of understanding gained through non-verbal communication?

Q3. Does this percentage surprise you? Why or why not?

ANTICIPATED ANSWERS

A1. They also look at the person who is speaking to see what their body is doing.

A2. 55% of understanding is gained through non-verbal communication.

A3. Answers will vary.

Teaching Point 2	**Explain the Use of Gestures as a Form of Non-verbal Communication**
Time: 5 min	Method: Interactive Lecture

Gesture. A gesture is a form of non-verbal communication made with a part of the body, used instead of or in combination with verbal communication. Examples of non-verbal communication are facial expressions, hand signals, eye gazing and body postures (e.g. smile, handshake, wave, etc.).

Gestures that people use also convey meanings, such as:

- **Waving.** Saying hello or goodbye, or to get someone's attention.
- **Making a Fist.** You are angry.
- **Thumbs Up.** Okay.
- **Pointing.** Showing something.

Not all simple gestures are always understood and misunderstandings occur because of these gestures. It is important to understand that gestures mean different things in different cultures. Sometimes gestures can be rude in one culture, but okay in another. In North America spinning your finger around your ear is known as "You're crazy". In Argentina the same gesture means "You have a phone call".

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is a gesture?

Q2. What is the gesture for anger?

Q3. Can you think of another gesture that has not been mentioned, that people use and what does it mean?

ANTICIPATED ANSWERS

A1. A gesture is a form of non-verbal communication made with a part of the body, used instead of or in combination with verbal communication.

A2. Making a fist.

A3. Answers will vary but may include:

- finger to lips—shhh, be quiet,
- shaking head—no,
- nodding—yes or agreement to something,
- wagging finger at someone—scolding, or
- yawn and put flat hand to lips—I'm tired.

Teaching Point 3 — **Conduct an Activity Where the Cadets Name an Emotion That They Have Shown in the Last Week**

Time: 15 min — Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to develop the cadets' knowledge of non-verbal communication and understand the challenges in communicating without speech.

RESOURCES

Cue cards located at Annex B.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Prior to the start of the activity, ask the cadets to name an emotion that they have shown during the past week. Some of their responses may be anger, fear, happiness, satisfaction, sorrow or surprise.

1. Request a volunteer to stand in front of the class and select a cue card with an emotion.
2. Once the cadet has selected the cue card ask them to act out the emotion to the class using body language to communicate the emotion. The cadet cannot tell the emotion to the class using speech.
3. The class must determine the emotion.
4. Once the class determines the correct answer, have another volunteer come to the front of the class and select a cue card and repeat the activity.

This activity is not limited to the emotions on the cue cards. Allow the cadets to create additional cue cards and act out additional emotions.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

The cadets' participation in the in-class activity will serve as the confirmation of this lesson.

END OF LESSON CONFIRMATION

The cadets' participation in the non-verbal communication activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Participating in the non-verbal communication activity helps the cadets understand the importance body language has on communication.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-104 Australian Government, Department of Education, Science and Training. (2007). *Communication in the Workplace: Non-verbal Communication (Body Language).* Retrieved 22 February 2007, from http://www.dest.gov.au/nwt/hospitality/comm_non.htm.

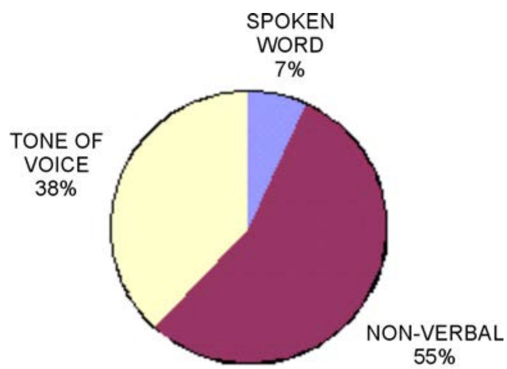
THIS PAGE INTENTIONALLY LEFT BLANK

NON-VERBAL COMMUNICATION

7% Spoken words

38% Tone of voice

55% Non verbal



"Department of Education Training and Youth Affairs", Non-verbal Communication. Retrieved 20 March 2007, from http://www.dest.gov.au/nwt/hospitality/comm_non.htm

Figure A-1 Non-verbal Communication

THIS PAGE INTENTIONALLY LEFT BLANK

CUE CARDS

SORROW

FEAR

SATISFACTION

SURPRISE

HAPPINESS

ANGER

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 5

EO C240.02 – INVENT A COMMUNICATION SYSTEM FOR SPACE

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Photocopy the message cue cards located at Annex A to be used during the in-class activity in TP2.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to space communication, to give an overview of it and to generate interest in the subject.

An in-class activity was chosen for TP2 as it is an interactive way to present the content and stimulate an interest among cadets.

A group discussion was chosen for TP3 as it allows the cadets to interact with their peers and share their knowledge, experience, opinions and feelings about space communication.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson and in groups of no more than four the cadet shall be expected to invent a communication system for space.

IMPORTANCE

It is important for cadets to understand how to communicate in space using methods other than speech. Communication is one of the challenges to living in space. If radio communication is lost in space, astronauts must still be able to communicate with one another. The cadets' participation in a non-verbal communication activity will help stimulate an interest in other methods of communication.

Teaching Point 1 | **Explain That Astronauts Use Radio Communication While in Space to Communicate With Other Astronauts and Ground Control**

Time: 5 min | Method: Interactive Lecture

RADIO COMMUNICATION

While in space, shuttle astronauts use ultra high frequency (UHF) radio transceivers to communicate with their colleagues inside the shuttle cabin. The astronauts also sometimes use their UHF radios to talk with ground control during launch or landing.

COMMUNICATIONS CARRIER ASSEMBLY (CCA)

The CCA is a fabric cap worn by the astronaut. It contains microphones and speakers for use with the radio. It allows for hands-free radio communication while wearing a spacesuit.

RADIO COMMUNICATION FAILURE

It is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communication failure. During two-way radio communication failure, when confronted with a situation not covered in the regulations, astronauts are expected to exercise good judgement in whatever alternative communication method they choose to communicate with each other.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. While in space, what do shuttle astronauts use to communicate with their colleagues inside the shuttle cabin?

Q2. What allows hands-free radio communication while wearing a spacesuit?

Q3. What must astronauts do during two-way radio communication failure?

ANTICIPATED ANSWERS

A1. While in space, shuttle astronauts use UHF radio transceivers to communicate with their colleagues inside the shuttle cabin.

A2. The CCA is a fabric cap worn by the astronaut. It contains microphones and speakers for use with the radio.

A3. Astronauts are expected to exercise good judgement in whatever alternative communication method they choose to communicate with each other.

Teaching Point 2	**Invent a Communication System for Space**
Time: 40 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets invent a communication system for space that does not involve the use of speech.

RESOURCES

Message cue cards located at Annex A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into groups of no more than four.
2. Provide the groups with a message cue card located at Annex A to focus on what they must be able to communicate using their communication invention.
3. Groups will have 30 minutes to invent a communication system for space.

If the groups complete the task quickly, have them make up additional messages using their inventions.

Use the remaining 10 minutes to complete the following steps.

4. One cadet from each group will present their group's invention to the class by communicating the message from their cue card using the invention.
5. Once the cadet has communicated the message using their invention, the class must determine the message. The cadet cannot communicate the message to the class using speech.
6. The cadet will read the message aloud to the class once they determine the message.

If the class cannot determine the message, have the group read out the message to the class. The group will not be penalized if they are unsuccessful in communicating the message.

7. Repeat steps 4–6 until all groups have presented their invention.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

The cadets' invention of a communication system for space will serve as the confirmation of this TP.

Teaching Point 3 — **Discuss Communication System Inventions With the Entire Group**

Time: 10 min — Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to discuss the non-verbal communication inventions using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. Why did your group select this alternative method of communication to communicate your message?

Q2. What was the biggest challenge in developing your invention?

Q3. What was the most challenging part in communicating your message?

Q4. How would you modify the inventions to be more effective?

Q5. Are there other non-verbal communication systems that could have been more effective?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

The cadets' participation in the invention of a communication system for space will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Participating in the invention of a communication system for space may emphasize how important communication is for astronauts in space.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-135 Virtual Skies. (2007). *Two-way Radio Communication Failure (Aeronautical Information Manual Section 6.4.1).* Retrieved 18 March 2007, from http://virtualskies.arc.nasa.gov/communication/youDecide/AIM6_4_1.html.

THIS PAGE INTENTIONALLY LEFT BLANK

MESSAGE CUE CARDS

I am out of air.

I am stuck.

Come here.

I am sick.

I need help.

I am lost.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 6

EO C240.03 – IDENTIFY PARTS OF A ROCKET

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-802/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.

Photocopy the handout located at Annex A for each cadet.

Photocopy and cut out the rocket puzzle pieces located at Annex B to be used in TP2.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to orient the cadets to the parts of a rocket, to generate interest and to present basic material.

An in-class activity was chosen for TP2 as it is an interactive way to confirm the cadet's comprehension of the material.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify parts of a rocket to become familiar with its components.

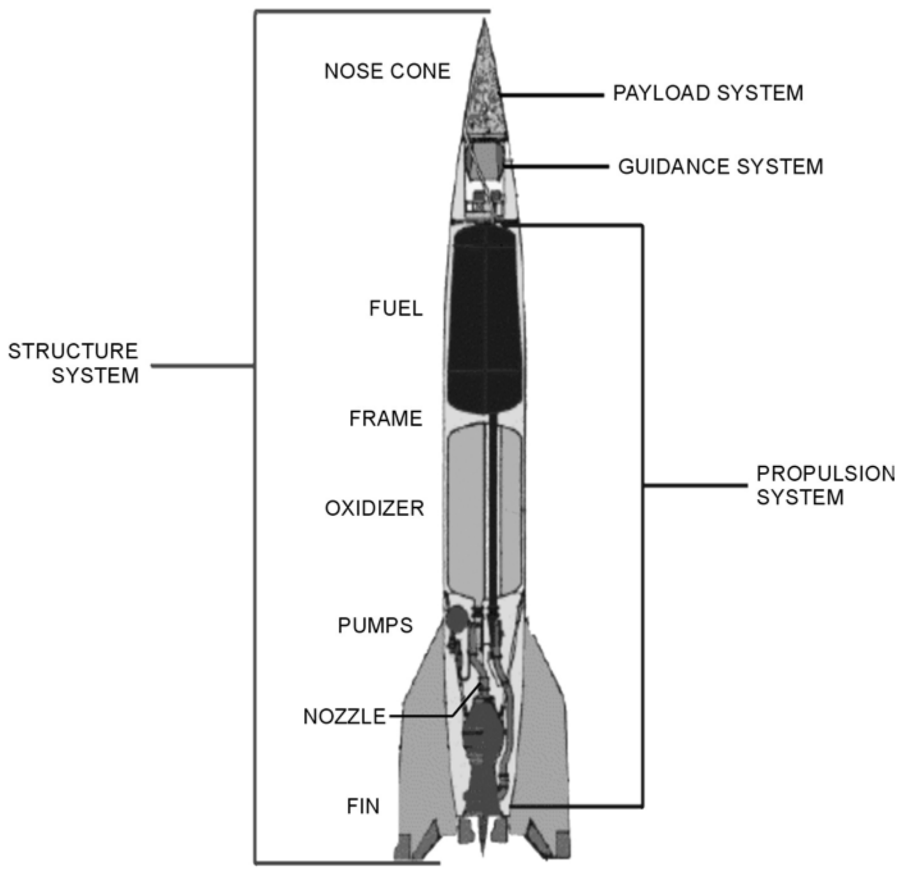
IMPORTANCE

It is important for cadets to know the parts of a rocket so that they can understand how they are constructed. Identifying the parts of a rocket may develop an interest in the components that make up a rocket, which may lead to future aerospace opportunities in the Air Cadet Program.

Teaching Point 1 — **Explain the Parts of a Rocket**

Time: 15 min — Method: Interactive Lecture

In flight, a rocket is subjected to the forces of weight, thrust, and aerodynamics. There are many parts that make up a rocket. For design and analysis, engineers group parts that have the same function into systems.



NASA, 2007, Rocket Parts, Retrieved 26 February 2007, from http://exploration.grc.nasa.gov/education/rockerpart.html#

Figure 1 Parts of a Rocket

ROCKET PARTS

Structural System. Also known as the frame, it is similar to the fuselage of an airplane. The frame is made from very strong but light-weight materials, like titanium or aluminum. The frame employs long “stringers” that run from the top to the bottom, which are connected to “hoops” that run around the circumference. The “skin” is then attached to the stringers and hoops to form the basic shape of the rocket. The skin may be coated with a thermal protection system to keep out the heat of air friction during flight and to keep in the cold temperatures needed for certain fuels and oxidizers. Fins are attached to rockets at the bottom of the frame to provide stability during flight.

The structure system includes the following parts:

- the nose cone,
- fuel,
- the frame,

- the oxidizer,
- the pumps,
- the nozzle, and
- the fins.

Propulsion System. Most of a full-scale rocket is made up of the propulsion system. There are two main classes of propulsion systems, liquid rocket engines and solid rocket engines. The V2 used a liquid rocket engine consisting of fuel and oxidizer (propellant) tanks, pumps, a combustion chamber with nozzle, and the associated plumbing. The Space Shuttle, Delta II, and Titan III all use solid external rockets.

Payload System. Payload systems depend on the rocket's mission. The earliest examples of payloads on rockets were fireworks for celebrating holidays. The payload of the German V2, shown in Figure 1, was several thousand pounds of explosives. Following World War II, many countries developed guided ballistic missiles armed with nuclear warheads for payloads. The same rockets were modified to launch satellites with a wide range of missions; communications, weather monitoring, spying, planetary exploration, and observatories, like the Hubble Space Telescope. Special rockets were developed to launch people into Earth's orbit and onto the surface of the Moon.

Guidance System. Guidance systems include very sophisticated sensors, on-board computers, radars, and communication equipment to manoeuvre the rocket in flight. Many different methods have been developed to control rockets in flight. The V2 guidance system included small veins in the exhaust of the nozzle to deflect the thrust from the engine. Modern rockets typically rotate the nozzle to manoeuvre the rocket. The guidance system must also provide some level of stability so that the rocket does not tumble in flight.

Distribute a handout of the parts of a rocket located at Annex A to each cadet.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. How do engineers group parts of rockets and why?

Q2. What rocket parts make up the structure system?

Q3. What are the systems in a rocket?

ANTICIPATED ANSWERS

A1. Engineers group rocket parts that have the same function into systems for design and analysis purposes.

A2. The structure system includes the following parts:

- the nose cone,
- fuel,
- the frame,
- the oxidizer,
- the pumps,

- the nozzle, and
- the fin.

A3. The systems of a rocket include:

- the structure system,
- the propulsion system,
- the payload system, and
- the guidance system.

Teaching Point 2	**Name the Parts of a Rocket**
Time: 10 min	Method: In-Class Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to help cadets become familiar with the parts of a rocket.

RESOURCES

- The puzzle located at Annex B, and
- Tape.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Provide the cadets with the puzzle parts and shapes of a rocket.
2. Request a cadet to volunteer and select a shape and place it on the board in front of the class.
3. Repeat the steps until all the shapes are up on the board and the rocket is built. Then repeat the steps using the words and pictures to label the rocket.

Allow cadets to make corrections if the parts of the puzzle are in the wrong place.

4. Use the handout located at Annex A as a guide to confirm if the puzzle is correct.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

The cadets' participation in identifying the parts of a rocket will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Knowing the parts of a rocket will help cadets understand how rockets are constructed. Identifying the parts of a rocket will help cadets understand the components that make up the rocket, which may develop an interest in rocket technology that may lead to future aerospace opportunities in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

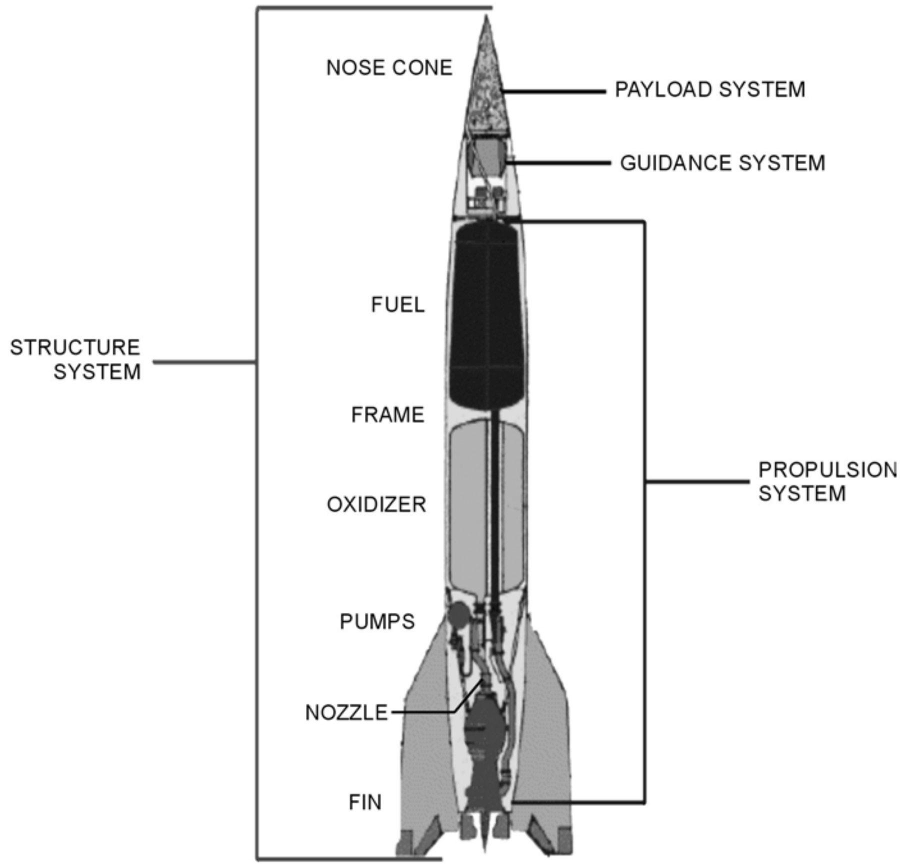
N/A.

REFERENCES

C3-106 NASA. (2006). *Rocket Parts.* Retrieved 22 February 2007, from http://exploration.grc.nasa.gov/education/rocket/rockpart.html#.

THIS PAGE INTENTIONALLY LEFT BLANK

PARTS OF A ROCKET

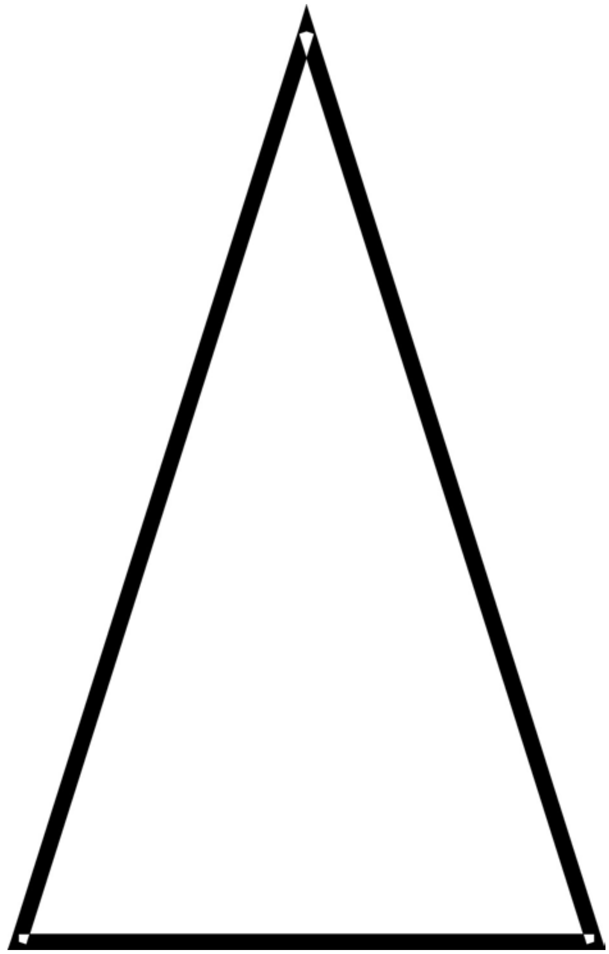


"NASA", Parts of a Rocket. Retrieved 23 April 2007, from http://exploration.grc.nasa.gov/education/rocketpart.html#

Figure A-1 Parts of a Rocket

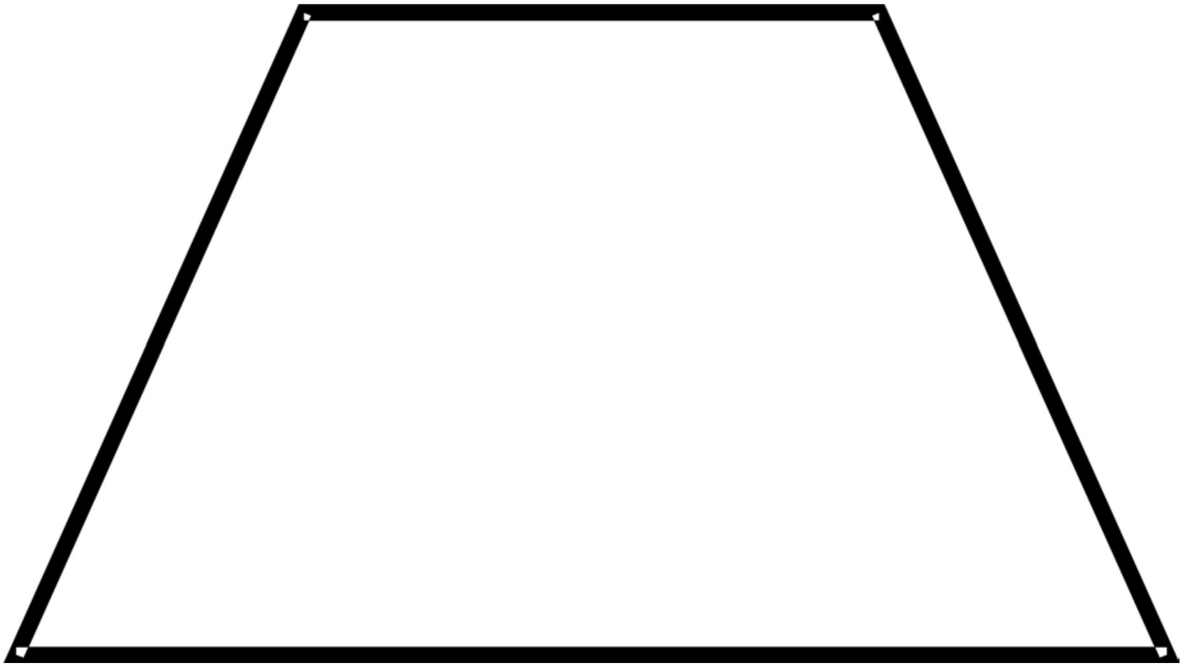
THIS PAGE INTENTIONALLY LEFT BLANK

ROCKET PUZZLE PIECES



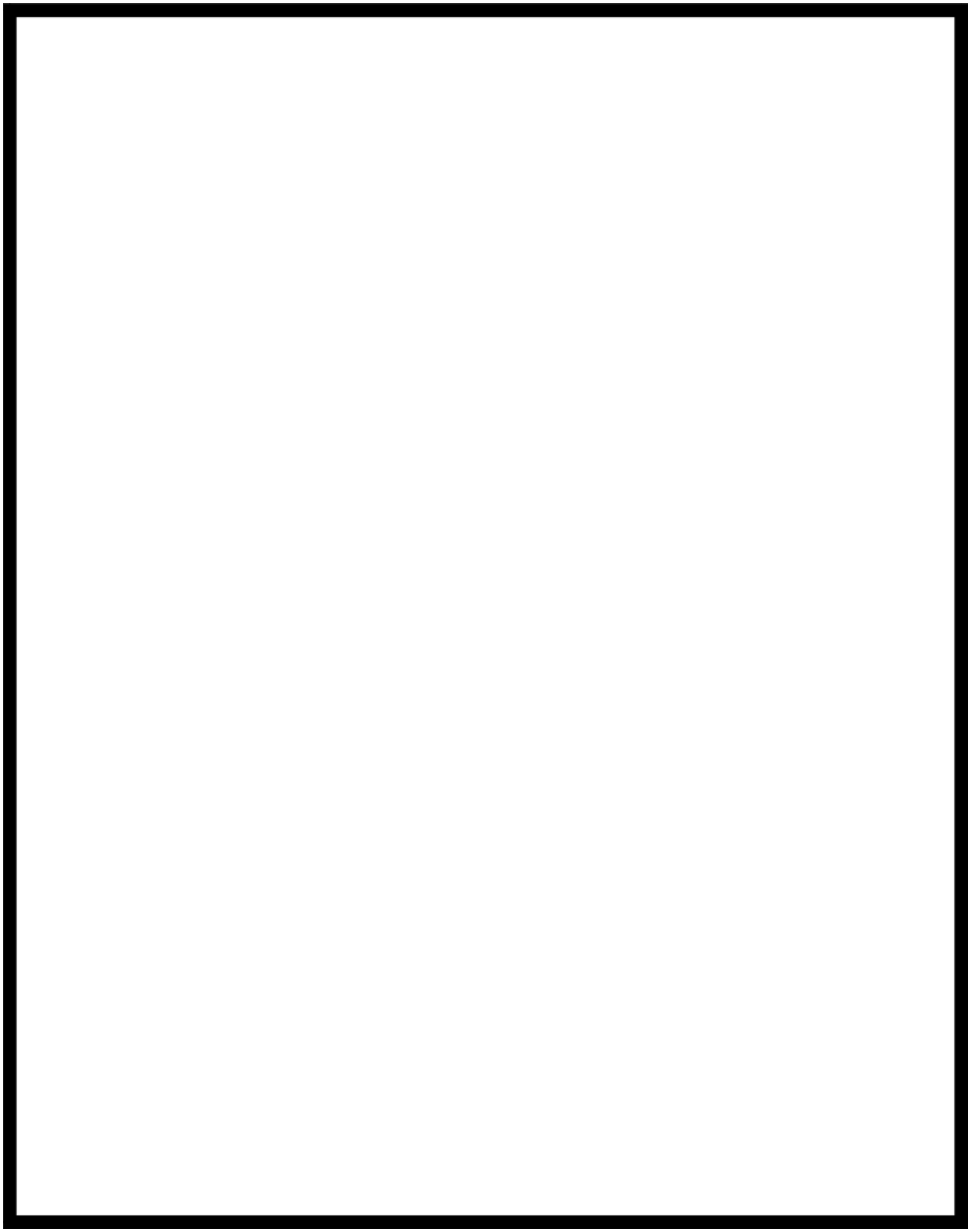
D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-1 Nose Cone (Part A)



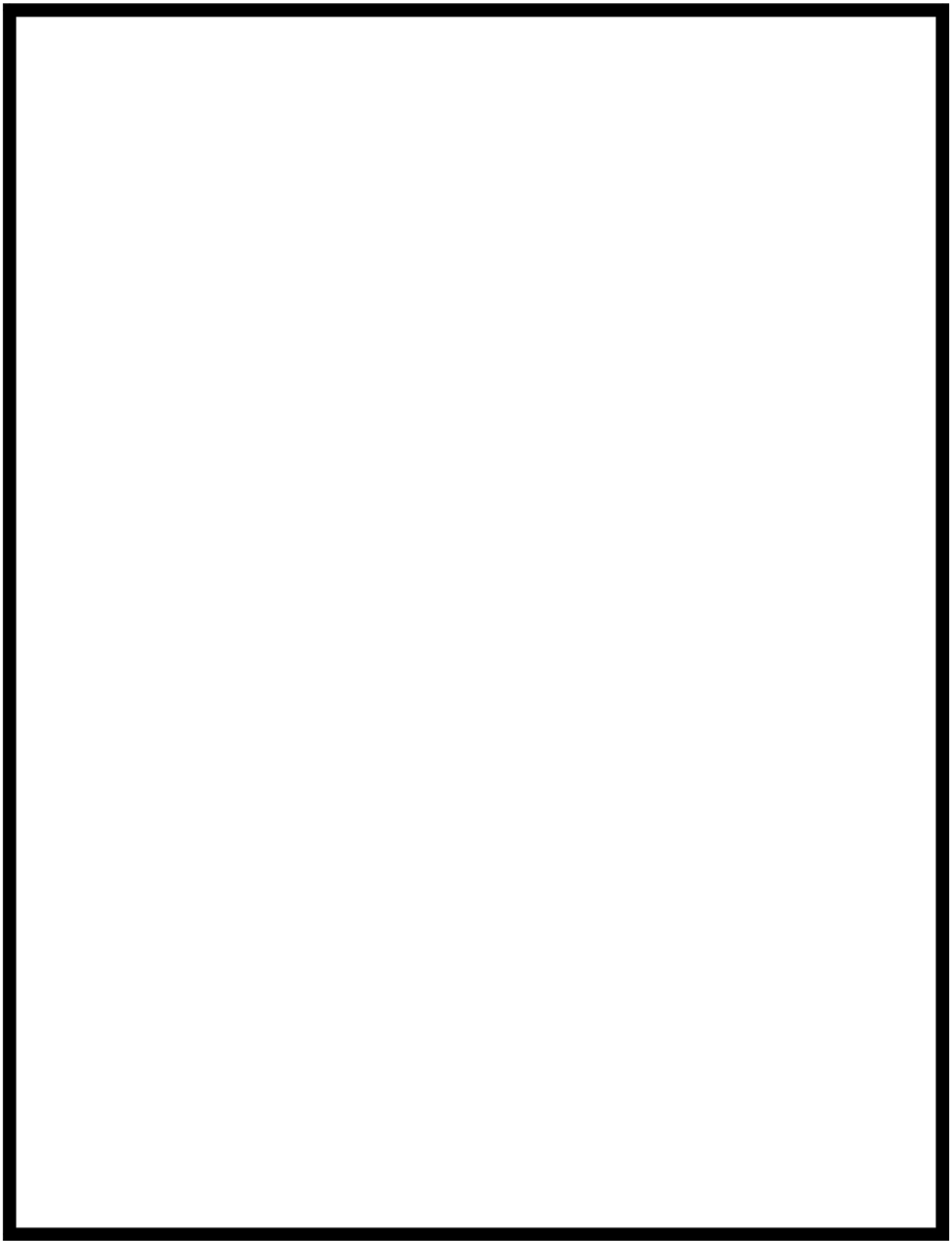
D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-2 Nose Cone (Part B)



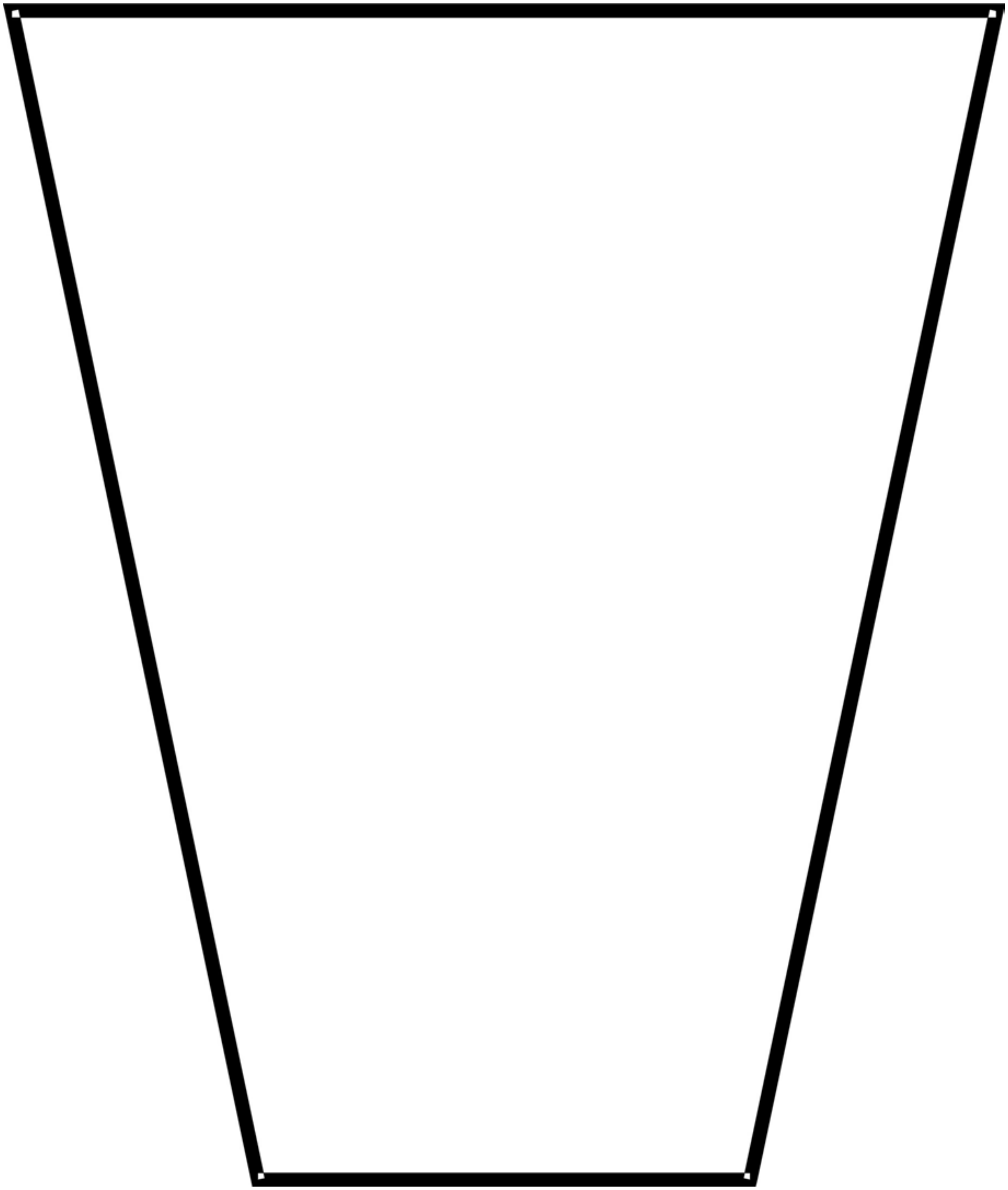
D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-3 Frame (Fuel Section)



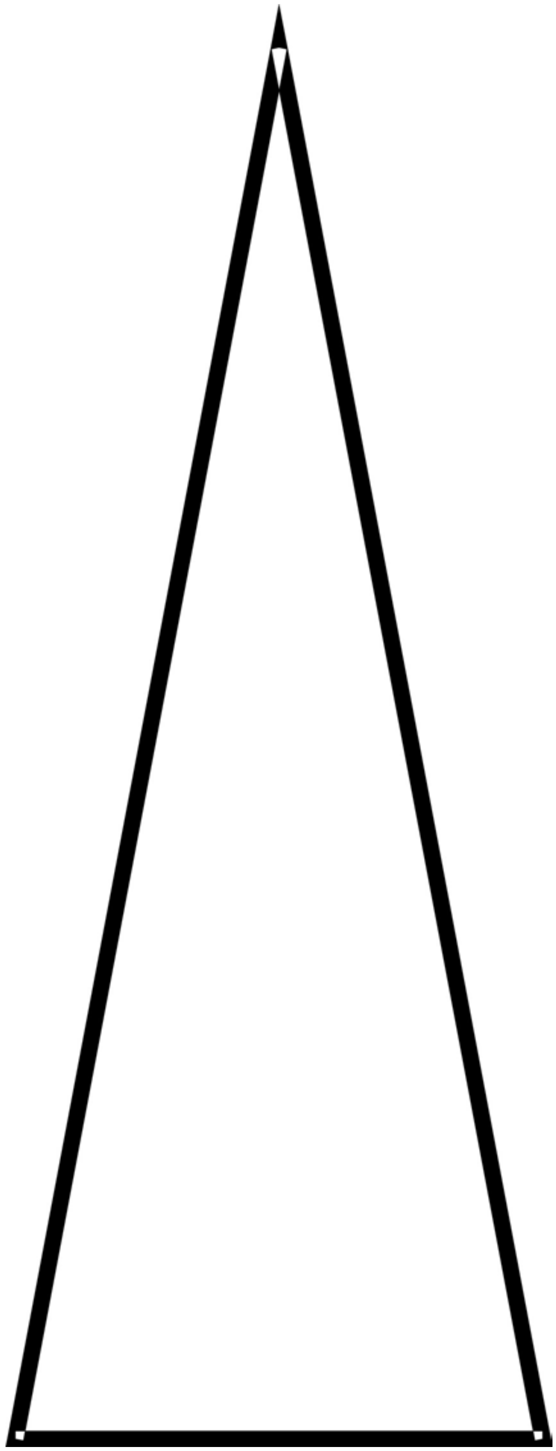
D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-4 Frame (Oxidizer Section)



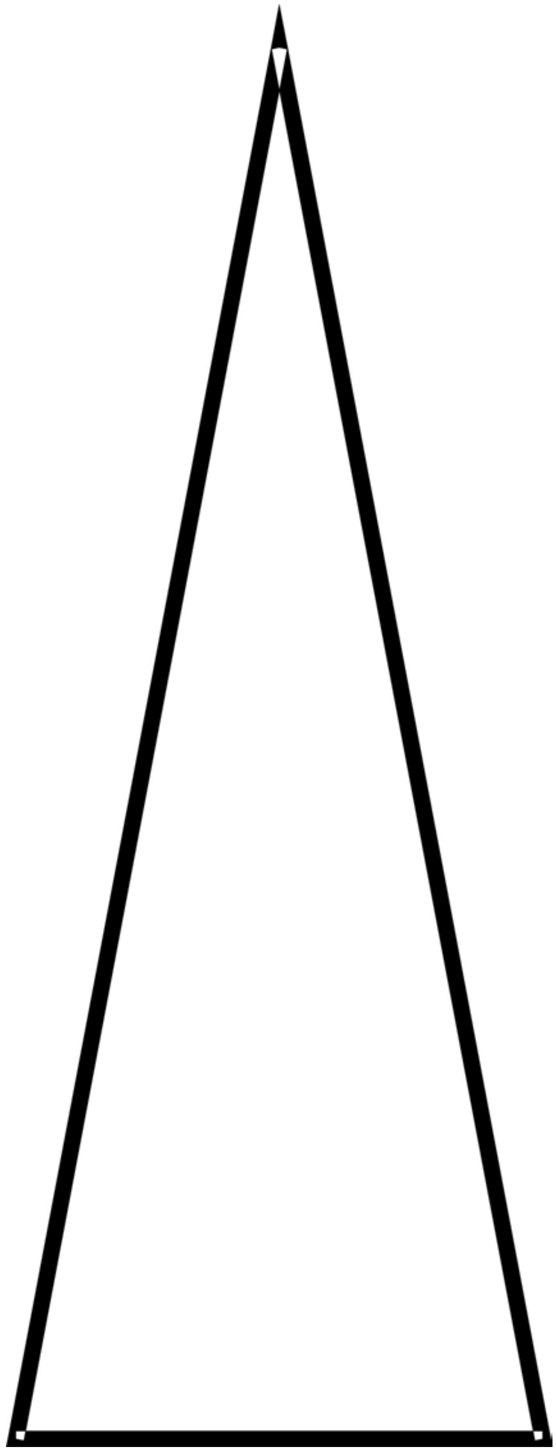
D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-5 Frame (Pumps and Nozzle Section 0)



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-6 Fin (Section 1)

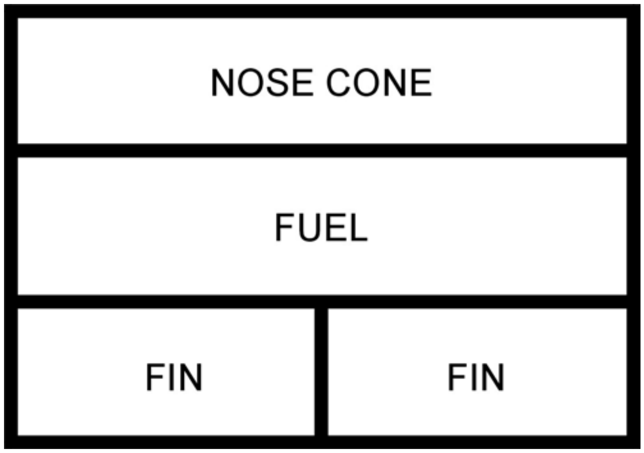


D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-7 Fin (Section 2)

PARTS OF A ROCKET: LABELS

Cut out the following boxes and figures to be used to label the rocket puzzle.



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure B-8 Rocket Labels

GUIDANCE SYSTEM

"Clip Art", Microsoft Corporation, 2003 , Santa Rosa: CA: Impreza Systems, Copyright 2000, Impresa Systems

Figure B-9 Guidance System

PAYLOAD SYSTEM

"Clip Art", Microsoft Corporation, 2003 , Santa Rosa: CA: Impreza Systems, Copyright 2000, Impresa Systems

Figure B-10 Payload

FUEL PUMP

"Google Images", New Philadelphia, Ohio, Fuel Pump. Retrieved 18 April 2007, from http://www.neohiotravel.com/images/gaspump.gif

Figure B-11 Fuel Pump

OXIDIZER

"Google Images", California State University, Oxidizer Label. Retrieved 18 April 2007, from http://www.csudh.edu/oliver/chemdata/warnlabs/oxidizer.jpg

Figure B-12 Oxidizer

NOZZLE

"Google Images", Airwork Aviation Images, Engines. Retrieved 18 April 2007, from http://www.airwork-images.com/details.php?gid=278&sgid=&pid=456

Figure B-13 Nozzle

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 7

EO C240.04 – NAVIGATE WITH A GLOBAL POSITIONING SYSTEM (GPS)

Total Time:	90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Prepare a 200 m route for the cadets to navigate.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to introduce a new subject and give an overview of GPS navigation.

Demonstration and performance was chosen for TP2 as it allows the instructor to explain and demonstrate navigating with a GPS while providing an opportunity for the cadet to practice the skill under supervision.

A practical activity was chosen for TPs 3 and 4 as it is an interactive way to introduce cadets to navigating with a GPS. This activity contributes to the development of these skills and knowledge in a fun and challenging setting.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson and in a group of no more than five, the cadet shall be expected to navigate with a GPS on a field exercise.

IMPORTANCE

It is important for cadets to navigate with a GPS and to learn its uses and limitations for future navigation on a field exercise. GPS navigation is a valuable tool and will serve as an excellent resource for navigating to a specific location.

Teaching Point 1	**Describe the GPS**
Time: 5 min	Method: Interactive Lecture

WHAT IS GPS

Global Positioning System (GPS) is a satellite system used to navigate. It enables anyone on the planet who owns a GPS receiver to know where they are 24 hours a day in any kind of weather.

A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude).

HOW ACCURATE IS GPS

Today's GPS receivers are extremely accurate, thanks to their parallel multi-channel design. Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. GPS receivers are accurate to within 15 m on average.

In 1998, the Wide Area Augmentation System (WAAS) was added to provide increased accuracy for use by commercial airplane navigation systems. WAAS increases accuracy to better than 3 m.

GPS SATELLITE SYSTEM

GPS satellites are powered by solar energy. They have backup batteries onboard to keep them running in the event of a solar eclipse, when there is no solar power. Small rocket boosters on each satellite keep them flying in the correct path.

Here are some other interesting facts about the GPS satellites (also called NAVSTAR, the official U.S. Department of Defense name for GPS):

- The first GPS satellite was launched in 1978.
- GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use.
- A full constellation of 24 satellites was achieved in 1994.
- The 24 satellites that make up the GPS space segment are orbiting the Earth about 20 000 km above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are travelling at speeds of roughly 12 000 km/h.
- Each satellite is built to last about 10 years. Replacements are constantly being built and launched into orbit.
- A GPS satellite weighs approximately 900 Kg and is about 5 m across with the solar panels extended.
- Transmitter power is only 50 watts or less.
- There are no subscription fees or set-up charges to use GPS.

SOURCES OF GPS SIGNAL ERRORS

Factors that can degrade the GPS signal and thus affect accuracy include the following:

- **Signal Multi-path.** This occurs when the GPS signal is reflected off objects such as tall buildings or large rock surfaces before it reaches the receiver. This increases the travel time of the signal, thereby causing errors.
- **Number of Satellites Visible.** The more satellites a GPS receiver can "see," the better the accuracy. Buildings, terrain, electronic interference, or sometimes even dense foliage can block signal reception, causing position errors or possibly no position reading at all. GPS units typically will not work indoors, underwater or underground.
- **Receiver Clock Errors.** A receiver's built-in clock is not as accurate as the atomic clocks onboard the GPS satellites. Therefore, it may have very slight timing errors.

Other factors that can degrade the GPS signal.

- **Ionosphere and Troposphere Delays.** The satellite signal slows as it passes through the atmosphere. The GPS system uses a built-in model that calculates an average amount of delay to partially correct for this type of error.
- **Orbital Errors.** Also known as ephemeris errors, these are inaccuracies of the satellite's reported location.
- **Satellite Geometry/Shading.** This refers to the relative position of the satellites at any given time. Ideal satellite geometry exits when the satellites are located at wide angles relative to each other. Poor geometry results when the satellites are located in a line or in a tight grouping.
- **Intentional Degradation of the Satellite Signal.** Selective Availability (SA) is an intentional degradation of the signal once imposed by the U.S. Department of Defense. SA was intended to prevent military adversaries from using the highly accurate GPS signals. The government turned off SA in May 2000, which significantly improved the accuracy of civilian GPS receivers.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is a GPS?

Q2. How accurate is a GPS?

Q3. How are GPS satellites powered?

ANTICIPATED ANSWERS

A1. A Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense.

A2. GPS receivers are accurate to within 15 m on average.

A3. GPS satellites are powered by solar energy and have backup batteries on board to keep them running in the event of a solar eclipse.

Teaching Point 2 | **Explain What a GPS Tells the User**

Time: 10 min | Method: Demonstration and Performance

WHAT A GPS TELLS THE USER

A GPS tells the user the following standard features:

- their position – coordinates and elevation;
- distance to a waypoint;
- speed of travel;
- direction of travel (may not work in low speeds);
- estimated time of arrival; and
- cross track error (lateral distance off a straight line course).

Some GPS models may have extra features, such as:

- built-in maps,
- sunrise/sunset,
- signal strength indicators,
- battery strength indicators,
- audible alarm, and
- course deviation errors.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What does a GPS tell the user?

Q2. Does a GPS tell the user the direction of travel at slow speeds?

Q3. What extra features can be found on some GPS models?

ANTICIPATED ANSWERS

A1. Any of the following answers are correct.

- their position – coordinates and elevation;
- distance to a waypoint;
- speed of travel;
- direction of travel (may not work in low speeds);
- estimated time of arrival; and
- cross track error (lateral distance off a straight line course).

A2. Yes and no.

- Sometimes the direction of travel feature may not work in low speeds on a GPS.

A3. Any of the following answers are correct.

- built-in maps,
- sunrise/sunset,
- signal strength indicators,
- battery strength indicators,
- audible alarm, and
- course deviation errors.

Teaching Point 3	**Operate the GPS**
Time: 20 min	Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is for the cadets to become familiar with operating a GPS.

RESOURCES

GPS (one per five cadets) (Type TBD).

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Complete the following steps:

1. Divide the cadets into groups of no more than five.
2. Distribute one hand-held GPS to each group.
3. Turn on and initialize the GPS.
4. Review the various screens.
5. Identify battery strength.
6. Locate your current grid reference.
7. Identify your direction of travel.
8. Set your current waypoint.
9. Set a waypoint (not your current position).
10. Set the go-to to a preset waypoint.
11. Turn off the GPS.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 3

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

Teaching Point 4	**Navigate a Route**
Time: 50 min	Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is for the cadets to become familiar with navigating with a GPS.

RESOURCES

GPS (one per five cadets) (Type TBD).

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. In the same groups as TP3, have cadets turn on the GPS.
2. Using the bearing to the preset waypoint from TP3, have the cadets navigate the 200 m route (caution, waypoints too close together will not work; you will need approximately 200 m between waypoints).
3. Have the cadets identify when they have arrived at the preset waypoint.
4. Have the cadets turn off the GPS.
5. Have the cadets return the GPS to the instructor.

SAFETY

State the area boundaries for conducting this activity.

CONFIRMATION OF TEACHING POINT 4

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

END OF LESSON CONFIRMATION

The cadets' participation in the GPS navigation activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

A GPS is a valuable tool and serves as an excellent resource to find a specific place and navigate a route to that position.

INSTRUCTOR NOTES/REMARKS

This lesson will be presented during the field exercise associated with PO 290 (Participate in a Field Exercise).

REFERENCES

C3-117 (ISBN 0-96-522025-7) Ferguson, M. H. (1996). *GPS Land Navigation: A Complete Guide Book for Backcountry Users of the NAVSTAR Satellite System.* Calgary, AB: Glassford Publishing.

C3-132 (ISBN 1-894765-48-6) Letham, L. (2003). *GPS Made Easy.* Surrey, BC: Rocky Mountain Books.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 8

EO C240.05 – SIMULATE SURVIVAL IN SPACE

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Complete a recce of the area selected to conduct this lesson.

Obtain one map of the actual training area (where the activity will be conducted) for each group.

Photocopy the survival scenario located at Annex A for each group.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 as it is an interactive way to revisit survival in space, provoke thought and stimulate an interest among cadets.

A group discussion was chosen for TP2 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions, and feelings about survival in space.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson, and in groups of no more than four, the cadet shall be expected to simulate survival in space.

IMPORTANCE

It is important for cadets to simulate survival in space as it gives them the opportunity to understand the challenges astronauts face while living in space by using their knowledge about survival and applying it to a new situation.

Teaching Point 1 — **Conduct an In-class Activity Where Cadets Choose Five Items From a List to Survive in Space**

Time: 35 min — Method: In-Class Activity

Water on the Moon

The lunar soil contains ice crystals in craters near the lunar poles (which cannot be seen from Earth). The ice is spread across thousands of square kilometres of lunar terrain, but only one percent of the soil is ice.

The Earth's Moon

The Moon is Earth's one natural satellite. It is more than one quarter the size of Earth itself (3474 km diameter). The Moon has no magnetic field and its gravity is one-sixth of the Earth's gravity because of its smaller size.

The footprints left by Apollo astronauts will last for centuries because there is no wind on the Moon. The Moon does not possess any atmosphere, so there is no weather as we are used to on Earth. The temperatures on the Moon are extreme, ranging from 100°C at noon to -173°C at night because there is no atmosphere to trap the heat.

ACTIVITY

OBJECTIVE

The objective of this activity is to further develop the cadets' interest and understanding of what surviving in a space environment might be like.

RESOURCES

- Handout the scenario located at Annex A,
- The following survival resources for each group:
  - a box of matches,
  - a magnetic compass,
  - a stellar map of the Moon,
  - 2 military water cans (to simulate oxygen tanks),
  - 4 two-litre bottles to simulate water,
  - 10 metres of nylon rope,
  - simulated food boxes,
  - a radio,

- ◦ a fire blanket, and
- ◦ a map of the training area.

ACTIVITY LAYOUT

- Layout survival items for each group.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into groups of no more than four.
2. Provide each group with a copy of the scenario located at Annex A.
3. Each group will select the survival items for the survival scenario from the resources provided.
4. Inform the cadets that they have 35 minutes to complete the activity.

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 — **Conduct a Group Discussion and Have the Groups Explain Why They Chose Their Items for Survival**

Time: 20 min — Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to discuss the groups' reasons for choosing their items to complete the survival simulation using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

QUESTIONS

Q1. What were the items that your group selected to survive in space?

Q2. Why did your group select these survival items?

Q3. What was the most important item on your list and why?

Q4. What was the most challenging decision you had to make?

Q5. What item was not on this list that could be very useful to survival in space?

Q6. If you had a chance to do this exact simulation again, what would be one thing you would do differently and why?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 2

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

END OF LESSON CONFIRMATION

The cadets' participation in the survival in space simulation will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Stimulating the cadets' interest in space by introducing elements of survival in space through active participation in this EO may lead to future aerospace opportunities in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-111 Lakeland Central School District. (2007). *Space Survival Challenge.* Retrieved 27 February 2007, from http://www.lakelandschools.org/EDTECH/leslie/space.htm.

THIS PAGE INTENTIONALLY LEFT BLANK

SPACE SURVIVAL SCENARIO

Situation

You are a member of a space shuttle crew scheduled to meet with the Earth colony on the lighted surface of the Moon. Due to mechanical failure, you and your three crewmates had to crash land about 10 km from the colony. During the landing on the Moon, much of the equipment aboard was damaged. Only ten items were left undamaged. Since survival depends on reaching the colony as soon as possible, the most critical items must be chosen to help you return.

Mission

You will be working in groups of four as a team of astronauts. Your survival depends on selecting no more than five items to bring with you as you try to get to the Earth colony on the Moon. Your challenge is to rank, in order (most important to least), those objects that have been left undamaged on your ship. Base your decisions on what you already know about conditions in space and on the Moon.

Items that Survived the Crash Landing

- a box of matches,
- a magnetic compass,
- a stellar map of the Moon,
- 2 military water cans (to simulate oxygen tanks),
- 4 two-litre bottles to simulate water,
- 10 metres of nylon rope,
- simulated food boxes,
- a radio,
- a fire blanket, and
- a map of the actual training area (to simulate a map of the moon).

Instructions

1. Select five items from the list that your team needs to survive and get back to the colony.
2. Rank your objects in order from most to least important.
3. Justify your choices within your group by explaining how the items will be used to return to the colony.
4. Prepare to present your findings to the class in a group discussion.

THIS PAGE INTENTIONALLY LEFT BLANK

INSTRUCTOR ANSWER KEY TO THE SPACE SURVIVAL SCENARIO

Cadets are encouraged to be creative with the application of their items. If they can justify the items used, then their decision to select the item is permissible with the exception of the following items.

The following items on the list will be of no use to the groups:

- The box of matches will be of no use because matches will not light because there is no oxygen on the moon.
- The magnetic compass will not work because there is no magnetic field on the moon.
- The handheld radios will not work because there is no air to carry sound waves and they are redundant because your spacesuit is equipped with built-in hands-free radio communication technology.

All other items from the list are useful for this simulation.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 9

EO C240.06 – DETERMINE DIRECTION USING CONSTELLATIONS ON A FIELD EXERCISE

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-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration and performance was chosen for this lesson as it allows the instructor to explain and demonstrate determining direction 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 be expected to determine direction using constellations on a field exercise.

IMPORTANCE

It is important for cadets to know how to identify Polaris, as a primary celestial reference, as it may be an important skill set to have when determining direction on a field exercise. This skill is also valuable when typical directional aids such as a map or a compass are not available.

Teaching Point 1 | **Determine Direction at Night Using Polaris**

Time: 25 min | Method: Demonstration and Performance

This teaching point is about stars; however, the knowledge portion can be instructed during daylight hours.

The Earth is in a constant state of motion spinning on its axis. It completes one full revolution every 24 hours. The points, where this axis intersects the Earth's surface, are known as the North and South Poles. If a person stood at the top of the North Pole, over the course of one day, that person would spin one complete rotation. On the surface of the Earth, this spin is undetectable. The spin actually makes it appear that the sky is revolving around the Earth.

THE RELATIONSHIP BETWEEN NORTH AND POLARIS

Polaris, more commonly known as the North Star, is most often used to determine north. It is a fixed point located over the North Pole, making it a consistent and reliable (stationary) reference point when determining which way is north.

Polaris is not a bright star, and is therefore difficult to identify in the night sky. It acts as a centre point while constellations move around it. Polaris is located at the tip of the Little Dipper (Ursa Minor). It can be found with the help of two constellations—the Big Dipper and Cassiopeia.

Constellations such as the Big Dipper and Cassiopeia revolve counterclockwise around Polaris.

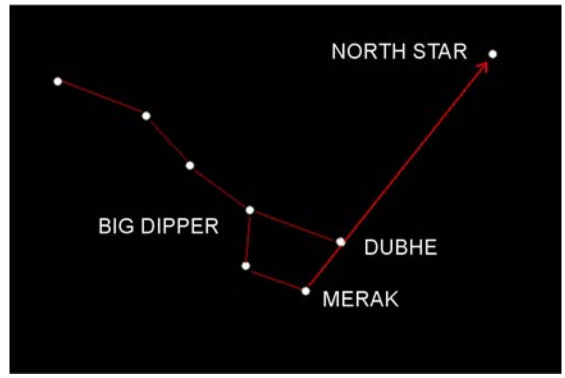
THE BIG DIPPER

The Big Dipper is the central feature of a very large constellation (Ursa Major) that wheels around Polaris. It is a combination of seven stars that resembles a small bowl with a long handle (dipper).

To find Polaris using the Big Dipper, follow its stars from the handle to the side of the bowl. The star Dubhe (DUB-ee), at the bowl's outer lip, is lined up with the star Merak (mer-AHK), inside the bowl. The stars Dubhe and Merak are commonly known as the pointer stars. They make a straight line that runs north and directly to Polaris. The distance from Dubhe to Polaris is five times the distance between the pointer stars.

"Map Reading and Navigation", Second Brigade: The South Carolina State Guard (SCSG) Basic Training Manual. Retrieved 30 October 2006, from http://www.nettally.com/hgowan/north_star.gif

Figure 1 North Pole



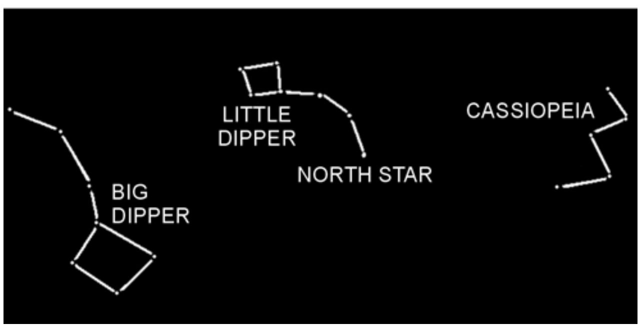
D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 2 Dubhe and Merak

CASSIOPEIA

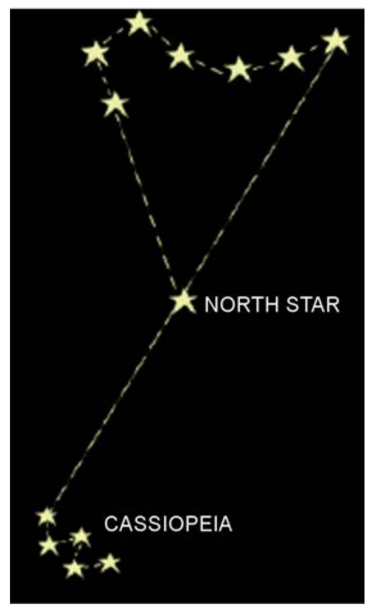
Cassiopeia is shaped like a W or an M, depending on the time of night, and wheels around the North Star.

Cassiopeia is perpendicular to Polaris (at a right angle) when the legs of the M are connected. The distance from Cassiopeia to Polaris is twice the width of the M.



D Cdts 3, 2006, Ottawa, ON: Department of National Defence

Figure 3 Little Dipper



"Navigation for Survival", The World Outdoor Web Navigation Guide. Retrieved 25 October 2006, from http://www.w-o-w.com/ARTICLES/navigation.figure12.gif

Figure 4 Cassiopeia

Determining direction using Polaris must be conducted during the night. This night activity will consist of numerous stop points that are lesson specific; however, time has been allotted for the confirmation of the following points:

- locating and identifying Polaris using the Big Dipper;
- locating and identifying the pointer stars; and
- locating and identifying Polaris using Cassiopeia.

If this lesson is taught on an overcast night and the stars are not visible, the process must still be explained. The demonstration by the instructor and the cadet activity must be conducted at a later time, preferably while on the field exercise.

Note: Cadets should also be able to locate the Little Dipper after finding Polaris.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is the common name for the star Polaris?

Q2. How far is the distance from Dubhe to Polaris?

Q3. What letter should Cassiopeia be viewed as when determining direction?

ANTICIPATED ANSWERS

A1. The North Star.

A2. The distance from Dubhe to Polaris is five times the distance between Dubhe and Merak.

A3. Cassiopeia must always be viewed as an M.

END OF LESSON CONFIRMATION

The cadets’ participation in determining direction at night will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Alternate means of determining direction are important skills to have when determining direction using constellations on a field exercise, specifically when typical direction aids such as a compass or map are unavailable. Using Polaris, as a primary celestial reference, to navigate is a skill set that may be used frequently and will be helpful in future training on a field exercise.

INSTRUCTOR NOTES/REMARKS

This lesson is to be conducted at night however the knowledge portion of this lesson can be conducted during daylight hours.

REFERENCES

C2-008 (ISBN 0-00-265314-7) Wiseman, J. (1999). *The SAS Survival Handbook.* Hammersmith, London: HarperCollins Publishers.

C2-041 (ISBN 0-07-136110-3) Seidman, D with Cleveland, P. (2001). *The Essential Wilderness Navigator.* Camden, ME: Ragged Mountain Press.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 15

PO 260 – PARTICIPATE IN AERODROME OPERATIONS ACTIVITIES

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M260.01 – EXPLAIN ASPECTS OF AIR TRAFFIC CONTROL (ATC)

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-802/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.

Photocopy flash cards located at Annex A. Paste flash cards with light signals on one side of the card and light signal commands on the reverse (e.g. 1-2, 3-4, 5-6, etc.).

Photocopy NORDO light signals matching activity located at Annex B for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to ATC, to give an overview of it, and to generate an interest.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to have participated in a discussion on ATC.

IMPORTANCE

It is important for cadets to understand the role of ATC at an aerodrome. This lesson will assist in stimulating the cadets' interest in aerospace activities which may lead to future summer training opportunities in the Air Cadet Program.

Teaching Point 1	**Explain the Role of an Air Traffic Controller at an Aerodrome**
Time: 10 min	Method: Interactive Lecture

Aerodrome. Any area of land or water designed for the arrival, departure, movement and servicing of aircraft. It includes buildings, installations, and equipment situated therein.

Airport. Any aerodrome with an airport certificate. Some airports are designated "international airports" to support international commercial air transport. An airport certificate testifies that the aerodrome meets airport certification safety standards.

The Role of the Air Traffic Controller

The ATC system is a vast network of people and equipment that ensures the safe operation of commercial and private aircraft.

The air traffic controller's' immediate concern is safety, but controllers must also direct planes efficiently to minimize delays. Their main responsibility is to organize the flow of aircraft into and out of the aerodrome.

Air traffic controllers coordinate the movement of air traffic to make certain that planes stay a safe distance apart. They prevent collisions between:

- aircraft,
- aircraft and obstructions, and
- aircraft and vehicles on the manoeuvring area.

In addition, air traffic controllers keep pilots informed about changes in weather conditions such as wind shear, a sudden change in the velocity or direction of the wind that can cause the pilot to lose control of the aircraft.

ATC Authorization

An ATC clearance is an authorization from an ATC unit for an aircraft to proceed within controlled airspace under specific conditions. Some air traffic controllers regulate traffic through designated airspaces; others regulate airport arrivals and departures.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is the air traffic controller's immediate concern?

Q2. What are the three main things that air traffic controllers prevent collisions between?

Q3. What is an ATC clearance?

ANTICIPATED ANSWERS

A1. The air traffic controller's' immediate concern is safety.

A2. Air traffic controllers prevent collisions between:

- aircraft,

- aircraft and obstructions, and
- aircraft and vehicles on the manoeuvring area.

A3. An ATC clearance is an authorization from an ATC unit for an aircraft to proceed within controlled airspace under specific conditions.

Teaching Point 2	Provide a Basic Overview of Radar Technology Used in ATC
Time: 5 min	Method: Interactive Lecture

RADAR

The name “RADAR” is an abbreviation for “radio detection and ranging”. To operate, radar requires a highly directional radio transmitter/antenna and a scope, or screen, to display the information received by the antenna.

The principle uses of radar in aviation are:

- ATC;
- fixing positions of airplanes in flight;
- detecting thunderstorm activity; and
- approaching and landing guidance to airplanes.

The use of radar in ATC greatly increases the utilization of the airspace and permits expansion of flight information services such as traffic and weather information and navigational assistance.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What does the abbreviation “RADAR” mean?

Q2. What are the principle uses of radar in aviation?

Q3. What does the use of radar in ATC increase?

ANTICIPATED ANSWERS

A1. “RADAR” is an abbreviation for “radio detection and ranging.”

A2. The principle uses of radar in aviation are:

- ATC;
- fixing positions of airplanes in flight;
- detecting thunderstorm activity; and
- approaching and landing guidance to airplanes.

A3. The use of radar in ATC increases the utilization of the airspace.

Teaching Point 3 | **Explain NORDO (Without Radio) Procedures at a Controlled Airport**

Time: 10 min | Method: In-Class Activity

NORDO

Aircraft without radio (NORDO) are not permitted to operate at most large controlled airports served by the scheduled air carriers. Where they are permitted to operate (less busy controlled airports), they are directed by visual signals. A pilot must be alert to the light signals from the tower letting you know what to do.

Prior to initiating a NORDO flight, the pilot should contact the control tower to inform the controllers of their intentions and to secure a clearance for operation within the airspace. The tower will then be expecting the pilot and will be prepared to give the pilot light signals.

AUTHORIZED LIGHT SIGNALS (DEPARTING AIRCRAFT)

Flashing Green. Cleared to taxi.

Steady Green. Cleared for take-off.

Flashing Red. Taxi clear of runway in use.

Steady Red Light. Stop.

Flashing White. Return to starting point on airport.

Blinking Runway Lights. Vehicle and pedestrians are to vacate the runway immediately.

AUTHORIZED LIGHT SIGNALS (ARRIVING AIRCRAFT)

Steady Green Light. Clear to land.

Steady Red Light or Red Flare. Do not land. Continue in circuit. Avoid making sharp turns, climbing or diving after you receive the signal.

Flashing Green Light. Recall signal. Return for landing (usually to recall an airplane which has taken off or has been previously waved off with a red light). This will be followed by a steady green light when the approach path and landing area is clear.

Alternating Red and Green Light (U.S.). Danger. Be on alert. This signal may be used to warn you of such hazards as danger of collision, obstruction, soft field, ice on runways, mechanical failure of your undercarriage, etc. The danger signal is not a prohibitive signal and will be followed by a red or green light as circumstances warrant.

Flashing Red Light. Airport unsafe. Do not land.

Red Pyrotechnical Light. The firing of a red pyrotechnical light, whether by day or night and notwithstanding any previous instruction means “Do not land for the time being”.

ACTIVITY

Time: 5 min

Choose one activity from the following.

Cadets will use flash cards and state the correct command for the appropriate light signal on the flash card, or they will complete the NORDO signal handout by matching the light signal to the appropriate command.

OBJECTIVE

The objective of this activity is to familiarize the cadets with light signals used in NORDO communication.

RESOURCES

Flash cards located at Annex A.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Request a volunteer to stand in front of the class and select a flash card.
2. Once the cadet has selected the flash card ask them to confirm the answer on the back and hold up the flash card to the front of the class.
3. The class must determine the correct command of the light signal.
4. Once the class determines the command of the light signal. Have another volunteer come to the front of the class and select a flash card and repeat the activity.

SAFETY

N/A.

ACTIVITY

Time: 5 min

OBJECTIVE

The objective of this activity is to familiarize the cadets with light signals used in NORDO communication.

RESOURCES

Handout located at Annex B.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Distribute the NORDO Signals located at Annex B to each cadet.
2. Allow the cadets 4 min to match the light signals to the correct command.
3. Verify the correct answers with the cadets.

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 the NORDO communication activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Participating in a discussion on ATC will help the cadet learn about ATC and gain an appreciation of the role ATC plays in an aerodrome. Stimulating the cadets' interest in aerospace activities may lead to future summer training opportunities in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-096 (ISBN 1715-7382) Transport Canada. (2006). *Aeronautical Information Manual.* Ottawa, ON: Her Majesty the Queen in Right of Canada.

C3-097 U.S. Department of Labour. (2007). *Air Traffic Controllers.* Retrieved 9 February 2007, from http://www.bls.gov/oco/ocos108.htm.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Ltd.

LIGHT SIGNALS/COMMANDS FLASH CARDS

FLASHING GREEN

(DEPARTING AIRCRAFT)

Cleared to taxi.

STEADY GREEN

(DEPARTING AIRCRAFT)

Cleared for take-off.

FLASHING RED

(DEPARTING AIRCRAFT)

Taxi clear of runway in use.

STEADY RED

(DEPARTING AIRCRAFT)

Stop.

FLASHING WHITE

(DEPARTING AIRCRAFT)

Return to starting point on airport.

BLINKING RUNWAY LIGHTS

(DEPARTING AIRCRAFT)

Vehicle and pedestrians are to vacate the runway immediately.

STEADY GREEN LIGHT

(ARRIVING AIRCRAFT)

Clear to land.

STEADY
RED LIGHT
OR
RED FLARE
(ARRIVING AIRCRAFT)

Do not land. Continue in circuit. Avoid making sharp turns, climbing or diving after you receive the signal.

15-M260.01A-16

FLASHING GREEN LIGHT

(ARRIVING AIRCRAFT)

Recall signal. Return for landing.
(Usually to recall an airplane which has taken off or has been previously waved off with a red light).

ALTERNATING RED AND GREEN LIGHT (U.S.)

(ARRIVING AIRCRAFT)

Danger. Be on alert. This signal may be used to warn you of such hazards as danger of collision, obstruction, soft field, ice on runways, mechanical failure of your undercarriage, etc.

FLASHING RED LIGHT

(ARRIVING AIRCRAFT)

Airport unsafe. Do not land.

RED PYROTECHNICAL LIGHT

(ARRIVING AIRCRAFT)

The firing of a red pyrotechnical light, whether by day or night and notwithstanding any previous instruction means “Do not land for the time being”.

NORDO SIGNALS

Match the NORDO Signal to the correct command.

DEPARTING AIRCRAFT	a. ______	Danger. Be on alert. This signal may be used to warn you of such hazards as danger of collision, obstruction, soft field, ice on runways, mechanical failure of your undercarriage, etc. The danger signal is not a prohibitive signal and will be followed by a red or green light as circumstances warrant.
1. Flashing green.	b. ______	Cleared to taxi.
2. Steady green.	c. ______	The firing of a red pyrotechnical light, whether by day or night and notwithstanding any previous instruction means, “Do not land for the time being”.
3. Flashing red.	d. ______	Taxi clear of runway in use.
4. Steady red light.	e. ______	Vehicle and pedestrians are to vacate the runway immediately.
5. Flashing white.	f. ______	Stop.
6. Blinking runway lights.	g. ______	Return to starting point on airport.
ARRIVING AIRCRAFT	h. ______	Clear to land.
7. Steady green light.	i. ______	Do not land. Continue in circuit. Avoid making sharp turns, climbing or diving after you receive the signal.
8. Steady red light or red flare.	j. ______	Airport unsafe. Do not land.
9. Flashing green light.	k. ______	Cleared for take-off.
10. Alternating red and green light (U.S.).	l. ______	Recall signal. Return for landing (usually to recall an airplane which has taken off or has been previously waved off with a red light). This will be followed by a steady green light when the approach path and landing area is clear.
11. Flashing red light.		
12. Red pyrotechnical light.		

THIS PAGE INTENTIONALLY LEFT BLANK

NORDO SIGNALS – INSTRUCTOR ANSWER KEY

1. b
2. k
3. d
4. f
5. g
6. e
7. h
8. i
9. l
10. a
11. j
12. c

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M260.02 – IDENTIFY ASPECTS OF BASIC AERODROME OPERATIONS

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-802/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 CATSA Website for an up-to-date list of packing restrictions for air travellers.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to basic aerodrome operations, to generate interest and to give an overview of it.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to discuss basic aerodrome operations of a civilian aerodrome.

IMPORTANCE

It is important for cadets to discuss basic aerodrome operations at a civilian airport to gain an awareness of the services and facilities present at an aerodrome. This may generate an interest in aerodrome operations and may lead to future opportunities in the Air Cadet Program.

Teaching Point 1	**Discuss Basic Aerodrome Operations**
Time: 5 min	Method: Interactive Lecture

Basic operations at a civilian aerodrome are generally divided into three categories. They are air traffic control, ground control and airport maintenance.

AIR TRAFFIC CONTROL

Most people do not give second thought to who is actually in control of the aircraft when it is flying. Most people would say that the pilot has control of the direction and course of the aircraft but they would be mistaken.

The task of ensuring safe operations of commercial and private aircraft falls on air traffic controllers. They must coordinate the movements of thousands of aircraft, keep them at safe distances from each other, direct them during takeoff and landing, direct them around bad weather and ensure that traffic flows smoothly with minimal delays.

GROUND CONTROL

Ground control, sometimes known as Ground Movement Control (GMC) or Surface Movement Control (SMC) is responsible for the airport "manoeuvering" areas, or areas not released to the airlines or other users. This generally includes all taxiways, holding areas, and some transitional aprons or intersections where aircraft have arrived and vacated the runways and departure gates.

AIRPORT MAINTENANCE

Airport maintenance is responsible for a variety of airport field maintenance work, including general maintenance and construction work. They operate equipment and service a variety of power and general maintenance equipment in the upkeep of runways, taxiways, and aprons as well as perform other related duties.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What three categories are basic operations divided into at a civilian aerodrome?

Q2. What does GMC stand for?

Q3. What is airport maintenance responsible for?

ANTICIPATED ANSWERS

A1. Basic operations at a civilian aerodrome are generally divided into three categories. They are air traffic control, ground control and airport maintenance.

A2. GMC stands for ground movement control.

A3. Airport maintenance is responsible for a variety of airport field maintenance work, including general maintenance and construction work.

Teaching Point 2 | **Explain the Role of Ground Controllers**

Time: 5 min | Method: Interactive Lecture

THE ROLE OF GROUND CONTROLLERS

Once an aircraft has landed, ground controllers provide the pilot with precise taxi information to passenger gates and jetways.

From the cockpit, it is difficult to assure that there is sufficient clearance between the aircraft structure and any buildings or other aircraft. Marshalling personnel are provided to assist aircraft when arriving at and departing from passenger gates and jetways.

While the goal of ground controllers is to maintain aircraft in such a manner as to assure safe flight, they must provide clearance for aircraft-to-taxi on the ground at the aerodrome while creating a safe environment while an aircraft is on the ground.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What do ground controllers provide once an aircraft has landed?

Q2. Why and when are marshalling personnel provided?

Q3. What is the goal of ground controllers?

ANTICIPATED ANSWERS

A1. Once an aircraft has landed, ground controllers provide the pilot with precise taxi information to passenger gates and jetways.

A2. Marshalling personnel are provided to assist aircraft when arriving at and departing from passenger gates and jetways.

A3. The goal of ground controllers is to maintain aircraft in such a manner as to assure safe flight.

Teaching Point 3 | **Explain that Ground Facilities and Services Assist With Aircraft Arrivals and Departures**

Time: 5 min | Method: Interactive Lecture

Ground facilities and services assist with aircraft arrivals and departures. The following are some of the ground services and facilities that can be found at a basic aerodrome.

RUNWAY MAINTENANCE

Runway maintenance is responsible for the runway upkeep within the airport grounds. Duties range from tarmac servicing to keeping the runways in good condition. During the winter, the main focus of the work is on runway and taxiing area maintenance.

RUNWAY LIGHTING

Runway lighting is used at airports which allow night landings. Seen from the air, runway lights form an outline of the runway. A particular runway may have some or all of the following:

- **Runway End Identification Lights (REIL).** Unidirectional (facing approach direction) or omni-directional are a pair of synchronized flashing lights installed at the runway threshold, one on each side.
- **Runway End Lights.** Rows of lights on each side of the runway on precision instrument runways, these lights extend along the full width of the runway. These lights show green when viewed by approaching aircraft and red when seen from the runway.
- **Runway Edge Lights.** These are white elevated lights that run the length of the runway on either side. Taxiways are differentiated by being bordered by blue lights. On precision instrument runways, the edge-lighting becomes yellow in the last 2000 feet of the runway.
- **Runway Centreline Lighting System (RCLS).** These are lights embedded into the surface of the runway at 50 foot intervals along the runway centreline on some precision instrument runways. The lights are white except for the last 3000 feet. For the last 3000 feet, the lights alternate white and red for 2000 feet and red for the last 1000 feet.
- **Touchdown Zone Lights (TDZL).** This consists of rows of white light bars (with three in each row) on either side of the centreline over the first 3000 feet (or to the midpoint, whichever is less) of the runway.
- **Taxiway Centreline Lead-off Lights.** These are installed along lead-off markings. They are alternating green and yellow lights that are embedded into the runway pavement. They start with green lights branching off the runway centreline to the position of the first centreline light beyond the holding position on the taxiway.
- **Taxiway Centreline Lead-on Lights.** These are installed the same way as the taxiway centreline lead-off lights.
- **Land and Hold Short Lights.** These are a row of white pulsating lights installed across the runway to indicate the hold short position on some runways.
- **Approach Lighting System (ALS).** A lighting system installed on the approach end of an airport runway, it consists of a series of light bars, strobe lights, or a combination of the two that extend outward from the end of the runway.

BAGGAGE HANDLING

Baggage handlers work both indoors and outdoors at an aerodrome. They are responsible for making sure that not only does the mail, freight and luggage get onto the right aircraft but also that it gets there on time.

FUEL STORAGE SYSTEMS

Most of the large airports that service transport category aircraft have underground storage tanks and buried fuel lines. This arrangement allows the aircraft to be fuelled without having to carry the fuel to the aircraft in fuel trucks. Most aircraft that are fuelled from this type of system use under wing fuelling.

DE-ICING/ANTI-ICING

The successful treatment of ice and snow deposits on airplanes on the ground is an absolute necessity for safe winter operations. A flight that is expected to operate in known ground icing conditions shall not takeoff unless the aircraft has been inspected for icing and, if necessary, has been given the appropriate de-icing/anti-icing treatment. Accumulation of ice or other contaminants shall be removed so that the aircraft is kept in an airworthy condition prior to takeoff.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What are five ground services or facilities that assist aircraft during arrivals and departures?

Q2. What lights may a particular runway have?

Q3. What is an absolute necessity for airplanes on the ground in winter operations?

ANTICIPATED ANSWERS

A1. Ground services or facilities that assist aircraft during arrivals and departures are:

- runway maintenance,
- runway lighting,
- baggage handling,
- fuel storage systems, and
- de-icing/anti-icing.

A2. A particular runway may have some or all of the following lights :

- REIL,
- runway end lights,
- runway edge lights,
- RCLS,
- TDZL,
- taxiway centreline lead-off lights,
- taxiway centreline lead-on-lights,
- land and hold short lights, and
- ALS.

A3. The successful treatment of ice and snow deposits on aircraft on the ground is an absolute necessity for safe winter operations.

Teaching Point 4	Explain What the Canadian Air Transport Security Authority (CATSA) Is and Outline its Duties
Time: 10 min	Method: Interactive Lecture

CANADIAN AIR TRANSPORT SECURITY AUTHORITY (CATSA)

CATSA is a crown corporation based in the national capital region and it reports to Parliament through the Minister of Transport. It works with ground control to protect the public by securing critical elements of the air transportation system as assigned by the government. CATSA ensures passengers are aware of packing restrictions.

CATSA DUTIES AND RESPONSIBILITIES

CATSA is responsible for the following:

- Pre-Board Screening (PBS) of passengers and their belongings at Canada's major airports must be conducted before every flight.
- Acquiring, deploying, operating, and maintaining Explosive Detection Systems (EDS) equipment at designated airports which covers 99 percent of air travellers in Canada.
- Contracting for RCMP policing services and implementation of the Canadian Air Carrier Protective Program. Working with the RCMP for the provision of on-board security services under the Canadian Air Carrier Protective Program. This program covers selected domestic, trans-border and international flights, and all flights to Reagan National Airport in Washington, DC.
- The implementation of a restricted area identification card. CATSA has implemented an enhanced restricted area identification card for non-passengers which includes the use of biometric identifiers. This card is issued by the airport authority and enhances the security of restricted areas at major Canadian airports. The program includes a national database authenticating the validity of the identification card.
- Non-Passenger Screening (NPS) entering airport restricted areas. NPS has been regulated by Transport Canada since February 2004 in order to add another layer of security to Canada's air transport security system. The purpose of NPS is to enhance both airport and civil aviation security by operating random and unpredictable security screening checkpoints at entry points to or within airport restricted areas.
- Supplemental airport policing service contributions. Contributions toward airport policing costs: in the aftermath of September 11, 2001, new measures were implemented at airports to increase police presence. The Government of Canada, through CATSA, has committed to assisting selected airports with these additional costs.

Note: Refer to the CATSA Website at www.catsa-acsta.gc.ca for an up-to-date list of baggage packing restrictions for air travellers.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What does CATSA stand for?

Q2. What are three duties and responsibilities of CATSA?

Q3. What item has CATSA implemented that includes the use of biometric identifiers?

ANTICIPATED ANSWERS

A1. CATSA stands for Canadian Air Transport Security Authority.

A2. Three duties and responsibilities of CATSA are (any three of the following):

- pre-board screening of passengers and their belongings;
- acquisition, deployment, operation and maintenance of explosive detection systems (eds);
- contracting for RCMP policing services on selected flights and all flights to Reagan National Airport, Washington, DC;
- the implementation of a restricted area identification card;
- the screening of non-passengers (nps) entering airport restricted areas; and
- making contributions for supplemental airport policing services.

A3. CATSA has implemented an enhanced restricted area identification card for non-passengers which includes the use of biometric identifiers.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What does SMC stand for?

Q2. What is runway maintenance responsible for?

Q3. What does NPS stand for?

ANTICIPATED ANSWERS

A1. SMC stands for surface movement control.

A2. Runway maintenance is responsible for the runway upkeep within the airport grounds.

A3. NPS stands for non-passenger screening.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Discussing basic aerodrome operations at a civilian airport helps the cadet gain an awareness of the services and facilities present at an aerodrome. This may generate an interest in aerodrome operations and may lead to future opportunities in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-098 Canadian Air Transport Security Authority (CATSA). (2007). *Canadian Air Transport Security Authority: Mandate.* Retrieved 19 February 2007, from http://www.catsa-acsta.gc.ca/english/about_propos/.

C3-099 Airport Innovation. (2007). *Airport Ground Control Equipment.* Retrieved 21 February 2007, from http://www.airportinnovation.com/airport_ground.php.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO C260.04 – PERFORM MARSHALLING

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-802/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.

Paste flash cards located at Annex A with marshalling signals on one side of the card and marshalling commands on the reverse (e.g. 1-2, 3-4, 5-6, etc.).

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to present basic material on marshalling duties, orient the cadets to the topic and to generate interest.

Demonstration and performance was chosen for TP2 as it allows the instructor to explain and demonstrate the skill the cadet is expected to acquire while providing an opportunity for the cadets to practice the skill under supervision.

A game was chosen for TP3 as it is a fun and challenging way to practice the skills taught during the lesson and to confirm the cadets' knowledge of the material.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of the lesson the cadet will have performed aircraft marshalling movements.

IMPORTANCE

It is important for the cadet to be familiar with marshalling signals as an orientation to aerodrome activities. Marshalling aircraft is one of the many duties performed by ground crew/maintenance staff at an aerodrome. Familiarizing the cadets with these tasks will expand their awareness of different roles in aerodrome operations.

Teaching Point 1	Discuss the Importance of Marshalling at an Aerodrome
Time: 5 min	Method: Interactive Lecture

WHY IS AIRCRAFT MARSHALLING USED?

- Aircraft marshalling ensures the safety of all aircraft and personnel on the ground. Marshalling is used to direct aircraft. The marshaller uses hand-held lighted wands to give signals to a pilot; the pilot then manoeuvres the aircraft into the correct position.

WHEN IS AIRCRAFT MARSHALLING USED?

- Aircraft marshalling is used when there are multiple aircraft moving on the ground, or a large aircraft is moving under its own power.

WHERE IS AIRCRAFT MARSHALLING USED?

- Aircraft marshalling is used when aircraft enter, depart or manoeuvre on the apron of an aerodrome.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Why is marshalling used?

Q2. When is marshalling used?

Q3. Where is marshalling used?

ANTICIPATED ANSWERS

A1. Where is marshalling used?

A2. While aircraft are moving under their own power on the ground.

A3. On the apron of an aerodrome.

Teaching Point 2	**Demonstrate and Allow Cadets to Practice Marshalling Signals**
Time: 10 min	Method: Demonstration and Performance

Using marshalling wands or lighted hand-held wands, demonstrate the following aircraft marshalling signals:

- stop,
- move ahead,
- move back,
- turn left,
- turn right,
- slow down,
- all clear,
- cut engines, and
- start engines.

In the real environment these signals are to be executed by the marshaller while positioned forward of the left wing tip of the aircraft, within view of the pilot.

 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 1 Marshalling Stop	Raise arms straight above the head. Move arms back and forth, crossing arms over the head.
 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 2 Marshalling Move Ahead	Arms are in the prove position, bent at the elbow, in front of the body with the upper arm parallel to the ground. Move the hands from in front of the body toward the head.
 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 3 Marshalling Move Back	Starting with the arms straight at the sides of the body, move arms from the waist toward the shoulders, out and away from the body.
 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 4 Marshalling Turn to Your Left	The right arm points to the right. The left arm is in the prove position, bent at the elbow, away from the body with the left hand above the head. Move the left arm back and forth from the shoulder to above the head.

 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 5 Marshalling Turn to Your Right	The right arm points to the right. The left arm is in the prove position, bent at the elbow, away from the body with the left hand above the head. Move the left arm back and forth from the shoulder to above the head.
 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 6 Marshalling Slow Down	With the arms out in front of the body, move the arms up and down from the waist to the shoulders.
 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 7 Marshalling All Clear	The left arm remains at the side of the body. The right arm is in the prove position, bent at the elbow, in front of the body with the upper arm parallel to the ground. Give the thumbs up signal with the right hand.
 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 8 Marshalling Cut Engines	The left arm remains at the side of the body. Position the right arm out from the shoulder, parallel to the tarmac. The right arm should be bent at the elbow. With the right hand, make a cutting motion in front of the throat.

 *Imperial Oil Limited. (2007). Aeronautical Information Manual. Retrieved 26 February 2007, from http://www.esso.ca/ Canada-English/Products/Aviation/PS_A_Marshalling.asp* Figure 9 Marshalling Start Engine(s)	With the left arm straight above the head, form a “V” with the index and middle fingers. With the right arm bent and the upper arm parallel to the tarmac, point the index finger up and curl the fingers. Make a circular, counterclockwise motion with the right hand.

After each marshalling motion is demonstrated, the cadets will practice the motion. After demonstrating all signals, call out each signal and have the cadets execute them. Any combination of signals may be used. Flash cards can also be used for confirmation of this information.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is the marshalling signal for “start engine”?

Q2. What is the marshalling signal for “stop”?

Q3. What is the marshalling signal for “slow down”?

ANTICIPATED ANSWERS

A1.

A2.

A3.

Teaching Point 3 **Allow Cadets to Practice Marshalling Signals**

Time: 10 min Method: Game

Choose one game from the following.

Either of these two games will be considered confirmation of this lesson.

Cadets will play a game where they pretend to marshal aircraft, or play the game “Simon Says”. Either the instructor or a cadet may play the role of Simon. This game may be repeated as many times as needed for confirmation of the material.

ACTIVITY

OBJECTIVE

The objective of this game is to have the cadets practice marshalling signals.

RESOURCES

Marshalling wands or hand-held lighted wands.

ACTIVITY LAYOUT

This activity is to be conducted in a darkened work area suitable for practicing marshalling motions.

ACTIVITY INSTRUCTIONS

Cadets will play a game where they simulate marshalling aircraft. This game is done in pairs. The first cadet will marshal using marshalling wands or lighted wands. The second cadet will act as the aircraft. The second cadet will take directions from the signals given. The objective of the game is to park the “aircraft” safely.

SAFETY

While cadets are holding the wands, ensure the cadets are at least an arm’s length apart to prevent wands from colliding.

ACTIVITY

OBJECTIVE

The objective of this game is to have the cadets practice marshalling signals.

RESOURCES

Marshalling wands or hand-held lighted wands.

ACTIVITY LAYOUT

This activity is to be conducted in a darkened work area suitable for practicing marshalling motions.

ACTIVITY INSTRUCTIONS

"Simon Says" is a game for three or more players. One of the people plays the role of Simon. The other players must do what Simon tells them to do. The key phrase is "Simon Says". If Simon says, "Simon says marshal stop", the rest of the players must marshal the signal for stop. If players do not marshal the signal for stop, those players are eliminated.

If Simon simply says, "Marshal stop", without saying "Simon says" first, the rest of the players should not marshal the signal stop; however, if any players marshall any signal, they are eliminated.

The game continues until there is only one player left. The last player in the game is considered the winner.

SAFETY

While cadets are holding the wands, ensure the cadets are at least an arm's length apart to prevent wands from colliding.

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 the marshalling activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

This lesson was an introduction to aerodrome activities. Marshalling aircraft is one of the many duties performed by ground crew/maintenance staff at an aerodrome.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C0-057 Transport Canada. (2006). *Aeronautical Information Manual.* Retrieved 26 September 2006, from http://www.tc.gc.ca/CivilAviation/publications/tp14371/AIR/1-1.htm#1-8.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Ltd.

C3-133 Imperial Oil Limited. (2007). *Marshalling Signals.* Retrieved 26 February 2007, from http://www.esso.ca/Canada-English/Products/Aviation/PS_A_Marshalling.asp.

THIS PAGE INTENTIONALLY LEFT BLANK

MARSHALLING COMMANDS FLASH CARDS

STOP

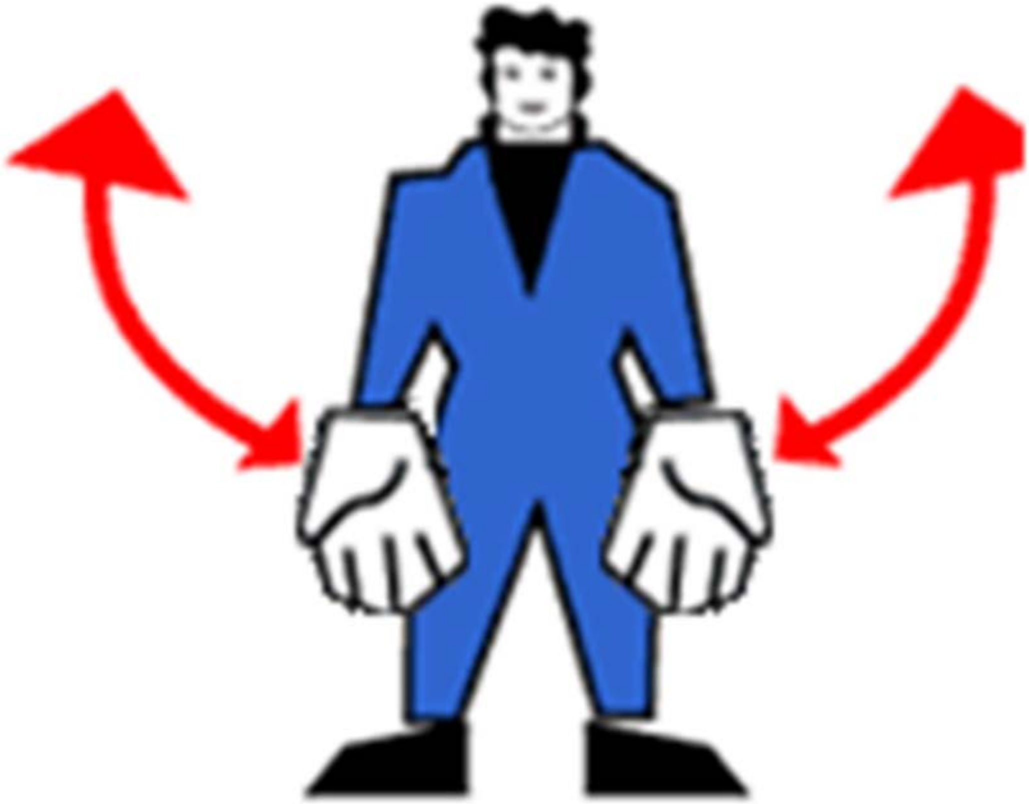
Raise arms straight above the head.

Move arms back and forth, crossing arms over the head.

MOVE AHEAD

Arms are in the prove position, bent at the elbow, in front of the body with the upper arm parallel to the ground.

Move the hands from in front of the body toward the head.



MOVE BACK

Starting with the arms straight at the sides of the body, move arms from the waist toward the shoulders, out and away from the body.

TURN TO YOUR LEFT

The right arm points to the right.

The left arm is in the prove position, bent at the elbow, away from the body with the left hand above the head.

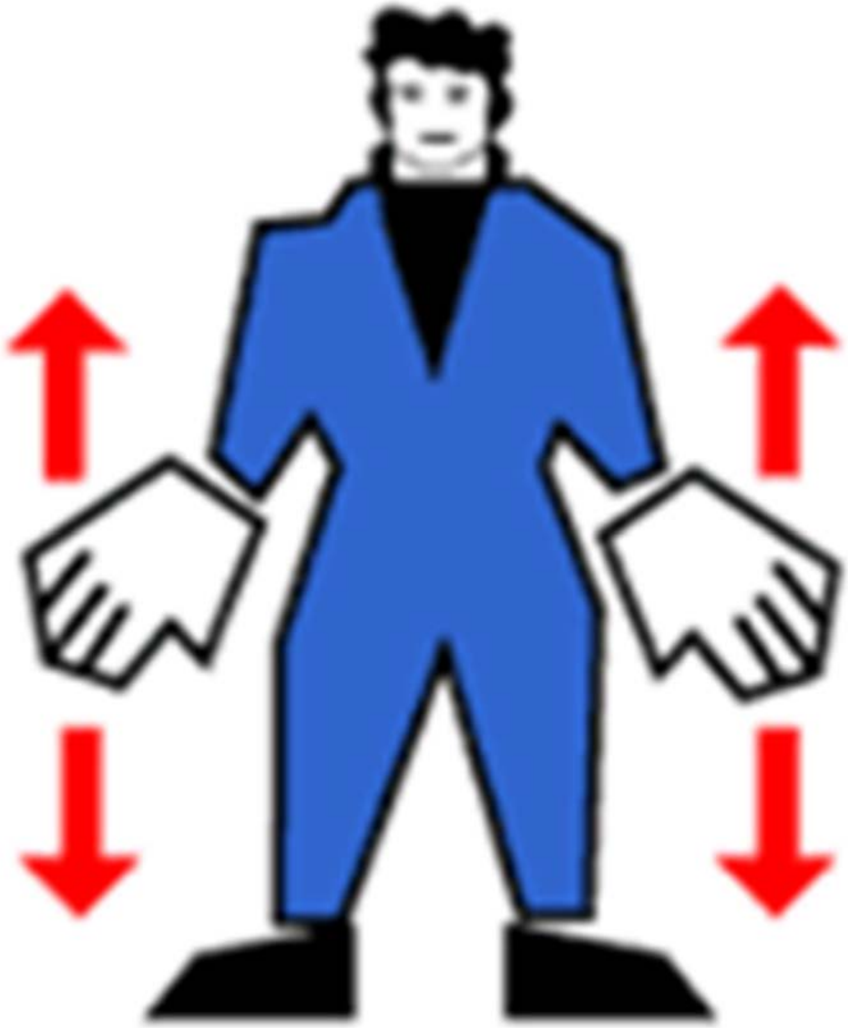
Move the left arm back and forth from the shoulder to above the head.

TURN TO YOUR RIGHT

The left arm points to the left.

The right arm is in the prove position, bent at the elbow, away from the body with the left hand above the head.

Move the right arm back and forth from the shoulder to above the head.



SLOW DOWN

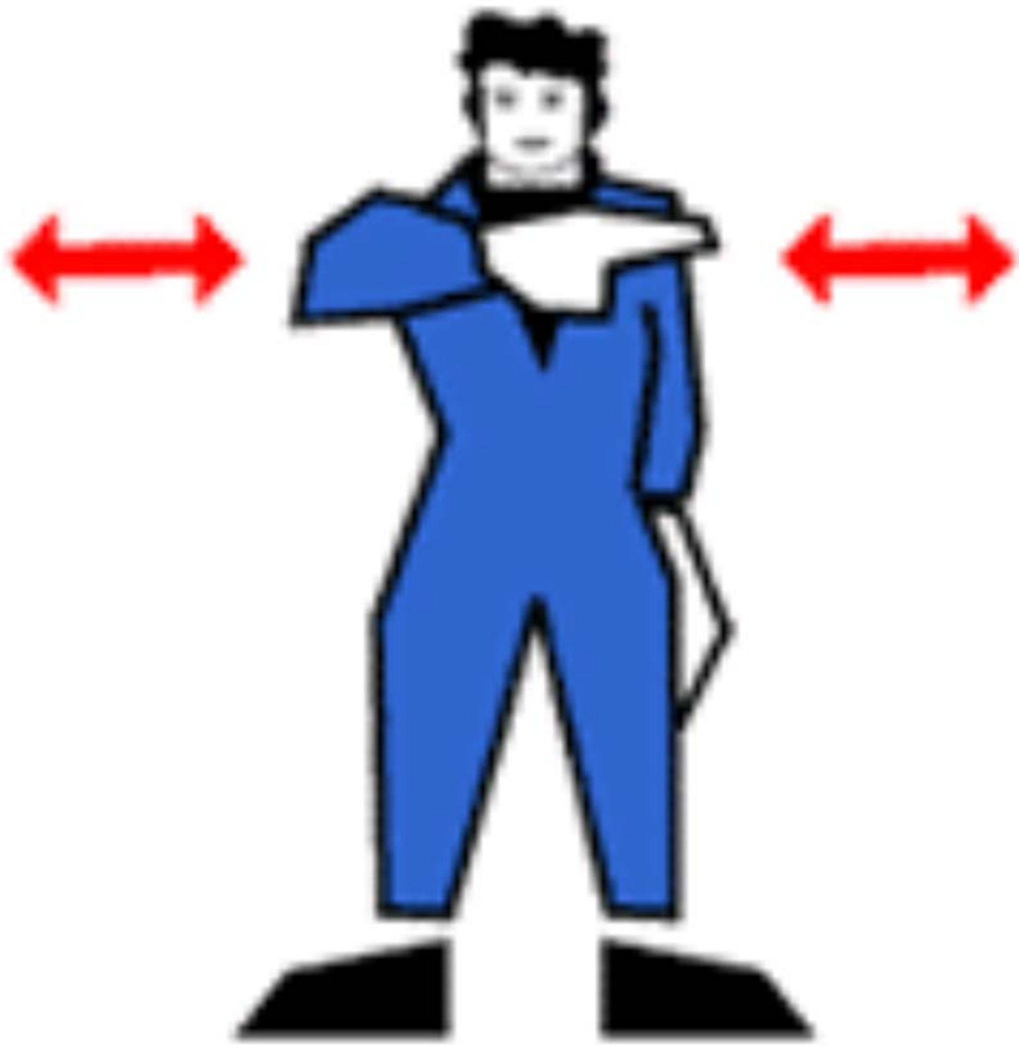
With the arms out in front of the body, move the arms up and down from the waist to the shoulders.

ALL CLEAR

The left arm remains at the side of the body.

The right arm is in the prove position, bent at the elbow, in front of the body with the upper arm parallel to the ground.

Give the thumbs up signal with the right hand.



CUT ENGINE(S)

The left arm remains at the side of the body.

Position the right arm out from the shoulder, parallel to the tarmac. The right arm should be bent at the elbow.

With the right hand, make a cutting motion in front of the throat.

START ENGINE(S)

With the left arm straight above the head, form a “V” with the index and middle fingers.

With the right arm bent and the upper arm parallel to the tarmac, point the index finger up and curl the fingers.

Make a circular, counter-clockwise motion with the right hand.

CHAPTER 16

PO 270 – DISCUSS AIRCRAFT MANUFACTURING AND MAINTENANCE

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M270.01 – IDENTIFY ASPECTS OF AIRCRAFT MANUFACTURING

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Photocopy career information sheets located at Annex A for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP2 to orient the cadets to the topic, to generate interest, to introduce aircraft manufacturing and to give an overview of it.

A group discussion method was chosen for TP3 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about aircraft manufacturing.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify aspects of aircraft manufacturing.

IMPORTANCE

It is important for cadets to learn about the aircraft manufacturing industry to gain an awareness of the aircraft systems, materials and careers in the industry. Developing an interest in aircraft manufacturing may lead to future opportunities in the Air Cadet Program and aircraft manufacturing.

Teaching Point 1	**Identify Aircraft Systems**
Time: 15 min	Method: Interactive Lecture

When assembling an aircraft, there are multiple aircraft systems included that are manufactured for the aircraft. The following are just a few aircraft systems and components that are manufactured to be used in assembling aircraft.

AIRCRAFT INSTRUMENT SYSTEMS

The development of efficient flight instruments is one of the most important factors that contributed to the growth of the present air transportation system. Prior to World War II, few airplanes were equipped for flight without using ground reference navigation or pilotage.

Aircraft instrument systems include flight instruments that depict the attitude, airspeed, and altitude of the aircraft, making up the aircraft instrument systems. Other instruments provide information such as engine operational parameters and electrical system performance. Other components manufactured to support these systems include electrical wiring and fluid-line plumbing.

Integrated circuits, containing microprocessors and other digital electronics, have revolutionized flight instrumentation and control systems. New generation flight instruments show textual and analog information on brightly coloured displays.

AIRFRAME ELECTRICAL SYSTEMS

These systems generate and route electricity to various aircraft components such as generators, motors and inverters. There are many manufacturers of these components that make up the airframe electrical systems. Because of the expense of the tools, test equipment and current technical publications, component manufacturers or certified repair stations service many of the electrical components.

HYDRAULIC AND PNEUMATIC POWER SYSTEMS

Early aircraft were equipped with flight controls and systems that were connected directly to the cockpit controls. As aircraft became more complex, it became necessary to operate systems remotely and the first of these was the brake system. Instead of cables or pushrods operating the brakes, hydraulic pressure was used to solve routing problems and multiple forces on the braking surfaces. While small aircraft continue to use cables or pushrods for operating flight controls, aircraft manufacturers equip larger aircraft with hydraulic or pneumatic control systems for their primary system.

AIRCRAFT LANDING GEAR SYSTEMS

The landing gear of the very first airplanes was not very complex. The Wright Flyer, for instance, took off from a rail and landed on skids. However, soon after the basic problems of flight were solved, attention was turned to providing better control and stability of the aircraft while it was operated on the ground. Retraction systems, shock absorbing and non-shock absorbing systems, aircraft wheels, nose wheel steering systems and aircraft brakes are some of the other components involved in manufacturing the landing gear.

AIRCRAFT FUEL SYSTEMS

Aircraft fuel systems vary in complexity from the extremely simple systems found in small, single-engine aircraft to the complex systems in large jet transports. Regardless of the type of aircraft, all fuel systems share many of the same common components. Every system has one or more fuel tanks, tubing to carry the fuel from the tank(s) to the engine(s), valves to control the flow of fuel, provisions for trapping water and contaminants and a method for indicating the fuel quantity.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. List the aircraft systems manufactured to be used in assembling an aircraft.

Q2. What do aircraft manufacturers equip larger aircraft with for their control systems?

Q3. What are some of the other components involved in manufacturing landing gear?

ANTICIPATED ANSWERS

A1. The aircraft systems are:

- aircraft instrument systems,
- airframe electrical systems,
- hydraulic and pneumatic systems,
- aircraft landing gear systems, and
- aircraft fuel systems.

A2. Aircraft manufacturers equip larger aircraft with hydraulic or pneumatic control systems for their primary control systems.

A3. Retraction systems, shock absorbing and non-shock absorbing systems, aircraft wheels, nose wheel steering systems and aircraft brakes are some of the other components involved in manufacturing landing gear.

Teaching Point 2	Identify the Materials Used in Aircraft Manufacturing
Time: 15 min	Method: Interactive Lecture

The techniques and materials used in the early years of aviation were quite primitive by modern standards. The Wright brothers' "Flyer," for example, was made from steel, wire, cable, silk and wood. However, as aircraft development advanced, a breakthrough occurred in the aircraft aluminum industry. Metallurgists found that mixing, or alloying aluminum with other metals resulted in a much stronger material. In fact, alloying increased the tensile strength of pure aluminum from about 13 000 pounds per square inch (psi) to a tensile strength of 65 000 psi or greater, which is equivalent to structural steel. As the need for aluminum alloys grew, manufacturers continued to refine them to produce materials with better corrosion resistance and greater strength.

Today, military aircraft are constructed of about 65 percent aluminum and 35 percent of other alloys, including titanium, inconel, silver and nickel. Civilian aircraft are approximately 80 percent aluminum alloy and 20 percent other alloys.

Today, military aircraft are constructed of about 65 percent aluminum and 35 percent of other alloys, including titanium, inconel, silver and nickel. Civilian aircraft are approximately 80 percent aluminum alloy and 20 percent other alloys.

NON-FERROUS METALS

Much of the metal used on today's aircraft contains no iron. The term that describes metals which have elements other than iron as their base is non-ferrous. Aluminum, titanium, nickel and copper are some of the more common non-ferrous metals used in aircraft manufacturing and repair.

Aluminum and Its Alloys. Pure aluminum lacks sufficient strength to be used for aircraft construction. However, its strength increases considerably when it is alloyed, or mixed with other compatible metals (e.g. when aluminum is mixed with copper or zinc, the resultant alloy is as strong as steel with only one third the weight).

Titanium. Titanium and its alloys are lightweight metals with very high strength. Pure titanium weighs 0.163 pounds per cubic inch (4.5 g/cm^3), which is about 50 percent lighter than stainless steel, yet it is approximately equal in strength to iron. Furthermore, pure titanium is soft and ductile with a density between that of aluminum and iron.

Nickel. Aircraft technicians need to be familiar with two nickel alloys. They are monel and inconel.

- **Monel.** Monel contains about 68 percent nickel and 29 percent copper, along with small amounts of iron and manganese. Monel works well in gears and parts that require high strength and toughness, as well as for parts in exhaust systems that require high strength and corrosion resistance at elevated temperatures.
- **Inconel.** Inconel contains about 80 percent nickel and 14 percent chromium, and small amounts of iron and other elements. Inconel is frequently used in turbine engines because of their ability to maintain their strength and corrosion resistance under extremely high temperatures.

Copper. Neither copper nor its alloys find much use as structural materials in aircraft construction. However, due to its excellent electrical and thermal conductivity, copper is the primary metal used for electrical wiring.

COMPOSITE FIBRES

Graphite, Kevlar and fibreglass are composite materials used to form various types of aircraft structures.

Graphite Fibres. Graphite fibres are manufactured by heating and stretching rayon fibres. This produces a change in the fibres' molecular structure that makes it extremely lightweight, strong, and tough.

Kevlar Fibre. Kevlar fibre is one of the most commonly used cloth-reinforcing fabrics. In its cloth form, Kevlar is a soft yellow organic fibre that is extremely light, strong and tough. Its great impact resistance makes it useful in areas where damage from sand or other debris can occur. These areas include around landing gear and behind propellers. Kevlar is rather difficult to work with however, and does not perform well under compressive loads.

Glass Fibre/Fibreglass. Fibreglass greatly enhances the strength and durability of thermosetting resin, which is a material that hardens when heated. For high strength requirements, the glass fibres are woven into a cloth. On the other hand, where cost is of greater importance than strength, the fibres are gathered into a loose mat which is saturated with resin and moulded into a desired shape.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What was the breakthrough that occurred in the aircraft aluminium industry?

Q2. Name four non-ferrous metals.

Q3. What are some of the more common non-ferrous metals used in aircraft manufacturing and repair?

ANTICIPATED ANSWERS

A1. Metallurgists found that mixing, or alloying aluminum with other metals resulted in a much stronger material.

A2. Four non-ferrous metals are:

- aluminum and its alloys,

- titanium,
- nickel, and
- copper.

A3. Aluminum, titanium, nickel and copper are some of the more common non-ferrous metals used in aircraft manufacturing and repair.

Teaching Point 3	**Discuss Careers Within the Aircraft Manufacturing Industry**
Time: 20 min	Method: Group Discussion

Distribute Career Information Sheets located at Annex A to the cadets.

BACKGROUND KNOWLEDGE

The following careers are available in the aircraft manufacturing industry:

AIRCRAFT INTERIOR TECHNICIAN

An aircraft interior technician's primary responsibilities include the removal, disassembly, cleaning, inspection, repair and re-installation of aircraft cabin furnishings. The technicians work both in an aircraft cabin and in a shop, and are familiar with the function, operation and safety requirements of aircraft passenger support systems. They maintain oxygen, water, waste, entertainment, and emergency systems and equipment. In addition, they refurbish seats, seat belts, carpets, interior panelling, windows, and galley and washroom modules. Their duties often overlap with those of other aviation technicians, such as aircraft maintenance engineers.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "E" (AVIONICS)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) – Category "E" license. Aircraft avionics technicians are responsible for the servicing, repair and modification of aircraft electronic systems and components. The job includes removing and installing components, bench testing and troubleshooting complex electronic aircraft systems. Today's aircraft can be quite sophisticated with "fly by wire," auto flight, global positioning, satellite navigation, in-flight entertainment, and automatic communication and receiving systems.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "M" (MAINTENANCE)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) – Category "M" license. AMEs are responsible for the release (certification) of an aeronautical product (aircraft), after maintenance or inspection. The job responsibilities include a variety of tasks including removing and installing components and troubleshooting complex systems. A qualified AME is able to maintain small aircraft, helicopters, and large transport category aircraft. Larger aircraft are quite sophisticated as they possess many different electrical, electronic, pneumatic, hydraulic, mechanical and propulsion systems, and the AME must understand and maintain them.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "S" (STRUCTURES)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) – Category "S" license. Category "S" structures technicians are responsible for the assessment, planning and implementation of aircraft structural fabrication and repairs. Structures technicians are often an integral part of repair crews including maintenance technicians, avionics technicians and professional engineers. They are expected to precisely follow aircraft fabrication and repair schemes for aluminium, titanium and stainless steel structures, as well as plastics and composites.

AIRCRAFT MECHANICAL COMPONENT TECHNICIAN

Aircraft mechanical component technicians are involved in the overhaul, repair, modification, inspection, testing and certification of aviation components of pneumatic, hydraulic, fuel, electrical, environmental and mechanical aircraft systems. Working in a shop environment, technicians are thoroughly familiar with the set-up and operation of tools and shop equipment as well as some semi-automatic processes. Possessing a high degree of manual dexterity, and a strong interest in mechanics, they work cooperatively with others and are able to follow directions precisely.

AIRCRAFT GAS TURBINE TECHNICIAN

Aircraft Gas turbine technicians enjoy a challenging occupation requiring a high degree of responsibility and skill. Technicians perform the disassembly, inspection, repair, assembly and testing of gas turbine engines in a clean shop environment with regular working hours. Qualified technicians experience many opportunities for advanced training and continued career satisfaction.

The point of the group discussion is to discuss careers within the aircraft manufacturing industry using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. Share with the class three pieces of interesting information that you did not know about careers in the aircraft manufacturing industry.

Q2. Why did you find this information interesting?

Q3. What was the most interesting career to you?

Q4. What are the primary responsibilities of the career that you found most interesting?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 3

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

END OF LESSON CONFIRMATION

The cadets' participation in the discussion on careers in the aircraft manufacturing industry will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Learning about the aircraft manufacturing industry will help the cadet gain an awareness of the aircraft systems, materials and careers in the industry. This new knowledge will help develop the cadets' interest in aircraft manufacturing and may lead to future opportunities in the Air Cadet Program and the aircraft manufacturing industry.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-107 British Columbia Institute of Technology. (2007). *Programs and Courses.* Retrieved 8 February 2007, from http://www.bcit.ca/study/programs/

C3-108 (ISBN 0-88487-203-3) Jeppesen Sanderson Training Products. (2000). *A&P Technician: General.* Englewood, CO: Jeppesen Sanderson Inc.

C3-109 (ISBN 1-894777-00-X) Canadian Aviation Maintenance Council (CAMC). (2002). *Aviation Maintenance Orientation Program.* Ottawa, ON: CAMC.

AIRCRAFT MANUFACTURING INDUSTRY CAREERS

AIRCRAFT INTERIOR TECHNICIAN

An aircraft interior technician's primary responsibilities include the removal, disassembly, cleaning, inspection, repair and re-installation of aircraft cabin furnishings. The technicians work both in an aircraft cabins and in shops, and are familiar with the function, operation and safety requirements of aircraft passenger support systems. They maintain oxygen, water, waste, entertainment, and emergency systems and equipment. In addition, they refurbish seats, seat belts, carpets, interior panelling, windows, and galley and washroom modules. Their duties often overlap with those of other aviation technicians, such as aircraft maintenance engineers. Successful completion of this program plus work experience, recorded and certified in a personal logbook, may qualify the candidates for national certification from the Canadian Aviation Maintenance Council (CAMC).

Job Opportunities

Aircraft interior technician jobs have historically been filled by automotive upholsterers who required intensive on the job re-training. Organized training for this trade has been put in place due to the demand for trained personnel. Jobs are found in national and regional airline companies and approved Aircraft Maintenance Organizations (AMOs).

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "E" (AVIONICS)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) - Category "E" license. Aircraft avionics technicians are responsible for the servicing, repair and modification of aircraft electronic systems and components. The job includes removing and installing components, bench testing and troubleshooting complex electronic aircraft systems. Today's aircraft can be quite sophisticated with "fly by wire," auto flight, global positioning, satellite navigation, in-flight entertainment, and automatic communication and receiving systems.

Job Opportunities

Opportunities are available across Canada in aviation electronic shops, helicopter operations and large and small aircraft operators/airlines. Other job opportunities such as fixed-based airport equipment servicing are also available.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "M" (MAINTENANCE)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) - Category "M" license. AMEs are responsible for the release (certification) of an aeronautical product (aircraft), after maintenance or inspection. The job responsibilities include a variety of tasks including removing and installing components and troubleshooting complex systems. A qualified AME is able to maintain small aircraft, helicopters and large transport category aircraft. Larger aircraft are quite sophisticated as they possess many different electrical, electronic, pneumatic, hydraulic, mechanical and propulsion systems and the AME must understand and maintain them.

Job Opportunities

Graduates from the AME M program have, for the last 40 years, found employment in both the Canadian and foreign aviation industry. First employment is as a log book-controlled work experience and then as an AME. Some graduates have gone on to become managers and owners of domestic and international aircraft maintenance establishments. Overall, through the year 2005, aircraft mechanics, particularly those with work experience, are expected to have excellent job opportunities since the number of job openings is expected to exceed the supply of qualified applicants (Aerospace Industry Association of BC AIABC study of October 2000). It is an exciting and rewarding industry with opportunity for travel and career development.

AIRCRAFT MAINTENANCE ENGINEER CATEGORY "S" (STRUCTURES)

Students prepare for a career in aircraft maintenance and begin to qualify for an aircraft maintenance engineer (AME) - Category "S" license. Category "S" structures technicians are responsible for the assessment, planning and implementation of aircraft structural fabrication and repairs. Structures technicians are often an integral part of repair crews including maintenance technicians, avionics technicians and professional engineers. They are expected to precisely follow aircraft fabrication and repair schemes for aluminium, titanium and stainless steel structures, as well as plastics and composites.

Job Opportunities

First employment is as a log book-controlled work experience. Then, as an AME, graduates from this program have found employment in a variety of companies in the aerospace industry across Canada. They may be employed in helicopter or light aircraft repair, airline maintenance of aircraft and component manufacturing. Some graduates have gone on to manage or own repair businesses.

AIRCRAFT MECHANICAL COMPONENT TECHNICIAN

Aircraft mechanical component technicians are involved in the overhaul, repair, modification, inspection, testing and certification of aviation components of pneumatic, hydraulic, fuel, electrical, environmental and mechanical aircraft systems. Working in a shop environment, technicians are thoroughly familiar with the set-up and operation of tools and shop equipment as well as some semi-automatic processes. Possessing a high degree of manual dexterity, and a strong interest in mechanics, they work cooperatively with others and are able to follow directions precisely.

Job Opportunities

The men and women who enter this career path can expect to find employment with companies that specialize in aircraft component overhaul, Approved Maintenance Organizations (AMOs) involved in the manufacture and overhaul of airframe systems, as well as major airlines. As a CAMC-developed course, the training and associated jobs skills provided are recognized anywhere in Canada. Recent trends indicate a strong demand for individuals trained in aviation component overhaul.

AIRCRAFT GAS TURBINE TECHNICIAN

Aircraft gas turbine technicians enjoy a challenging occupation requiring a high degree of responsibility and skill. Technicians perform the disassembly, inspection, repair, assembly and testing of gas turbine engines in a clean shop environment with regular working hours. Qualified technicians experience many opportunities for advanced training and continued career satisfaction.

Job Opportunities

The men and women who enter this career path find employment in both aircraft and industrial gas turbine engine repair and overhaul facilities across Canada. There is also a demand for trained technicians with this skill set in the aircraft component and propeller over-haul trades.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M270.02 – IDENTIFY REQUIREMENTS FOR AIRCRAFT MAINTENANCE

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to aircraft maintenance, generate an interest and present basic material.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify requirements for aircraft maintenance.

IMPORTANCE

It is important for cadets to identify the different components and aircraft systems for which maintenance technicians are responsible for the upkeep of the aircraft. Identifying the requirements of aircraft maintenance may stimulate an interest in the subject and this may lead to future aircraft maintenance course opportunities within the Air Cadet Program.

Teaching Point 1 | **Introduce Aircraft Maintenance**

Time: 10 min | Method: Interactive Lecture

AIRCRAFT MAINTENANCE

In air operations, maintenance, overhaul, and repair are ongoing duties performed to maintain the performance and safety of the aircraft. In air operations, maintenance, overhaul and repair are defined as follows:

Maintenance. Continuing repair work; work that is done regularly to keep a machine, building, or piece of equipment in good condition and working order.

Overhaul. Checking for mechanical faults; to examine a piece of machinery thoroughly to identify faults and improve or repair as necessary.

Repair. Fixing or mending something; to restore something broken or damaged to good condition.

AIRCRAFT INSTRUMENT SYSTEMS

Maintenance technicians must be familiar with the various types of instruments used to convey information to the pilot. Some are flight instruments that depict the attitude, airspeed, and altitude of the aircraft. Other instruments provide information such as engine operational parameters and electrical system performance.

The aircraft instrument systems group includes mechanics and technicians who install, adjust, repair and overhaul aircraft instruments and electrical or avionics systems on aircraft. This group also includes avionics inspectors who inspect instrument, electrical and avionics systems following assembly, modification, repair or overhaul. Workers in this group are employed by aircraft manufacturing, maintenance, repair and overhaul establishments and by airlines, the Canadian Forces and other aircraft operators.

AIRFRAME ELECTRICAL SYSTEMS

An aviation maintenance technician must be familiar with aircraft electrical systems, including ways in which electricity is generated and routed to various aircraft components. By understanding the principles of electricity and electrical system designs, a technician can effectively diagnose, isolate and repair malfunctions.

HYDRAULIC AND PNEUMATIC POWER SYSTEMS

Work performed by liquids is called ‘hydraulic’ whereas work performed by air is called “pneumatic”. Today’s aviation maintenance technician must be familiar with the principles of hydraulic and pneumatic systems as well as how the different aircraft systems utilize these principles.

AIRCRAFT LANDING GEAR SYSTEMS

The landing gear of the very first airplanes was not very complex. The Wright Flyer, for instance, took off from a rail and landed on skids. However, soon after the basic problems of flight were solved, attention was turned to providing better control and stability of the aircraft while it was operated on the ground. Bicycle and motorcycle designs were first used, which in turn, gave way to specially designed landing gear and wheels that absorbed the extreme loads imparted during takeoffs and landings. In addition, braking systems were installed to provide safer and more efficient control of slowing an airplane after landing.

In later years, as aircraft designs improved to increase speed and efficiency, retraction systems were provided to allow the landing gear to be stowed during flight to reduce aerodynamic loads or drag. With continued improvements in technology, landing gear systems on modern aircraft are highly reliable and capable of handling extreme conditions, enabling safe transitions between flight and ground mobility.

The industry regulation requires the strictest performance of scheduled maintenance, repairs, and overhauls on aircraft landing gear systems.

AIRCRAFT FUEL SYSTEMS

Modern aircraft fuel is generally stored in the wings, and on ultra-long-range jetliners, extra fuel storage is located in the tail area. Volatile fuels are crucial to the performance of fuel systems in modern aircraft. Although the fuel systems are relatively simple, the safety and reliability of these systems is dependent on proper inspection and maintenance.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Define maintenance.

Q2. What systems were installed, in addition to the landing gear, to provide safer and more efficient control of slowing an airplane after landing?

Q3. What are the safety and reliability of fuel systems dependent on?

ANTICIPATED ANSWERS

A1. Maintenance is defined as continuing repair work; work that is done regularly to keep a machine, building, or piece of equipment in good condition and working order.

A2. Braking systems were installed to provide safer and more efficient control of slowing an airplane after landing.

A3. The safety and reliability of fuel systems are dependent on proper inspection and maintenance.

Teaching Point 2	**Discuss the Maintenance of Aircraft Instruments**
Time: 20 min	Method: Interactive Lecture

Maintenance technicians must be familiar with various types of instruments used to convey information to the pilot. Some are flight instruments that depict the attitude, airspeed, and altitude of the aircraft. Other instruments provide information such as engine operational parameter and electrical system performance. Maintenance technicians must maintain the components that support the instruments, such as electrical wiring and fluid-line plumbing.

The following aircraft systems are maintained by aircraft maintenance technicians:

Altimeter. An altimeter is simply a barometer that measures the absolute pressure of the air. This pressure is caused by the weight of the air above the instrument. As an aircraft climbs, there is less atmosphere above the aircraft and the absolute pressure decreases. The instrument is calibrated to indicate higher altitude with decreased pressure and is usually referenced to sea level. The altimeter is one of the most important instruments used on an aircraft especially when the aircraft is operated in instrument meteorological conditions. Regulations require that the altimeter system be tested and inspected by the aircraft manufacturer or a certified and approved repair station.

"Google Images", Willkommen, Altimeter. Retrieved 23 April 2007, from www.lspl.ch/Images/Pictures/Altimeter.jpg

Figure 1 Altimeter

Air Speed Indicator. An air speed indicator is a differential pressure gauge that measures the difference between the pitot, or ram air pressure, and the static, or ambient air pressure. It consists of an airtight case that is vented to the static source. The diaphragm is also mechanically linked to a pointer on the instrument face, which indicates air speed.

"Google Images", Global Aviation, Air Speed Indicator. Retrieved 23 April 2007, from www.globalav.com.au/uma_flight_instruments.html

Figure 2 Air Speed Indicator

Gyroscope. Gyroscopes or gyros, have made it possible to fly an aircraft more precisely without an outside visual reference. A gyro is simply a rotating mass similar to a child's toy top. In most general aviation airplanes, there are three gyro instruments: the heading indicator, the attitude indicator and the turn and slip indicator.

"Google Images", Murphy Design, Gyroscope. Retrieved 23 April 2007, from www.cmurphydesign.com/images/gyroscope.jpg

Figure 3 Gyroscope

Heading Indicator (Directional Gyro). The heading indicator is an instrument designed to indicate the heading of the airplane and, because it is steady and accurate, to enable the pilot to steer that heading with the least effort.

"Google Images", Sea Gull, Heading Indicator. Retrieved 23 April 2007, from www.sgsim.com/instruments/DSCN7513-gyro-200.jpg

Figure 4 Heading Indicator

Attitude Indicator (Artificial Horizon/Gyro Horizon). The attitude indicator provides the pilot with an artificial horizon as a means of reference when the natural horizon cannot be seen because of clouds, fog, rain or other obstructions to visibility. It shows the pilot the relationship between the wings and nose of the airplane and the horizon of the Earth.

"Google Images", F-16C Reference Library, Attitude Indicator. Retrieved 23 April 2007, from www.xflight.de/f16/original/parts/center_console/adi/adi.gif

Figure 5 Attitude Indicator

Vertical Speed Indicator (VSI). The rate of climb or descent indicator, more properly called a vertical speed indicator (VSI), helps a pilot establish the rate of climb or descent, to allow arrival at a specified altitude at a given time. The VSI also backs up other instruments, such as the altimeter, by providing early indication of changes in pitch.

"Google Images", MSA, Vertical Speed Indicator. Retrieved 23 April 2007, from www.microlightsport.co.uk/Catalogue/Instruments/Instruments_List/VSI_vs2K.jpg

Figure 6 Vertical Speed Indicator

Radar Altimeter (Radio Altimeter). Displays the aircraft's altitude as measured by a radio signal, instead of by atmospheric pressure. It sends a high-frequency signal toward the ground, which is reflected back to the aircraft's radio altimeter receiver. Typically, this instrument is used at altitudes within 2500 feet of the ground, and provides a digital display of the aircraft's absolute altitude above ground level (AGL).

"Google Images", Willkommen, Altimeter. Retrieved 23 April 2007, from http://us.st11.yimg.com/us.st.yimg.com/I/yhst-10237233231589_1940_15587562

Figure 7 Radar Altimeter

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is one of the most important instruments used on an aircraft?

Q2. Where do regulations state an altimeter must be tested and inspected?

Q3. What shows the pilot the relationship between the wings and nose of the airplane and the horizon of the Earth?

ANTICIPATED ANSWERS

A1. The altimeter is one of the most important instruments used on an aircraft.

A2. Regulations require that the altimeter system be tested and inspected by the aircraft manufacturer or a certified and approved repair station.

A3. Attitude indicator (artificial horizon/gyro horizon) shows the pilot the relationship between the wings and nose of the airplane and the horizon of the Earth.

Teaching Point 3	**Discuss Landing Gear Maintenance**
Time: 20 min	Method: Interactive Lecture

The function of the landing gear is to take the shock of landing and also to support the weight of the airplane and enable it to manoeuvre on the ground. The earliest type of main landing gear was a through axle, similar to the wheel and axle arrangement on a cart or wagon. This is now completely obsolete, having been replaced with more sophisticated, shock absorbing landing gear systems.

Landing gear systems require maintenance technicians to test hydraulic and pneumatic systems and components made up of diverse materials that make up the landing gear of an aircraft.

TYPES OF LANDING GEAR

Fixed Undercarriage. On land airplanes, there are two basic classes of a fixed gear undercarriage: a main gear with a nose wheel, commonly called a tricycle gear, and a main gear with a tail wheel. There are several types of undercarriages in use for the main gear. These are used with both the tail wheel and the tricycle gear configuration.

"Google Images", ByDanJohnson.com, Fixed Landing Gear. Retrieved 23 April 2007, from http://www.bydanjohnson.com/picture0.cfm?330_5

Figure 8 Fixed Landing Gear

Slower aircraft lose little efficiency by using the lighter-weight fixed landing gear. The fixed landing gear decreases drag markedly by enclosing the wheels in streamlined fairings, called wheel pants. Many light airplanes utilize fixed landing gear that consists of spring or tubular steel landing gear legs with small frontal areas that produce minimum drag.

Retractable Landing Gear. Retractable landing gear is made to retract or fold up into the wing or fuselage in flight. The mechanical means and methods for accomplishing this are varied. The wheel may fold sideways, outward toward the wing or inward toward the fuselage. The latter is most common on high speed military airplanes when the wing camber is shallow. On some multi-engine airplanes, the wheels fold straight back or forward into the nacelle and is left partly projecting in order to protect the belly of the ship in the case of a wheels-up landing. Some retractable undercarriages are made to turn through 90 degrees as they travel up and fold into the side of the fuselage.

"Google Images", Xalasys Gallery, Retractable Landing Gear. Retrieved 23 April 2007, from http://gallery.xalasys.com/albums/speyer2005/DSCN4940.thumb.jpg

Figure 9 Retractable Landing Gear

Faster aircraft retract the landing gear into the structure and thus gain efficiency even at the cost of slightly more weight.

Tail-wheel. The landing gear configuration, in which the third wheel is rearward of the main gear (e.g. at the stern of the airplane), is referred to as a tail-wheel configuration (also known as "tail-draggers").

"Google Images", Loginet, Tail-Wheel. Retrieved 23 April 2007, from http://www.loginet.nl/europa/img/tailwheel2.jpg

Figure 10 Tail-wheel

Nose Wheel (Tricycle Gear Configuration). The practice of placing a steerable third wheel forward of the main gear has found universal acceptance in modern airplane design and is referred to as being a tricycle gear configuration. The prevalence of tricycle gear configurations, as used by most of today's manufacturers, is the result of certain advantages that this type of landing gear has over tail-wheel configuration.

> The majority of modern aircraft do not utilize a conventional landing gear, resulting in a generation of pilots who have never flown an airplane with a tail-wheel arrangement. Tail-wheel aircraft are configured with the two main wheels located ahead of the aircraft's centre of gravity and a much smaller wheel at the tail. Moving the rudder pedals that are linked to the tail-wheel steers the aircraft on the ground.
>
> Prior to WWII, almost all airplanes used the tail-wheel type landing gear. During WWII such airplanes as the Lockheed Lightning, the Consolidated Liberator, and the Boeing Superfortress, as well as the commercial Douglas DC-4, proved that the tricycle gear configuration was superior in ground handling ease. The tricycle gear configuration has since become the most widely used landing gear arrangement.

"Google Images", Acme Aerospace, Nose Wheel. Retrieved 23 April 2007, from http://www.acmeelec.com/aerospace/images/boeing777.gif

Figure 11 Nose Wheel

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What is the function of the landing gear?

Q2. State the types of landing gear.

Q3. What is another name for the nose wheel landing gear?

ANTICIPATED ANSWERS

A1. The function of the landing gear is to take the shock of landing and also to support the weight of the airplane and enable it to manoeuvre on the ground.

A2. Fixed gear, retractable gear, tail wheel, and nose wheel.

A3. Tricycle gear configuration.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What are the ongoing duties performed to maintain the performance and safety of the aircraft?

Q2. List three aircraft systems that are maintained by aircraft maintenance technicians.

Q3. What is the function of the landing gear?

ANTICIPATED ANSWERS

A1. Maintenance, overhaul, and repair are ongoing duties performed to maintain the performance and safety of the aircraft.

A2. Three aircraft systems that are maintained by aircraft maintenance technicians, include (any of the following):

- altimeter,
- airspeed indicator,
- gyroscope,
- heading indicator (directional gyro),
- attitude indicator (artificial horizon/gyro horizon),
- vertical speed indicator (vsi), and
- radar altimeter (radio altimeter).

A3. The function of the landing gear is to take the shock of landing and also to support the weight of the airplane and enable it to manoeuvre on the ground.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Identifying the requirements for aircraft maintenance will familiarize the cadets with the importance of aircraft maintenance in the aviation industry. The knowledge gained in this lesson may assist in stimulating an interest in aircraft maintenance in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-109 (ISBN 1-894777-00-X) Canadian Aviation Maintenance Council (CAMC). (2002). *Aviation Maintenance Orientation Program.* Ottawa, ON: CAMC.

C3-116 A-CR-CCP-263/PT-001/(ISBN 0-9680390-5-7) MacDonald, A. F. and Peppler, I. L. (2000). *From the Ground Up: Millennium Edition.* Ottawa, ON: Aviation Publishers Co. Ltd.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO M270.03 – DISCUSS EDUCATION AND EMPLOYMENT OPPORTUNITIES IN AIRCRAFT MANUFACTURING AND MAINTENANCE

Total Time:

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Photocopy the handouts located at Annexes A to E for each learning station.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for this lesson as it is an interactive way to present education and employment opportunities in the aircraft manufacturing and maintenance industry and to stimulate an interest among cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to have discussed education and employment opportunities in the aircraft manufacturing and maintenance industry.

IMPORTANCE

It is important for cadets to learn the different employment, education and career opportunities in order to gain an awareness of the options available to them in the aviation industry.

Teaching Point 1 | **Introduce the Aircraft Manufacturing and Maintenance Industry**

Time: 50 min | Method: In-Class Activity

This activity should be conducted as learning stations. Each learning station will be conducted concurrently.

Take notes after reading the material and looking at the relevant visual aids at each station. Do not move materials from one station to another. Groups will rotate from one learning station to the next, every fifteen minutes, until every learning station has been visited.

The three learning stations include:

1. employers in Canada,
2. career options, and
3. education and training institutions.

Learning Station One

Provide information about the employers in Canada, such as:

- Rolls-Royce Canada,
- Standard Aero,
- Aerospace and Defence Industries Association of Nova Scotia (ADIANS),
- Air Canada Technical Services,
- CHC Helicopter Corporation,
- Field Aviation,
- Goderich Aircraft Inc.,
- Canadian Heli Structures Ltd., and
- Bombardier.

Information on these employers can be found at Annex A.

Learning Station Two

Provide information about the career options in Canada, such as:

- aircraft gas turbine engine repair and overhaul technician,
- aircraft interior technician,
- aircraft maintenance technician,
- avionics maintenance technician,
- aircraft structures technician,
- aviation ground services attendant, and
- aviation and aerospace engineers.

Information on these careers can be found at Annex B.

Learning Station Three

Provide information about education and training institutions, such as:

- Simon Fraser University,
- Canadore College of Applied Arts and Technology,
- Centennial College,
- McGill University,
- École des métiers de l'aérospatiale de Montréal,
- Gander Aerospace Training Centre,
- Holland College,
- University of Calgary,
- Nova Scotia Community College, and
- Buffalo School of Aviation.

Information on these education and training institutions can be found at Annexes C to E.

ACTIVITY

Time: 50 min

OBJECTIVE

The objective of this activity is to introduce the cadets to the aircraft maintenance and manufacturing industry.

RESOURCES

Handouts located at Annexes A to E.

ACTIVITY LAYOUT

Create three learning stations in the classroom.

Place copies of the handouts for each cadet at the corresponding learning station.

ACTIVITY INSTRUCTIONS

1. Divide cadets into three groups.
2. Have each group start at different learning stations.
3. Each group will spend 15 minutes at each learning station.
4. After 15 minutes have each group rotate to the next learning station.
5. Rotate the groups until each group has visited all three learning stations.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Share with the class, three pieces of information about aircraft maintenance and manufacturing, that interested you.

Q2. Why did you find this information interesting?

Q3. Name an education or training institution in your area.

ANTICIPATED ANSWERS

A1. Answers may vary.

A2. Answers may vary.

A3. Answers may vary.

END OF LESSON CONFIRMATION

The cadets' participation in the in-class activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Introducing education and employment opportunities in aircraft manufacturing and maintenance will help the cadet gain an awareness of the industry and may develop their interest in future opportunities in the aircraft manufacturing and maintenance industry.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-101 Canadian Aviation Maintenance Council. (2006). *Careers in Aviation and Aerospace.* Ottawa, ON: Government of Canada's Sector Council Program.

C3-102 Canadian Aviation Maintenance Council. (2007). *Index of Corporate Profiles.* Retrieved 23 February 2007, from http://www.camc.ca/en/CorporateProflies/.

THIS PAGE INTENTIONALLY LEFT BLANK

AIRCRAFT MANUFACTURING AND MAINTENANCE EMPLOYERS IN CANADA

ROLLS-ROYCE CANADA

The company employs 1500 people at facilities in Montréal, Quebec, and Vancouver, British Columbia.

Montréal's capabilities include: repair and overhaul on a wide range of civil and military aero engines; research and development for the energy business; new production assembly and test for the Industrial RB211 engine; and component repair services for the Industrial Trent engines.

The Montréal facility is the largest of seven Rolls-Royce Canadian sites occupying more than 152 000 square metres of plant, laboratory and office space, and housing six engine test cells. Annual sales are in excess of $600 million, 90 percent of which is exported. The company supports 500 customers in 30 countries on five continents.

The Vancouver-based Marine Propulsion division of Rolls-Royce manufactures an integrated unit that performs both steering and propulsion functions. This unit replaces a conventional propeller, rudder and reduction gearbox.

The state-of-the-art test facility, which consists of approximately 8473 square metres, was constructed with the financial assistance of the Government of Quebec. The installation is intended to serve as a test bed for the industrial Trent engine as well as a provider of electricity to the City of Montréal, allowing the city to continue to supply drinking water in case of an emergency caused by a power failure affecting its water filtration plants.

STANDARD AERO

Standard Aero is one of the world's largest independent small gas turbine engine and accessories repair and overhaul companies. Standard Aero services engines used on corporate/business aircraft, commercial airliners, helicopters, and government/military aircraft. They do service for the following engines:

- PW100,
- PT6A,
- Model 250,
- T56/501D,
- AE3007,
- AE2100,
- CF34,
- GTCP 36, and
- 85.

AEROSPACE AND DEFENCE INDUSTRIES ASSOCIATION OF NOVA SCOTIA (ADIANS)

The Aerospace and Defence Industries Association of Nova Scotia (ADIANS) supports the growing and diversified aerospace and defence industry, which employs approximately 5200 workers. The association operates in both the defence and commercial markets. Approximately 80 percent of its revenue comes from maintaining the Department of National Defence's (DND) $25 billion worth of assets.

The large, medium and small firms which make up ADIANS' membership offer a range of products and services from advanced composite materials to training to transmitters and receivers.

ADIANS' initiatives foster sector strength in military and commercial development at the local, national and international level. The association helps members expand and position themselves for global market opportunities by helping them access government programs for industrial development opportunities. The association facilitates discussion and cooperation amongst industry, government, and all levels of academia when it comes to human resource training issues and technology challenges needed for innovation and growth.

ADIANS' development of an aerospace and defence sector export strategy, enhances current and future opportunities for manufacturers, suppliers and service companies.

AIR CANADA TECHNICAL SERVICES

Air Canada Technical Services provides a diverse range of maintenance, repair and overhaul services to many of the world's commercial airlines, leasing companies and the military. Their highly skilled personnel, state-of-the-art facilities and their commitment to excellence assures all their customers superior quality, reduced turn around times and competitive pricing.

OPERATIONS

Airframe Maintenance

- Line and heavy maintenance,
- Aircraft modifications,
- Cabin conversions,
- Aircraft painting, and
- Landing gear changes.

Component Maintenance

- Avionics,
- Instruments and electrical,
- Pneumatics and hydraulics,
- Fuel systems,
- Landing gears,
- Safety, and
- Wheels and brakes.

The aircraft handled under airframe and component maintenance are:

- The Airbus A310, A320, A330 and A340,
- The Boeing 737, 747, and 767; and
- The Bombardier Canadair Regional Jet (CRJ).

Engine Maintenance

Maintenance, repair and overhaul services are completed on the following engine models:

- CFM56,
- CF34,
- PW4000, and
- JT9D.

Other services include:

- On-wing support,
- Quick engine change,
- Thrust reversers,
- Auxiliary Power Unit GTCP36-300, and
- Engine components repairs.

Specialized Services

- Technical training,
- Fleet management and engineering,
- Technical records and publication services,
- Material management, and
- Composite repairs.

CHC HELICOPTER CORPORATION

CHC Helicopter Corporation is the world's largest provider of helicopter services to the global offshore oil and gas industry, with aircraft operating in 30 countries and a team of approximately 3500 professionals worldwide.

CHC continues to strengthen its position as the helicopter service company of choice for the world's leading oil and gas companies. CHC is a total solutions transportation service company, providing its customers with aircraft, pilots, maintenance, insurance, logistics support and training anywhere in the world. The company works on seven continents, from the Canadian Arctic to Antarctica, and from Azerbaijan to Venezuela.

CHC's current projects include: offshore industries support, offshore search and rescue, air ambulance services, repair and overhaul services, aerial firefighting support, construction industry service, mineral exploration support, composite materials manufacturing, flight training and flight simulator facilities, humanitarian aid work and a variety of other helicopter services around the world.

FIELD AVIATION

Since 1947, Field Aviation (Field) has grown into a worldwide airline support centre serving regional aircraft including commercial, corporate, individual, and military aircraft. Field is dedicated to servicing most turboprop and regional jet aircraft.

With over 50 years experience in repairing, modifying, and refinishing regional aircraft, Field has become one of Canada's largest full-service support organizations with major operation centres in Calgary and Toronto. Field employs aviation technicians that conduct a multitude of heavy checks, airframe structural repairs and modifications, exterior and interior refurbishments, along with a comprehensive array of aircraft avionics and engineering services. Field also manufactures quality spare parts and is equipped to repair sheet metal, hydraulic and composite components.

GODERICH AIRCRAFT INC.

Goderich Aircraft Inc. began in 1993. Goderich Aircraft Inc., formerly Crown Charter-Phoenix Aviation out of Brantford, Ontario, is located in Huron Park, Ontario and has grown to a staff of approximately 80 employees. Over the years it moved into the US market for aircraft refurbishment market and transformed into a company that provides a wide range of services for aircraft.

The company services include:

- aircraft painting,

- interior refurbishment, such as:
  - cabinets,
  - carpet, seats, or
  - floor plan modifications, and
- avionics, maintenance, such as:
  - large scale rebuilds,
  - modifications, and
  - parts sales.

Goderich Aircraft Inc. is able to complete maintenance inspections while the aircraft is undergoing other services.

CANADIAN HELI STRUCTURES LTD

Founded in 1996, Canadian Heli Structures Ltd. (C.H.S.) is a Canadian company incorporated under the laws of British Columbia, Canada. C.H.S. is a Bell Helicopter Textron (BHT) “Specialty Customer Service Facility” and is committed to the utmost in service of Bell Helicopter major structural repairs, modifications, and specialty welding on light and medium turbine helicopters.

With years of experience specializing on BHT light and medium airframe jigs, C.H.S. is able to perform airframe repairs with the knowledge of complete overhauls to the highest standards and quality service in a timely manner.

Their maintenance department is staffed with a wide range of technicians and all their maintenance is performed in compliance with Transport Canada Regulations, which is equivalent to the Federal Aviation Administration (FAA) regulations.

BOMBARDIER

In 1942, J. Armand Bombardier founded a company to manufacture tracked vehicles for transportation on snow-covered terrain. The company’s name is L’Auto-Neige Bombardier Limitée. In 1967, L’Auto-Neige Bombardier Limitée became Bombardier Limited.

Bombardier Aerospace is a world leader in the design and manufacturer of innovative aviation products and services for the business, regional and amphibious aircraft markets. This legacy of innovation consolidates more than 250 years of aviation history and has developed 19 successful new aircraft programs since 1989. Bombardier employs approximately 27 000 people worldwide.

Bombardier manufactures business, regional and amphibious aircraft to address the specific aviation needs of their customers. Their aircraft have a multiple range of applications. Their aircraft include:

- Bombardier Learjet family, to include:
  - Learjet 40 XR,
  - Learjet 45 XR, and
  - Learjet 60 XR;
- Bombardier Challenger family, to include:
  - Challenger 300,
  - Challenger 605,

  - Challenger 850,
  - Challenger 850 Corporate Shuttle,
  - Challenger 870 Corporate Shuttle, and
  - Challenger 890 Corporate Shuttle;
- Bombardier Global family, to include:
  - Bombardier Global 5000, and
  - Global Express XRS;
- Bombardier CRJ series regional jets, to include:
  - 50-passenger CRJ200,
  - 70- to 78-passenger CRJ700,
  - 75-passenger CRJ705,
  - 86- to 90-passenger CRJ900, and
  - up to 100-passenger CRJ1000;
- Bombardier Q series regional turboprops, to include:
  - 37- to 39-passenger Q200,
  - 50- to 56-passenger Q300, and
  - 68- to 78-passenger Q400; and
- Bombardier amphibious aircraft (Bombardier 415).

The world's most productive firefighting aircraft in service is the Bombardier 415. This amphibious water bomber can also be configured for a wide range of multi-mission capabilities including search and rescue, maritime patrol, law enforcement and environmental control.

THIS PAGE INTENTIONALLY LEFT BLANK

AIRCRAFT MANUFACTURING CAREERS

AIRCRAFT GAS TURBINE ENGINE REPAIR AND OVERHAUL TECHNICIAN

The gas turbine was one of the greatest inventions of the last century: it is unique and simple in its basic operation and yet immensely complicated to design and build. In the aviation industry, gas turbine engines are used in jet aircraft and power turbo-prop aircraft.

Aircraft gas turbine engine repair and overhaul technicians enjoy a very challenging and rewarding career that requires a high degree of responsibility and skill. Technicians perform the disassembly, inspection, repair, assembly and testing of gas turbine engines in sophisticated shop environments and test cells, complete with computer-assisted systems and leading-edge tools, machinery and techniques.

Education

An aircraft gas turbine repair and overhaul technician will need a high school diploma. You will also need to complete a recognized structured training program in gas turbine repair and overhaul; these courses may be taken at a college or through a company-sponsored program. See the College and University section for more information.

Work

Recent surveys indicate excellent job placement rates with opportunities in engine repair and overhaul facilities as well as airlines, component and propeller overhaul businesses and engine manufacturers. You can receive an aircraft gas turbine repair and overhaul technician certification through the Canadian Aviation Maintenance Council (CAMC).

AIRCRAFT INTERIOR TECHNICIAN

Aircraft interior technicians are responsible for maintaining the quality of aircraft interiors and cabin furnishings including safety, survival and evacuation equipment such as rafts, flotation devices and escape slides.

This trade is also responsible for aircraft reconfigurations, such as changing from cargo to passenger or passenger to cargo, and aircraft interior seating arrangements: first class, business class, economy class, etc. From headliners, carpet and cabinets through to panels, coverings, seats and bulkheads, these aviation experts have to assess, remove, repair and reinstall everything and anything that has to do with interior components. Not only are the tasks diverse for an aircraft interior technician, but so are the skills and the challenges they have. Aircraft interior technicians are master craftspeople that also have to be excellent team players that pay tireless attention to details and the highest maintenance and safety standards.

Education

Aircraft interior technicians have a high school diploma and have benefited from an apprenticeship or college training program. See the College and University section for more information.

Work

As a consummate team player and professional, aircraft interior technicians have promising careers as part of larger units working for airlines or major repair and overhaul companies and manufacturers. You can receive an aircraft interior technician certification through the Canadian Aviation Maintenance Council (CAMC).

AIRCRAFT MAINTENANCE TECHNICIAN

Aircraft Maintenance Technicians (AMTs) have the important responsibility of keeping aircraft operating safely and efficiently. It is not just important—lives depend on it. AMTs are the frontline aviation professionals that service, repair and overhaul aircraft components and systems including airframes, engines, electrical and hydraulic systems, propellers, avionics equipment and aircraft instruments.

As an AMT, you might work on one or many different types of aircraft such as jets, propeller-driven airplanes and helicopters. To keep aircraft in peak operating condition, AMTs perform scheduled maintenance and complete inspections that have to meet the strictest industry regulations. There are no exceptions. You have to be a perfectionist with excellent communication skills and an unshakeable commitment to safety. You must remain up to date as safety regulations change very rapidly. Innovations in space-age technology mean that AMTs have to be front-runners in their field in order to meet the rapid advances in computer technology, electronics and fibre composite structural material. It is fast, intense, deadline-driven and very high tech. If you are looking for a challenging career with limitless potential, be sure to look into becoming an aircraft maintenance technician.

Education

Aircraft maintenance technicians have a high school diploma. AMTs must complete training at a certified college or training facility. See the College and University section for more information.

Work

As a successful AMT, you can find a rewarding career with airlines, aircraft manufacturers, aerospace organizations, the military, as well as repair and maintenance facilities. There are many avenues open to experienced AMTs, for instance you can be certified by the Canadian Aviation Maintenance Council (CAMC) and/or become an aviation maintenance engineer “M” class (AME)(M), which is a Transport Canada licensed trade. From there, you could go on to join management as a company’s director of maintenance.

AVIONICS MAINTENANCE TECHNICIAN

Avionics is the study and practice of complex electronic and electrical systems including navigation, guidance systems, communications, surveillance and flight control. Critical to safe and timely operation of all aircraft on the ground and in the air, thorough and up-to-date knowledge of avionics opens the door to numerous employment opportunities in the aviation and aerospace industries.

As an avionics maintenance technician, you are a master of aircraft micro-processor technology. You are on the front-line doing tests, calibrations, repairs and maintenance on state-of-the-art systems including “fly by wire”, auto flight, global positioning and satellite navigation. Fascinated with sophisticated electronics systems, a good avionics maintenance technician is an excellent team player with solid communication skills and a tireless commitment to safety and excellence. This is arguably one of the most demanding trades in aviation.

Education

Avionics maintenance technicians have a high school diploma with strong grades in English, communications and mathematics; you will then complete a college program in electrical and electronics or specialized training at a certified college or training facility. See the College and University section for more information.

Work

A career as an avionics maintenance technician opens the door to airports, aviation electronic shops, airlines, helicopter operations, aircraft manufacturers and repair facilities and aerospace organizations. There are many avenues open to experienced avionics maintenance technicians, for instance you can be certified by the Canadian Aviation Maintenance Council (CAMC) and/or become an aviation maintenance engineer “E” category (AME)(E), which is a Transport Canada licensed trade.

AIRCRAFT STRUCTURES TECHNICIAN

An aircraft structures technician is one of the key members of the air maintenance team that handles services and maintains aircraft and associated equipment. This job is critical to aviation safety and quality maintenance as aircrews depend on your skills to keep them safe.

The aircraft structures technician’s job is to keep the aircraft in perfect flying condition by constructing and repairing metal and composite parts of an aircraft’s fuselage, wings and control surfaces, which include machining, painting, welding and refinishing. You will also be expected to follow aircraft fabrication and repair schemes with surgical precision for aluminum, titanium and stainless steel structures, as well as plastics and composites. If you enjoy working with tools, machines and state-of-the-art equipment, and you have stamina and are able to master new procedures quickly, this profession may be for you.

Education

Aircraft structures technicians have a high school diploma and require additional training at a certified college or training facility. See the College and University section for more information.

Work

You can become certified by the Canadian Aviation Maintenance Council (CAMC) as an aircraft structures technician and find a rewarding career with airlines, maintenance and overhaul companies, aircraft manufacturers or aerospace organizations. This trade is a prerequisite to becoming an aviation maintenance engineer “S” category (AME)(S), which is a Transport Canada licensed trade.

AVIATION GROUND SERVICES ATTENDANT

If you look out at the airport terminal grounds and see aircraft coming and going, you are at the same time viewing the busy workplace of an aviation ground services attendant. The individuals servicing the aircraft fill many roles that require in-depth training.

Every imaginable type of motorized equipment is used to service an aircraft, from pallet loaders, potable water trucks, mobile conveyor belts, tugs for pulling baggage cart trains to high-speed aircraft tow tractors, to name a few.

Ground services attendants are the people who load and unload the aircraft materials, and who are responsible for positioning the baggage/cargo in such a way as to stay within the operating weight and balance limits of the aircraft (an unbalanced aircraft is an unsafe aircraft), all the while working within stringent time constraints in a high noise environment with jet blast hazards.

The lead attendant is responsible for the final pre-flight security inspection and commands the push-back crew. Excellent math and physics skills, environmental awareness and hazardous material knowledge are but some of the skills necessary to the position. A love of the outdoors, the ability to operate in all weather conditions, and good physical conditioning are assets in this demanding job.

This serious role is often the entry level for other positions, especially in large organizations: promotion to lead or cargo loadmaster, for example. Baggage, commissary, cargo, weight and balance controllers can also rise up to management positions, overseeing people/teams, terminal control, gate assignments, and more.

Education

As a successful aviation ground control attendant, you will need to have a high school diploma. You also will have to receive internal company training in aviation general practices and specialized courses. Companies will provide the licenses for heavy equipment operator, safety training, firefighting proficiency, air side security, and a driving permit. Canadian Aviation Maintenance Council (CAMC) certification is available with a minimum of one year’s experience in the occupation at level 1 - Cargo, and one more year’s experience at level 2 - Passenger.

Work

Some of the job titles available in this occupation include:

- Station attendant,
- Lead station attendant,
- Cargo attendant, and
- Commissary attendant.

AVIATION AND AEROSPACE ENGINEERS

If there ever was an industry designed to meet the challenges and rewards of engineering, the aviation and aerospace industry is it. The following engineers are contributors in aviation and aerospace:

- Aerodynamics,
- Avionics,
- Design,
- Engineering reliability,
- Equipment,
- Field service,
- Flight test,
- Instrumentation,
- Manufacturing materials,
- Aeronautical,
- Aerospace,
- Ceramic,
- Chemical,
- Civil,
- Electronic,
- Electrical,
- Engineering physics,
- Industrial,
- Mechanical,
- Petroleum,
- Metallurgical, and
- Computer and nuclear.

What do all these engineers contribute? As an example, petroleum engineers research, develop and supervise projects associated with the design and operation of gas turbine and piston aero-engines. Aerospace engineers research, design and develop aircraft, spacecraft, missiles, aerospace systems and their components. Whatever the area that most interests you, there are countless opportunities within this dynamic, forward-thinking industry.

Education

You must complete a university degree in your preferred area of expertise in order to become an Engineer; in fact you must receive provincial recognition or accreditation. See the College and University section for more information.

Work

Engineers can find stimulating and rewarding careers in all aviation and aerospace-related firms that design, manufacture, repair and overhaul aeronautical products including complete aircraft, engines, components and systems and sub-systems.

THIS PAGE INTENTIONALLY LEFT BLANK

EDUCATIONAL INSTITUTIONS

BRITISH COLUMBIA

Simon Fraser University
School of Engineering Science
8888 University Drive
Burnaby, BC V5A 1S6
www.sfu.ca

University of British Columbia
Faculty of Applied Science
2329 West Mall
Vancouver, BC V6T 1Z4
www.ubc.ca

University of Victoria
Faculty of Engineering
P.O. Box 1700 STN CSC
Victoria, BC V8W 2Y2
www.uvic.ca

ACRO Aerospace
ACRO Aerospace Inc.
4551 Agar Drive
Richmond, BC V7B 1A4
www.acro.ca

Kelowna Flightcraft
5655 Airport Way
Kelowna, BC V1V 1S1
www.flightcraft.ca

ALBERTA

University of Calgary
Faculty of Engineering
2500 University Drive NW
Calgary, AB T2N 1N4
www.ucalgary.ca

SASKATCHEWAN

University of Saskatchewan
College of Engineering
105 Administration Place
Saskatoon, SK S7N 5A2
www.usask.ca

University of Regina
Faculty of Engineering
3737 Wascana Parkway
Regina, SK S4S 0A2
www.uregina.ca

MANITOBA

University of Manitoba
Faculty of Engineering
Winnipeg, MB R3T 2N2
www.umanitoba.ca

ONTARIO

Carleton University
Faculty of Engineering
1125 Colonel By Drive
Ottawa, ON K1S 5B6
www.carlton.ca

Ryerson University
Faculty of Engineering and Applied Science
350 Victoria Street
Toronto, ON M5B 2K3
www.ryerson.ca

University of Toronto
Faculty of Applied Science and Engineering
Division of Engineering Science
Galbraith Building, Room 149
35 St. George Street
Toronto, ON M5S 1A4
www.utoronto.ca

University of Toronto Institute for Aerospace Studies (UTIAS)
4925 Dufferin Street
Toronto, ON H3H 5T6
(416) 667-7700

EDUCATIONAL INSTITUTIONS

Lakehead University
Faculty of Engineering
955 Oliver Road
Thunder Bay, ON P7B 5E1
www.lakeheadu.ca

McMaster University
Faculty of Engineering
2329 West Mal1280 Main Street West l
Hamilton, ON L8S 4L8
www.mcmaster.ca

Queen's University
Faculty of Applied Science
99 University Avenue
Kingston, ON K7L 3N6
www.queensu.ca

Royal Military College
Engineering Division
P.O. Box 17000 Station Forces
Kingston, ON K7K 7B4
www.rmc.ca

University of Guelph
Faculty of Engineering
Guelph, ON N1G 2W1
www.uoguelph.ca

University of Ottawa
Faculty of Engineering
161 Louis Pasteur
Ottawa, ON K1N 6N5
www.genie.uottawa.ca

University of Waterloo
Faculty of Engineering
200 University Avenue West
Waterloo, ON N2L 3G1
www.uwaterloo.ca

University of Western Ontario
Faculty of Engineering Science
1151 Richmond Street, Suite 2
London, ON N6A 5B8
www.uwo.ca

University of Windsor
Faculty of Engineering
401 Sunset Avenue
Windsor, ON N9B 3P4
www.uwindsor.ca

Renaissance Aeronautics
169 Deer Park Circle
London, ON N6H 3B9
www.raacomposites.com

Canadore College of Applied Arts and Technology
55 Aviation Avenue
P.O. Box 5001
North Bay, ON P1B 8K9
www.canadorec.on.ca

Centennial College
P.O. Box 631, Station A
Scarborough, ON M1K 5E9
www.centennialcollege.ca

QUEBEC

École de technologie supérieure
1100, rue Notre-Dame Ouest
Montréal, QC H3C 1K3
www.etsmtl.ca

Université du Québec à Chicoutimi
Département des sciences appliquées
555, boulevard de l`Université
Chicoutimi, QC G7H 2B1
www.dsa.uqac.uquebec.ca

École nationale D`aérotechnique
Du Collège Édouard-Montpetit
5555, place de la Savane
St. Hubert, QC J3Y 5K2
www.collegeem.qc.ca

École des métiers de l`aérospatiale de Montréal
5300, rue Chauveau
Montreal, QC H1N 3V7
www.csdm.qc.ca/emam/

EDUCATIONAL INSTITUTIONS

John Abbott College
21, 275 Lakeshore Road
Ste, Anne de Bellevue, QC
H9X 3L9
www.johnabbott.qc.ca

Concordia University
Faculty of Engineering and Computer Science
1455 de Maisonneuve Blvd. West
Montreal, QC H3G 1M8
www.concordia.ca

École Polytechnique de Montréal
C.P. 6079, Succ. Centre-ville
Montréal, QC H3C 3A7
www.polymtl.ca

McGill University
Faculity of Engineering
845 Sherbrooke Street West
Montreal, QC H3A 2T5
www.mcgill.ca

Université de Sherbrooke
Faculté des sciences appliquées
2500, boulevard de l`Université
Sherbrooke, QC J1K 2R1
www.usherb.ca

Université Laval
Faculté des sciences et de génie
Cartier Boone-enfant, Local 2440
Cite Universitaire
Quebec, QC G1K 7P4
www.ulaval.ca

Université du Québec à Rimouski
Module de génie
300 allée des Ursulines, B.P. 3300
Rimouski, QC G5L 3A1
www.uqar.uquebec.ca

Université du Québec en Outaouais
Module de génie
C.P. 1250 Succursale B
Hull, QC J8X 3X7
www.uqo.ca

Université du Québec à Trois-Rivières
Département d'ingénierie
3351, boulevard des Forges, B.P. 500
Trois-Rivières, QC G9A 5H7
www.uqtr.ca

NOVA SCOTIA

Dalhousie University
Faculty of Engineering
1360 Barrington Street
Halifax, NS B3J 1Z1
www.dal.ca

Nova Scotia Community College
4 Hangar, Shearwater,
P.O. Box 1171, Stn. Main
Shearwater, NS B0J 3A0
www.nscc.ns.ca

NEW BRUNSWICK

Université de Moncton
École de génie
165, avenue Massey
Moncton, NB E1A 3E9

University of New Brunswick
Faculty of Engineering
3 Bailey Drive, P.O. Box 4400
Fredericton, NB E3B 5A3
www.unb.ca

EDUCATIONAL INSTITUTIONS

PRINCE EDWARD ISLAND

Holland College — Aerospace and Industrial Technology Centre
40 Parkway Drive
P.O. Box 235
Slemon Park, PE C0B 2P0
www.hollandc.pe.ca

NEWFOUNDLAND

College of the North Atlantic
Gander Campus
1 Magee Road, P.O. Box 395
Gander, NF A1V 1W8
www.northatlantic.nf.ca

Memorial University of Newfoundland
Faculty of Engineering
and Applied Science
St. John's, NF A1C 5S7
www.mun.ca

Gander Aerospace Training Centre
Gander Flight Training
P.O. Box 355
Gander, NF A1V 1W7
www.gft.nf.ca

NORTHWEST TERRITORIES

Buffalo School of Aviation
Box 2015
Yellowknife, NT X1A 2R3
www.buffaloairways.com

AVIATION TECHNICIAN PROGRAMS

Education / Training Institutions

Program	Acro Aerospace (BC)	British Columbia Institute (BC)	Canadore College (ON)	Carlton University (ON)	Centennial College (ON)	College of North Atlantic (NL)	DND Canadian Forces School of Aerospace Technology and Engineering (ON)	École des métiers de l`aérospatiale de Montréal (QC)	École nationale D`aérotechnique (QC)	Gander Aerospace Training Centre (NL)	Holland College — Aerospace and Industrial Technology Centre (PE)	Kelowna Flightcraft (BC)	Northern Alberta Institute of Technology (AB)	Nova Scotia Community College (NS)	Southern Alberta Institute of Technology (AB)	Stevenson Aviation and Aerospace Training Centre (MB)
Aircraft Gas Turbines Engine Repair and Overhaul Technician	x	x						x		x	x					
Aircraft Interior Technician		x														
Aircraft Maintenance Technician		x	x		x		x				x			x	x	x
Aircraft Structures Technician		x	x			x			x		x	x		x	x	x
Aviation Mechanical Component Technician		x														
Aviation Painter		x							x							
Aviations Welding Technician		x														x
Avionics Maintenance Technician		x	x		x		x		x				x		x	x
Helicopter Component Technician										x						

THIS PAGE INTENTIONALLY LEFT BLANK

ENGINEERING PROGRAMS

Education / Training Institutions

Program	Buffalo School of Aviation (NT)	Carlton University (ON)	Lakehead University (ON)	McMaster University (ON)	Queen's University (ON)	Ryerson University (ON)	Simon Fraser University (BC)	University of British Columbia	University of Calgary (AB)	University of Manitoba	University of Regina (SK)	University of Saskatchewan	University of Toronto (ON)	University of Victoria (BC)
Aviation Maintenance Engineer	x													
Bachelor of Aerospace Engineering		x				x							x	
Bachelor of Manufacturing Technology				x										
Chemical Engineering			x	x		x						x		
Computer Engineering				x	x	x	x	x	x	x			x	x
Computer Systems Engineering		x												
Electronics Engineering							x	x						
Electronic Systems Engineering											x			
Electrical Engineering		x	x	x	x	x			x	x		x	x	x
Electrical / Computer Engineering									x					
Engineering Physics					x		x	x				x		
Industrial Engineering						x							x	
Industrial Systems Engineering										x	x			
Manufacturing / Mechanical Engineering									x					
Masters of Applied Science in Aerospace Engineering		x											x	
Masters of Engineering Mechanics and Engineering Aerospace													x	
Materials Engineering													x	
Mechanical Engineering		x	x	x	x	x							x	x
Mechanical Engineering with Aerospace Option										x		x		
Metallurgical Engineering				x	x			x						
Metals and Materials Engineering								x	x					
PHD Aeronautical Aerospace Engineering		x												
Software Engineering			x	x		x			x					x
Systems Engineering							x				x			

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO C270.02 – IDENTIFY CANADIAN AVIATION MAINTENANCE COUNCIL (CAMC) INTERACTIVE MULTIMEDIA LEARNING TOOL (IMLT) ACTIVITIES

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-802/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.

Before proceeding with this lesson, the instructor must become familiar with the procedures involved in using the IMLT.

Contact your Area Cadet Officer (ACO) to receive a log-on user ID and password.

Current instructions for exploring the IMLT are provided at http://3da.com/imlt/.

The following procedures are to be researched in advance:

- accessing the internet;
- logging onto the CAMC IMLT; and
- operating the IMLT.

Photocopy handouts located at Annexes A and B for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to clarify, emphasize and summarize the teaching points. An on-line visit to the IMLT will provide an overview of and promote interest in CAMC activities.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify CAMC IMLT activities.

IMPORTANCE

It is important for cadets to know about the IMLT because it may help further develop their understanding of aviation. Identifying the modules in IMLT may develop an interest in aviation which may lead to future opportunities in the Air Cadet Program.

Teaching Point 1	**Explain CAMC**
Time: 10 min	Method: Interactive Lecture

CANADIAN AVIATION MAINTENANCE COUNCIL (CAMC)

The Canadian Aviation Maintenance Council (CAMC) is a not-for-profit sector council that represents and assists Canada's aviation and aerospace industry with its human resource strategy, issues and solutions. With the participation of industry members, they develop and publish National Occupational Standards with supporting log books (for professional certification) and curricula (for post-secondary training organizations). They promote safety, professionalism and standardization through:

- national communication with industry;
- human factors and safety management systems training;
- individual certification in 24 occupations; and
- accreditation of training organization programs.

AVIATION MAINTENANCE ORIENTATION PROGRAM (AMOP)

The CAMC Leading Edge/Youth Internship Program provides students with an academic orientation and work-based experience in aviation maintenance and technology. The program aims to develop interest among youth in careers within aviation and aerospace. It also establishes pathways for the transition from school to the working world of the aviation and aerospace industry.

The Leading Edge program provides a school-to-workplace transition for students who are about to make important decisions about their future. This program provides stepping stones from elementary school, to high school, to post secondary education, to industry. Therefore, community colleges and industry partnerships are essential elements to the success of the program at each location across Canada.

The program involves an aviation maintenance curriculum that begins at the high school level and is completed at the college level. High school graduates of the program will be able to proceed directly into a college technician diploma program or enter the industry workforce with some aviation knowledge and skills.

The funding model, which was initiated in September 1996, contains three elements:

- an academic phase comprising of classroom instruction and interactive multimedia based on the CAMC AMOP;
- a practical hands-on phase with a local industry partner where students can ideally work on or around aircraft under the guidance and supervision of a qualified technician; and
- a phase where students get to put theory into practice by:
  - working on/with aircraft or aircraft parts primarily provided by CAMC; or
  - by participating in the construction of available aircraft kit programs across Canada.

INTERACTIVE MULTIMEDIA LEARNING TOOL (IMLT)

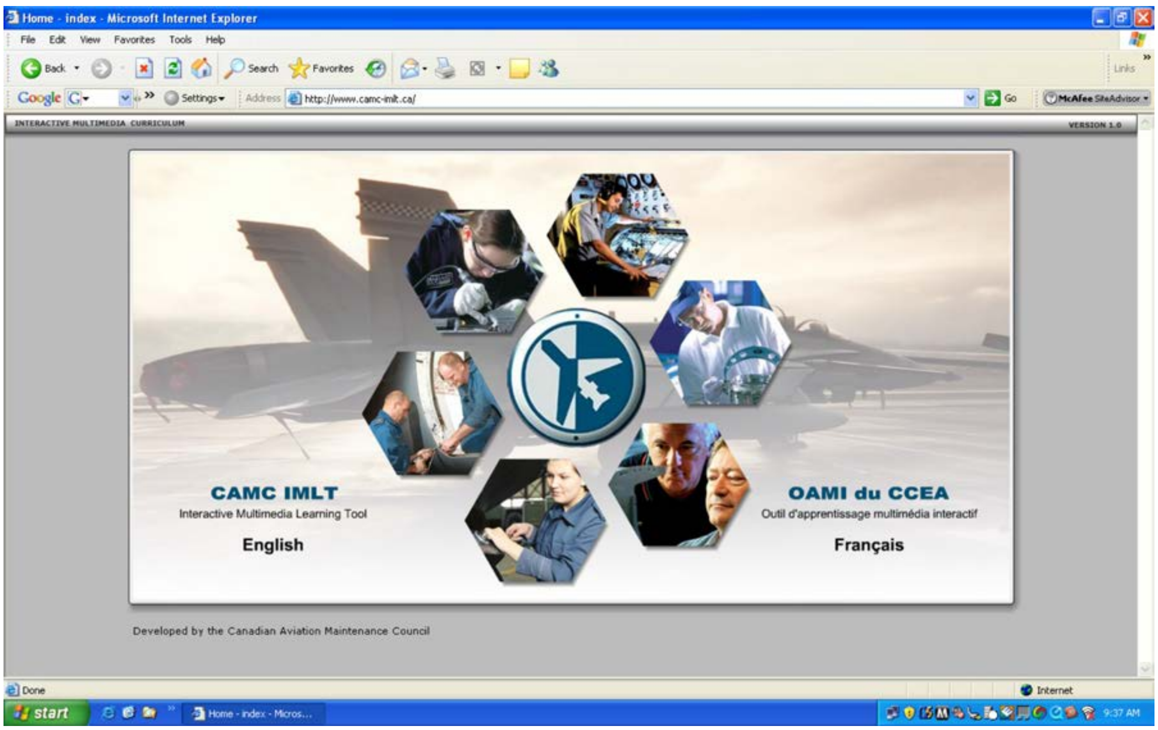
The IMLT is an interactive aviation curriculum that a cadet can individually log on to and create profiles, complete modules, and ask question related to the aviation industry. This can be done on their own time, using their personal computers.

Distribute handouts located at Annex A and review the following IMLT log-in screenshots with the cadets.

The following steps must be completed in order to log-in to the IMLT curriculum.

STEP ONE

Go to the IMLT Website at www.camc-imlt.ca and click on “English” or “French” (Figure 1).

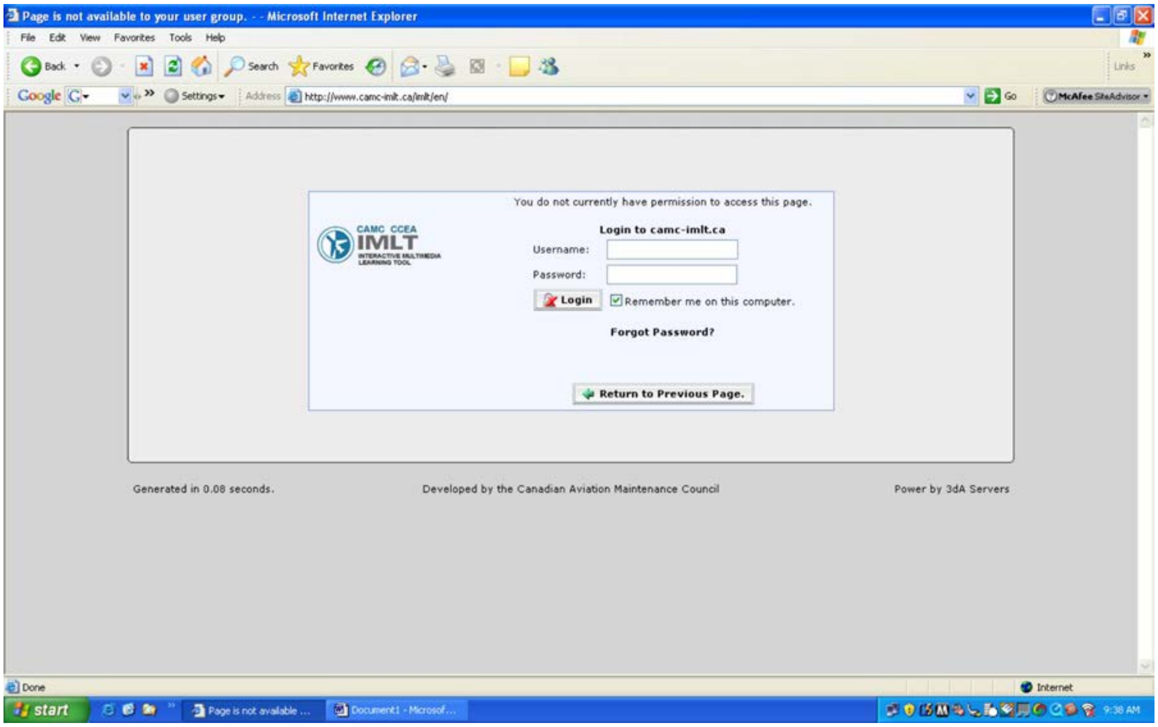


“CAMC”, IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 1 Home Index

STEP TWO

Enter the username and password (provided by the instructor) and then click enter (Figure 2).

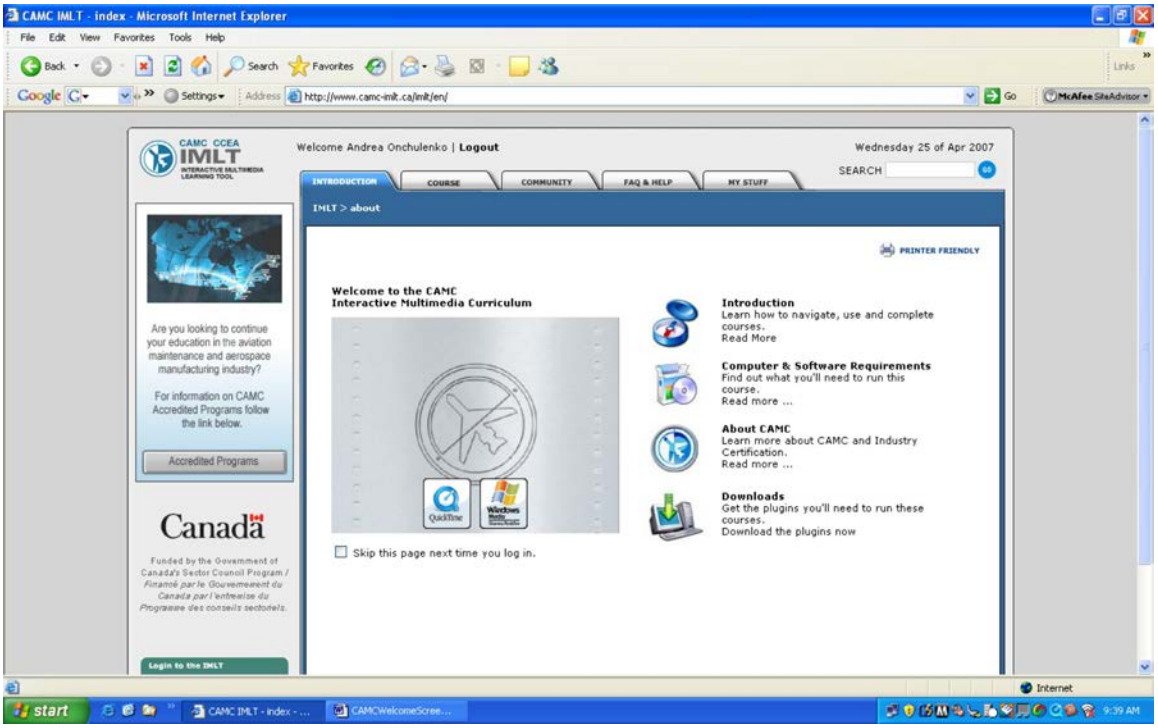


"CAMC", IMLT, Log-in. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 2 Log-in

STEP THREE

Select the course by clicking on the tab at the top of the welcome page (Figure 3).

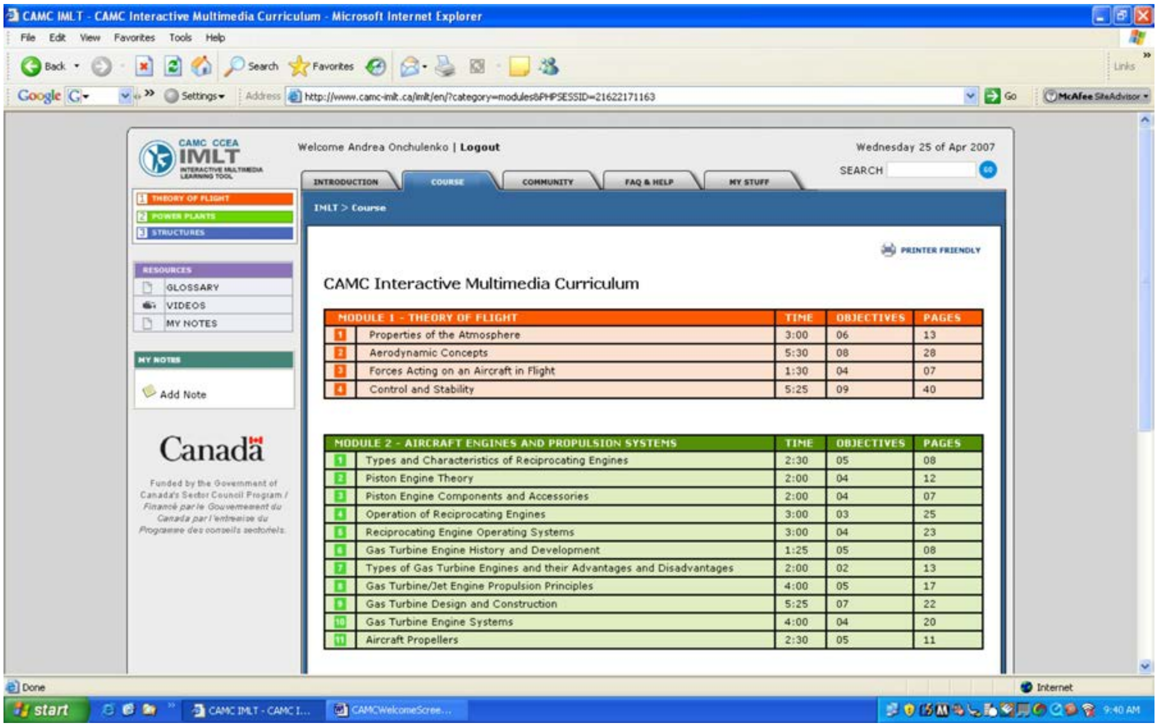


"CAMC", IMLT, Welcome Page. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 3 Welcome Page

STEP FOUR

Select the module that you wish to complete by clicking on the title (Figure 4).



"CAMC", IMLT, Modules. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure 4 Modules

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What does CAMC stand for?

Q2. What does IMLT stand for?

Q3. Where do you get a username and password to log-in to IMLT?

ANTICIPATED ANSWERS

A1. CAMC stands for Canadian Aviation and Maintenance Council.

A2. IMLT stands for Interactive Multimedia Learning Tool.

A3. The instructor will provide a username and password to log-in to IMLT.

Teaching Point 2	**Explain the IMLT Modules**
Time: 15 min	Method: Interactive Lecture

There are three IMLT curriculum modules.

MODULE 1 – THEORY OF FLIGHT

The theory of flight module establishes the basis upon which all aircraft fly. It includes the study of the atmosphere and the application of the laws of physics to explain how lift is generated and affected.

Module 1 includes the following topics:

- properties of the atmosphere,
- aerodynamic concepts,
- forces acting on an aircraft in flight, and
- control and stability.

MODULE 2 – POWER PLANTS

The power plant module examines the evolution, design and classification of various types of engines.

Module 2 includes the following topics:

- types and characteristics of reciprocating engines,
- piston engine theory,
- piston engine components and accessories,
- operation of reciprocating engines,
- reciprocating engine operating systems,
- gas turbine engine history and development,
- types of gas turbine engines and their advantages and disadvantages,
- gas turbine/jet engine propulsion principles,
- gas turbine design and construction,
- gas turbine engine systems, and
- aircraft propellers.

MODULE 3 – AIRCRAFT STRUCTURES

The aircraft structures module identifies the principle structural components and how their construction is such that they withstand the loads and stresses of flight as well as methods used to prevent premature problems.

Module 3 includes the following topics:

- loads and stresses imposed on an aircraft,
- aircraft parts and empennage structures,
- aircraft ground and engine support structures,
- rotorcraft structures,
- control systems,
- electricity,
- documentation,
- inspection, and

- inspections methods.

Distribute the handout located at Annex B to the cadets to review when using the IMLT on their own.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What are the three IMLT modules?

Q2. What is studied in the theory of flight module?

Q3. What does the power plant module examine?

ANTICIPATED ANSWERS

A1. The three modules are:

- theory of flight,
- power plants, and
- aircraft structures.

A2. The theory of flight module includes the study of atmosphere and the application of the laws of physics to explain how lift is generated and affected.

A3. The power plant module examines the evolution, design and classification of various types of engines.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What topics from the IMLT interest you?

Q2. How can IMLT help you in the Air Cadet Program?

Q3. What are the benefits of using IMLT?

ANTICIPATED ANSWERS

A1. Answers may vary.

A2. Answers may vary.

A3. Answers may vary.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Introducing the cadets to IMLT will help the cadets to further develop an understanding of aviation. Identifying the modules in IMLT may develop an interest in aviation which may lead to future aviation opportunities in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-115 Canadian Aviation Maintenance Council (CAMC). (2007). *CAMC Interactive Multimedia Learning Tool (IMLT).* Retrieved 6 March 2007, from http://3da.com/imlt/.

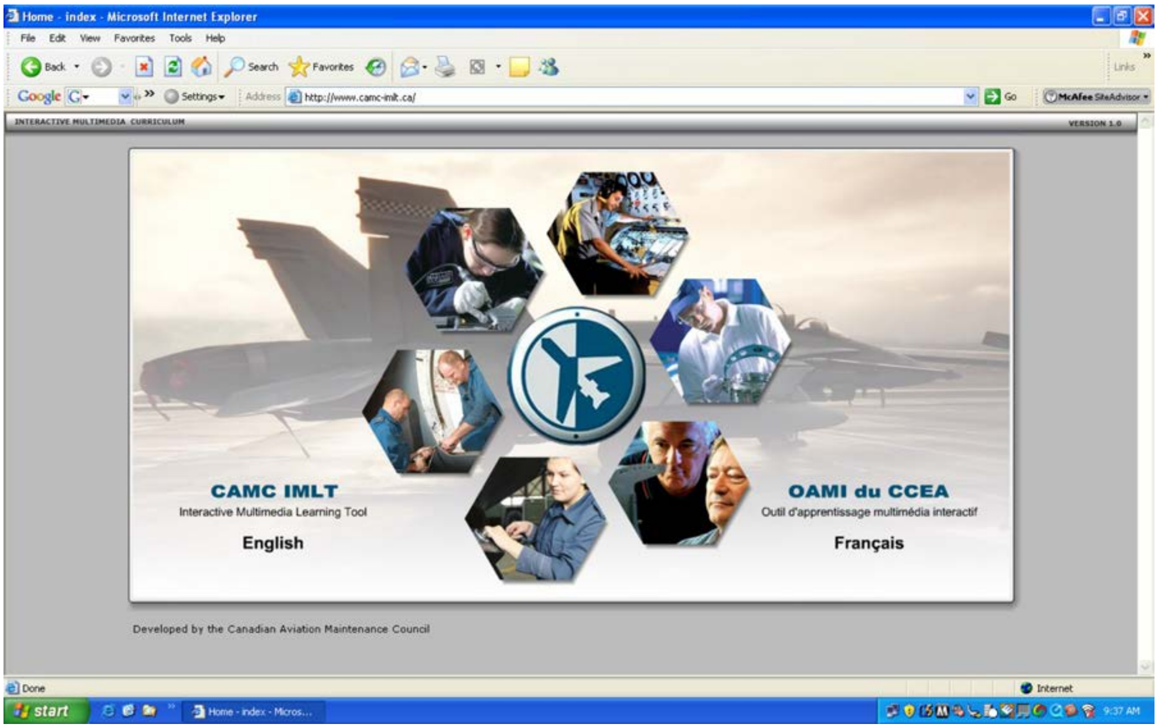
THIS PAGE INTENTIONALLY LEFT BLANK

IMLT USER'S GUIDE

The following steps must be completed in order to log-in to the IMLT curriculum.

STEP ONE

Go to the IMLT Website at http://www.camc-imlt.ca/ and click on "English" or "French".

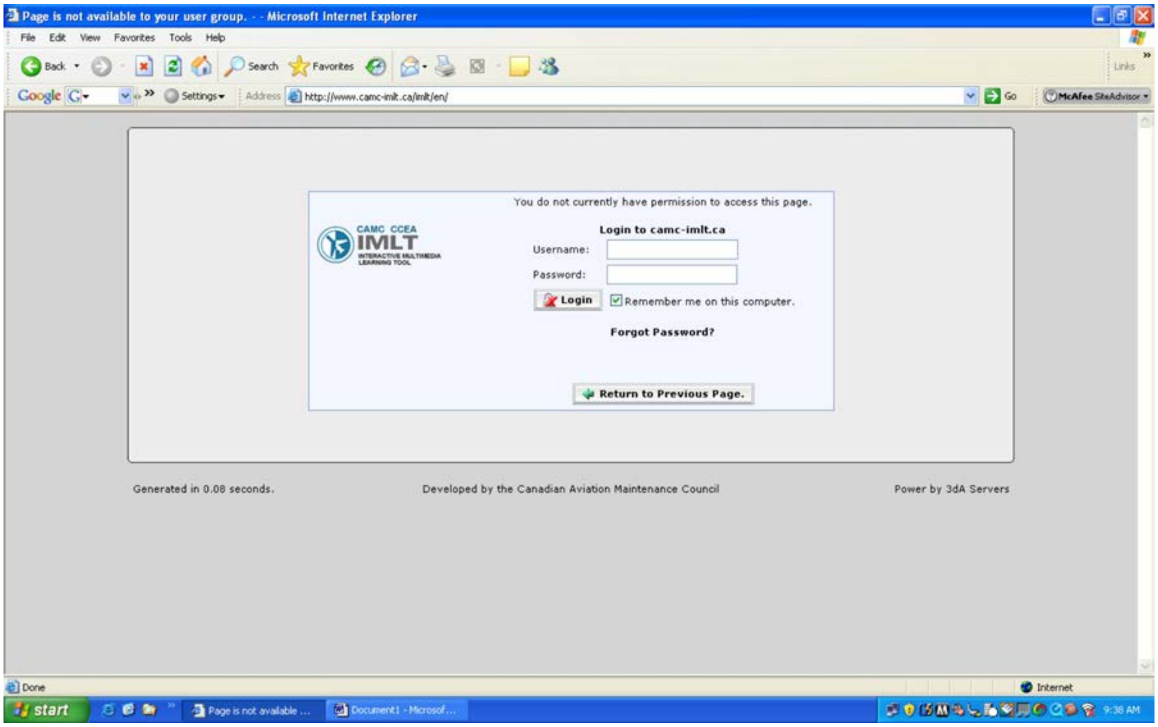


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure A-1 Home Index

STEP TWO

Enter the username and password (provided by the instructor) and then click enter.

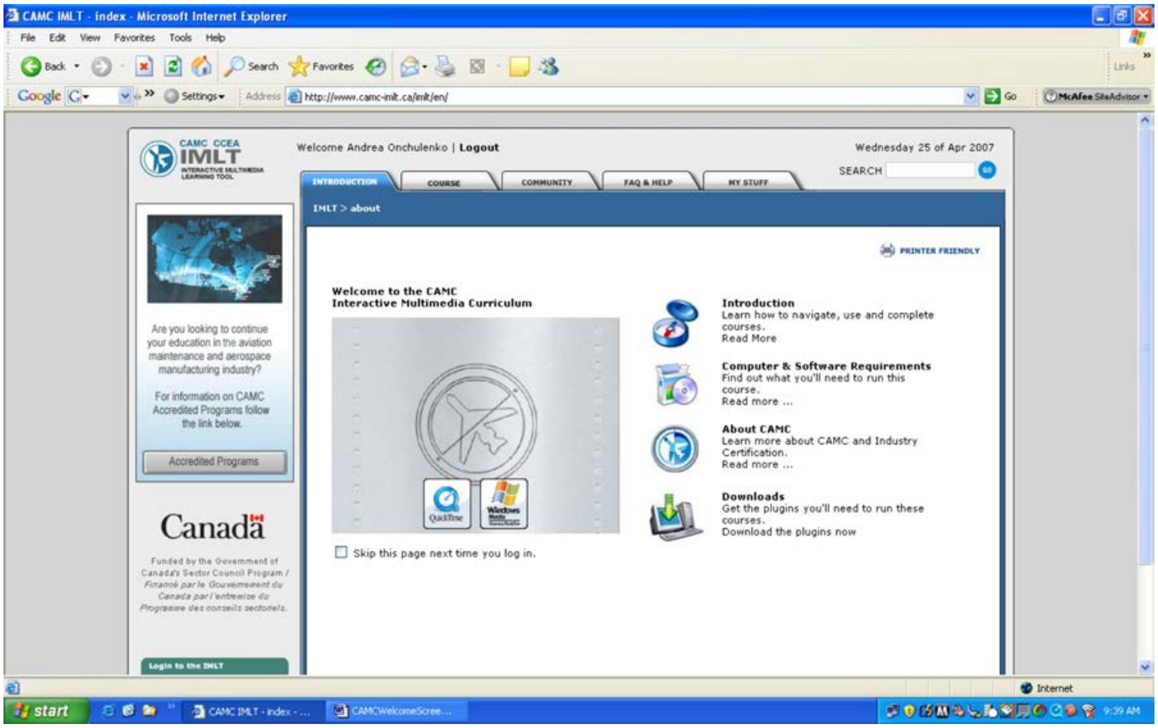


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure A-2 Log-in

STEP THREE

Select the course by clicking on the tab at the top of the welcome page.

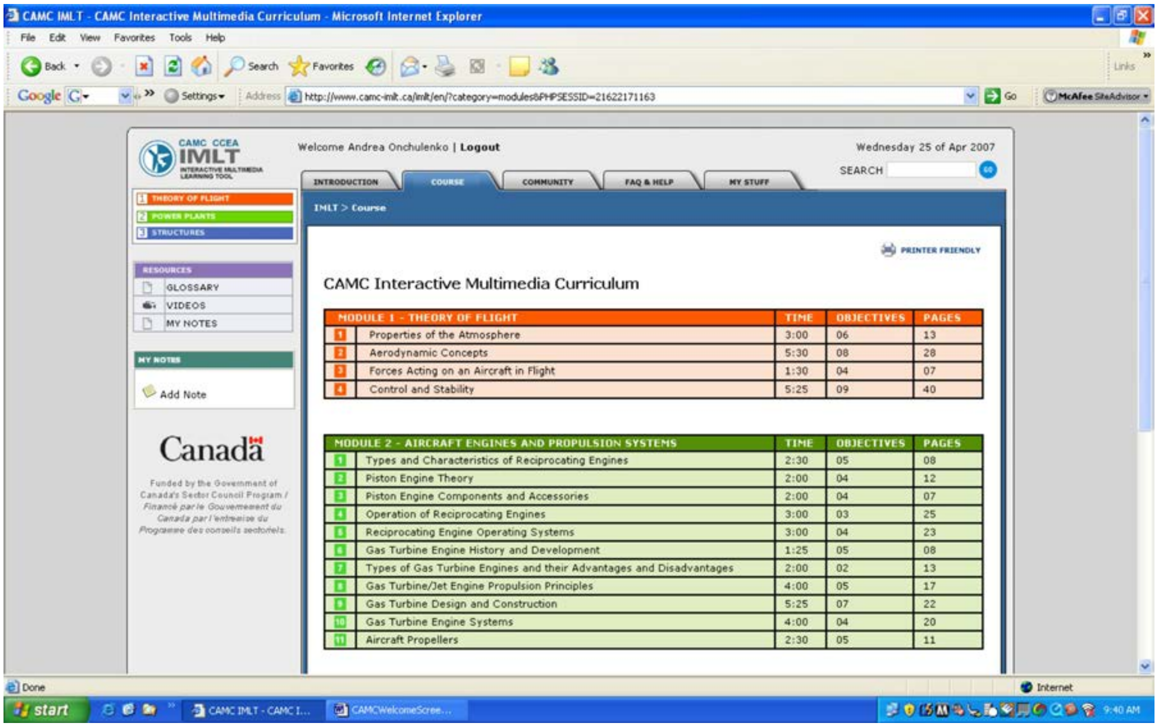


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure A-3 Introduction

STEP FOUR

Select the module that you wish to complete by clicking on the title.

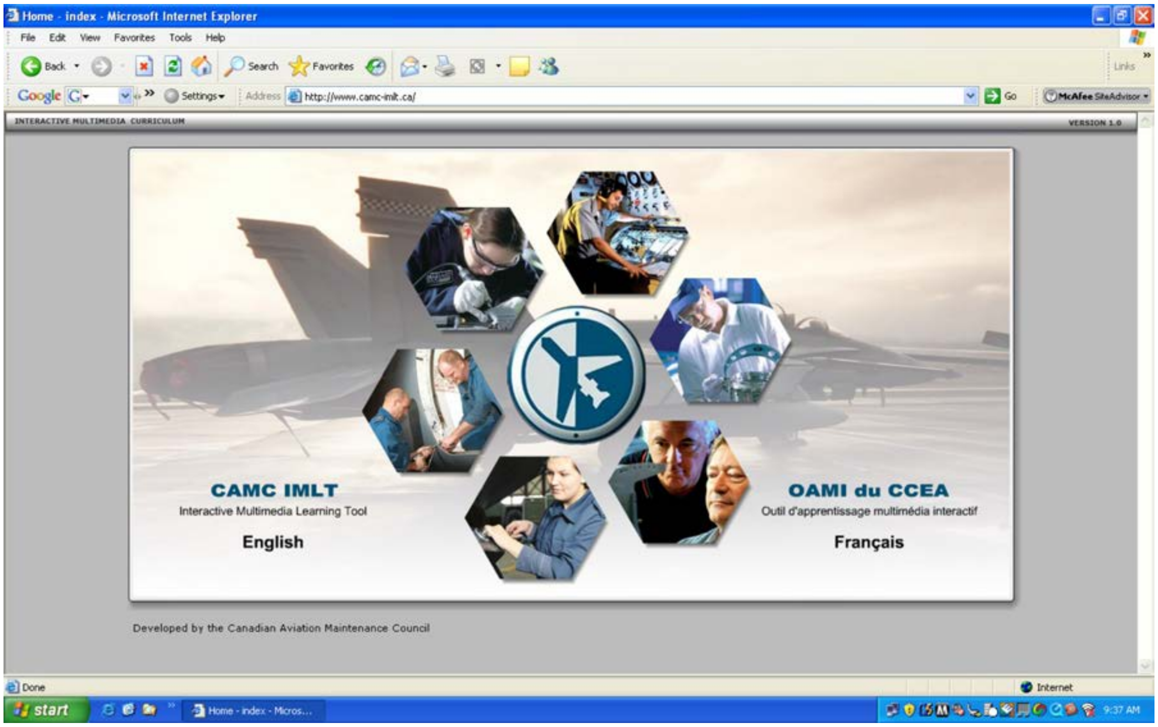


"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure A-4 Course Curriculum

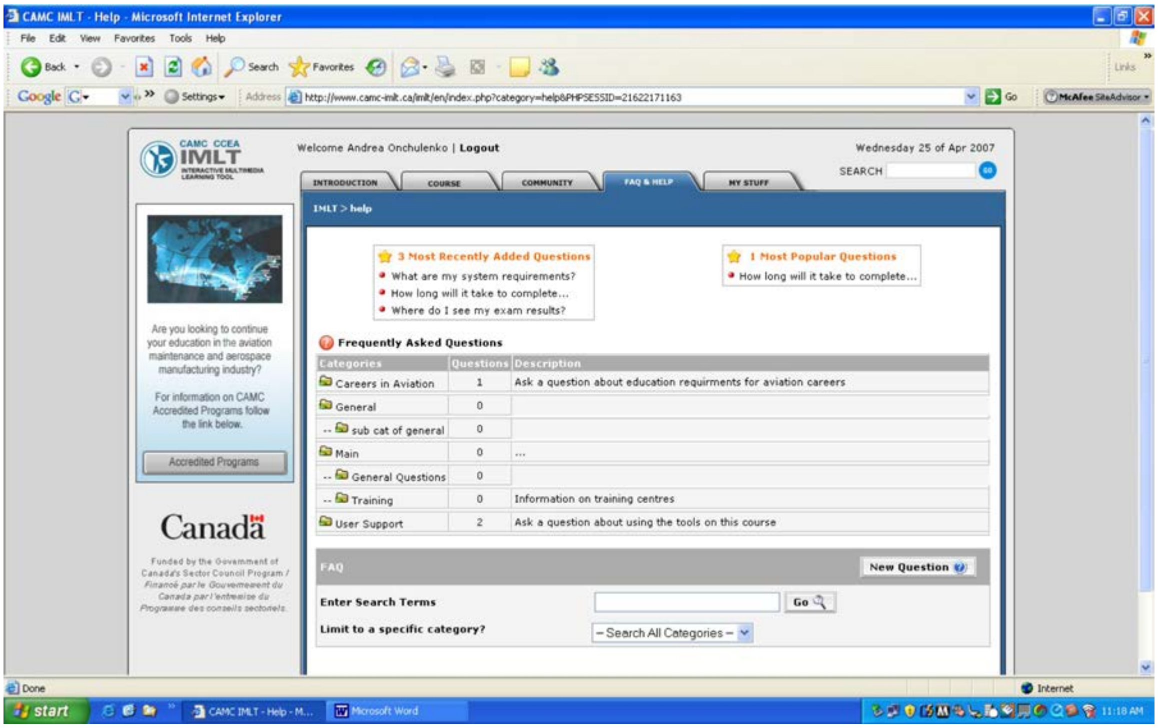
INTERACTIVE MEDIA LEARNING TOOL WELCOMING SCREENS

IMLT Sample Module Screen Shots



"CAMC", IMLT, Home Index. Retrieved 23 April 2007, from www.camc-imlt.ca

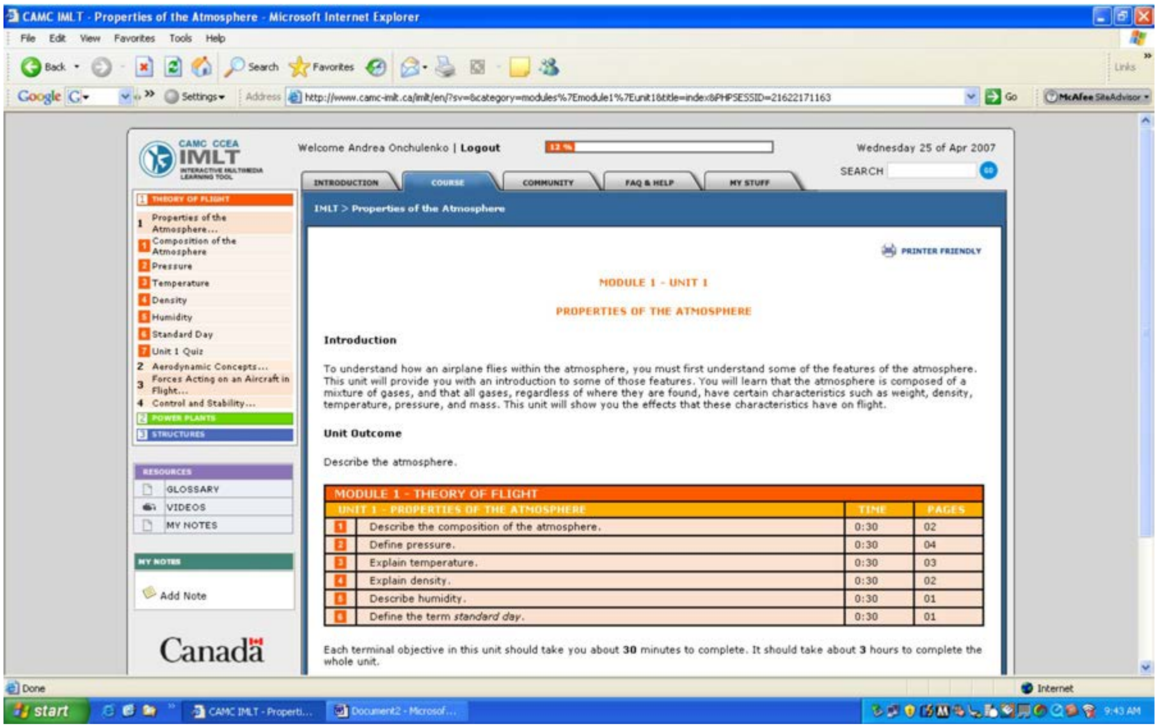
Figure B-1 Home Index



"CAMC", IMLT, FAQ and Help. Retrieved 23 April 2007, from www.camc-imlt.ca

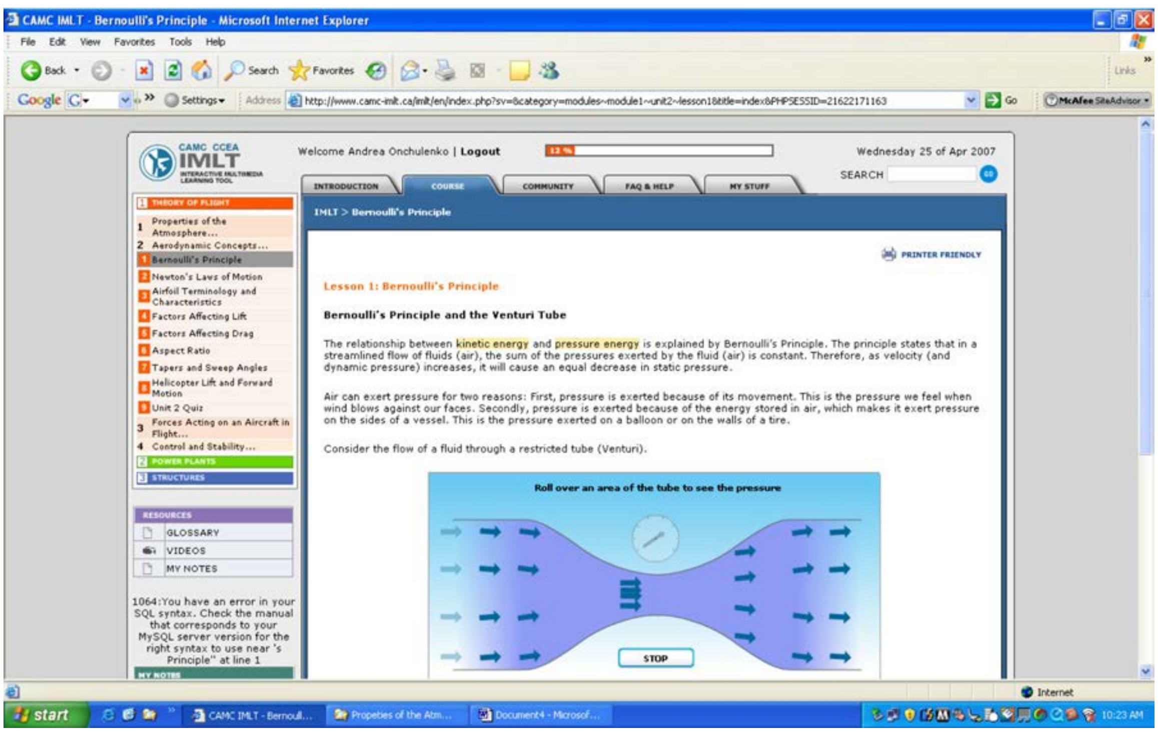
Figure B-2 FAQ and Help

THEORY OF FLIGHT



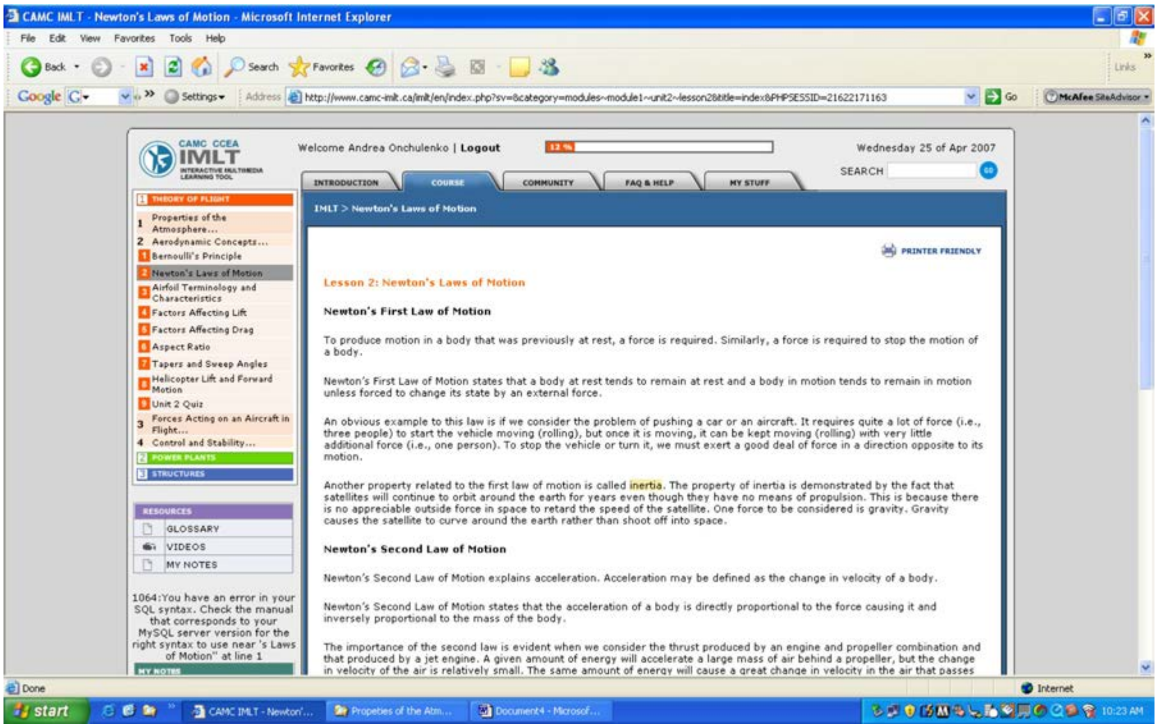
"CAMC", IMLT, Property of the Atmosphere. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-3 Theory of Flight: Property of the Atmosphere



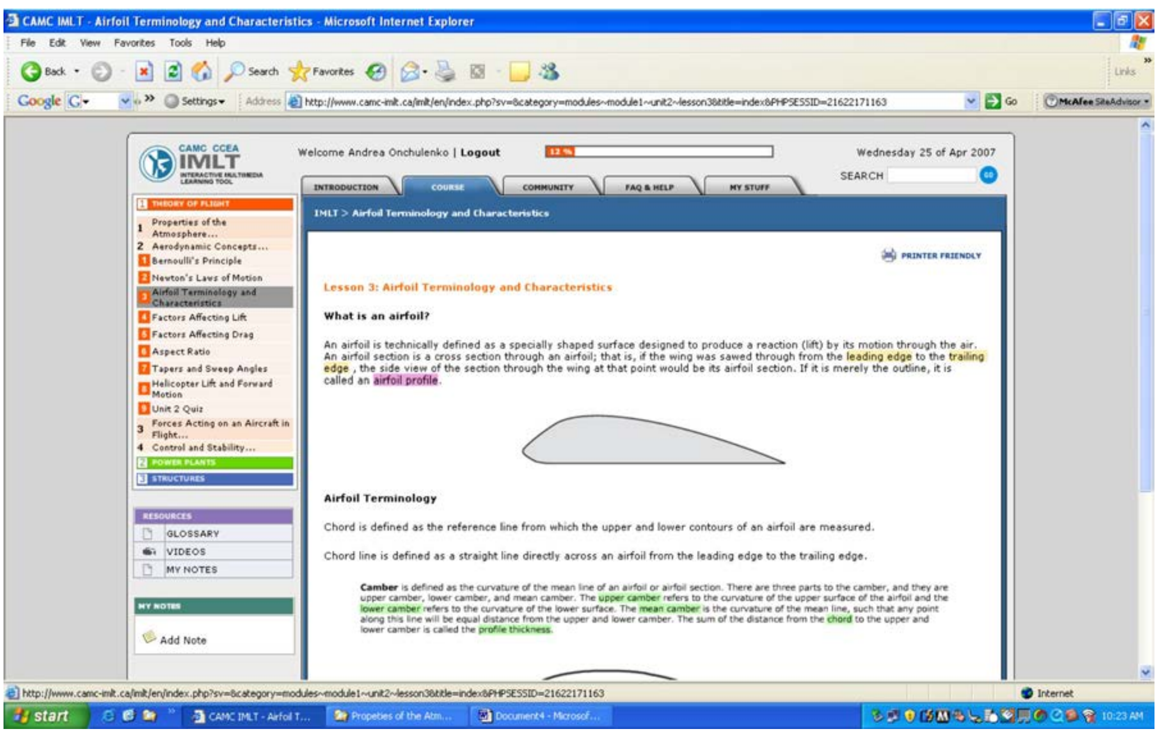
"CAMC", IMLT, Bernoulli's Principle. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-4 Theory of Flight: Bernoulli's Principle



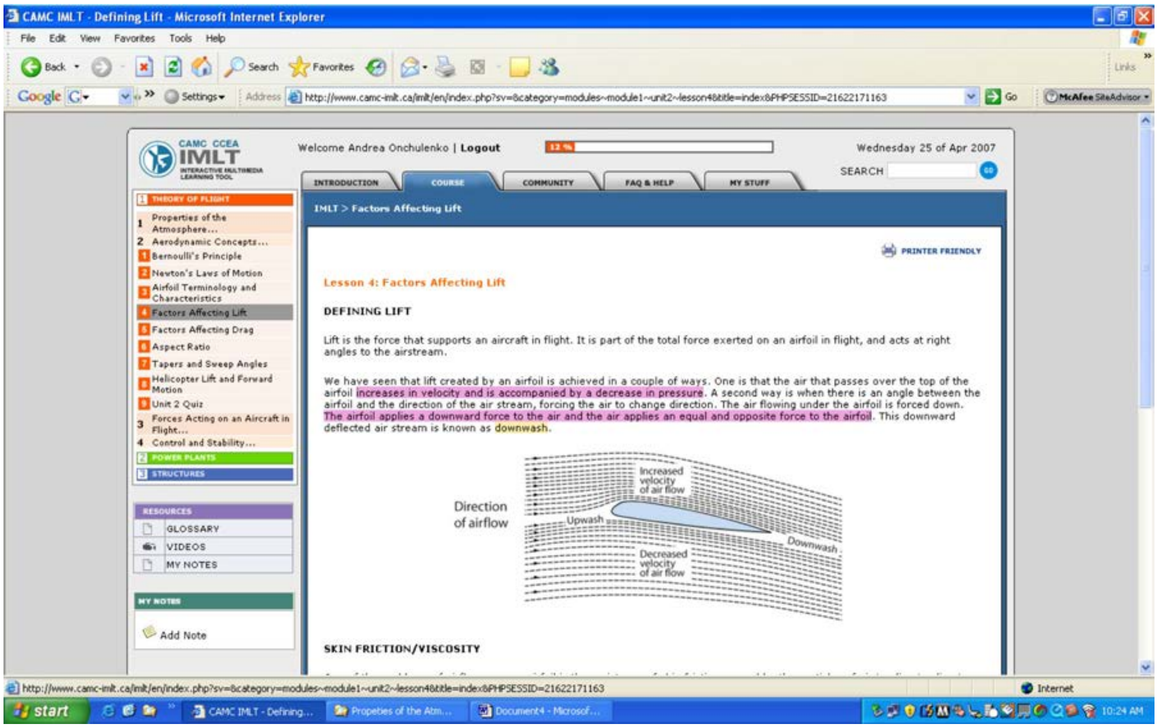
"CAMC", IMLT, Newton's Law of Motion. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-5 Theory of Flight: Newton's Laws of Motion



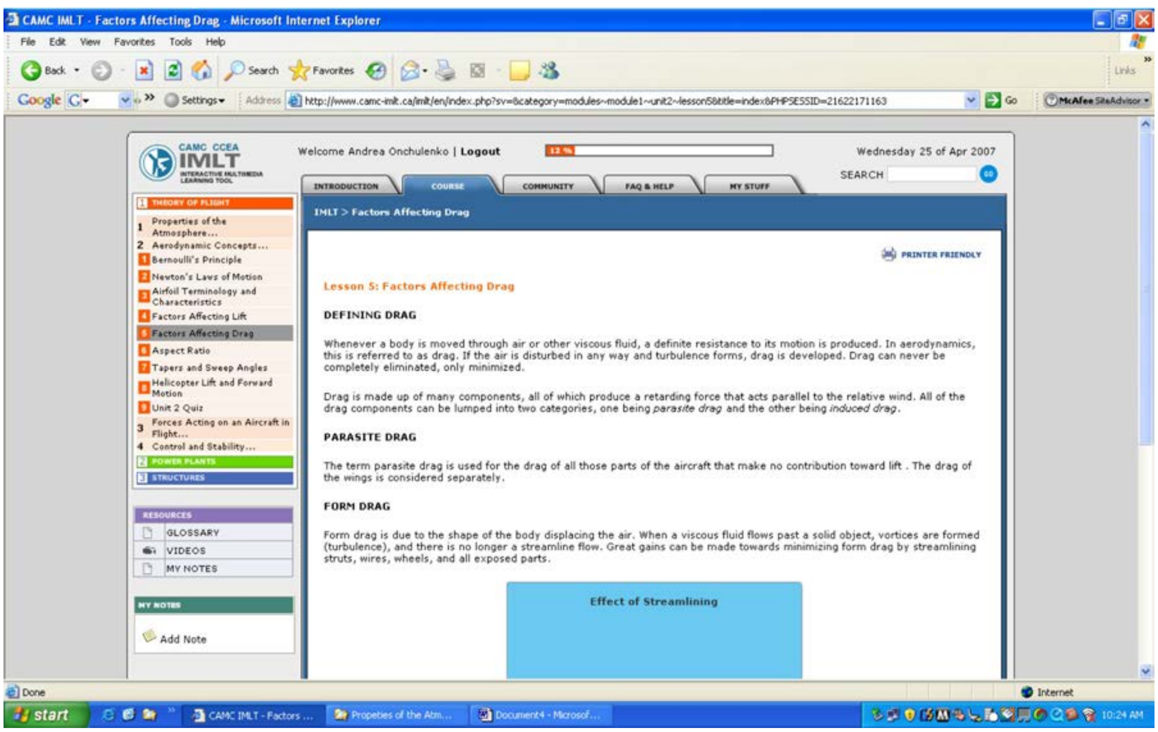
"CAMC", IMLT, Airfoil Terminology and Characteristics. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-6 Theory of Flight: Airfoil Terminology and Characteristics



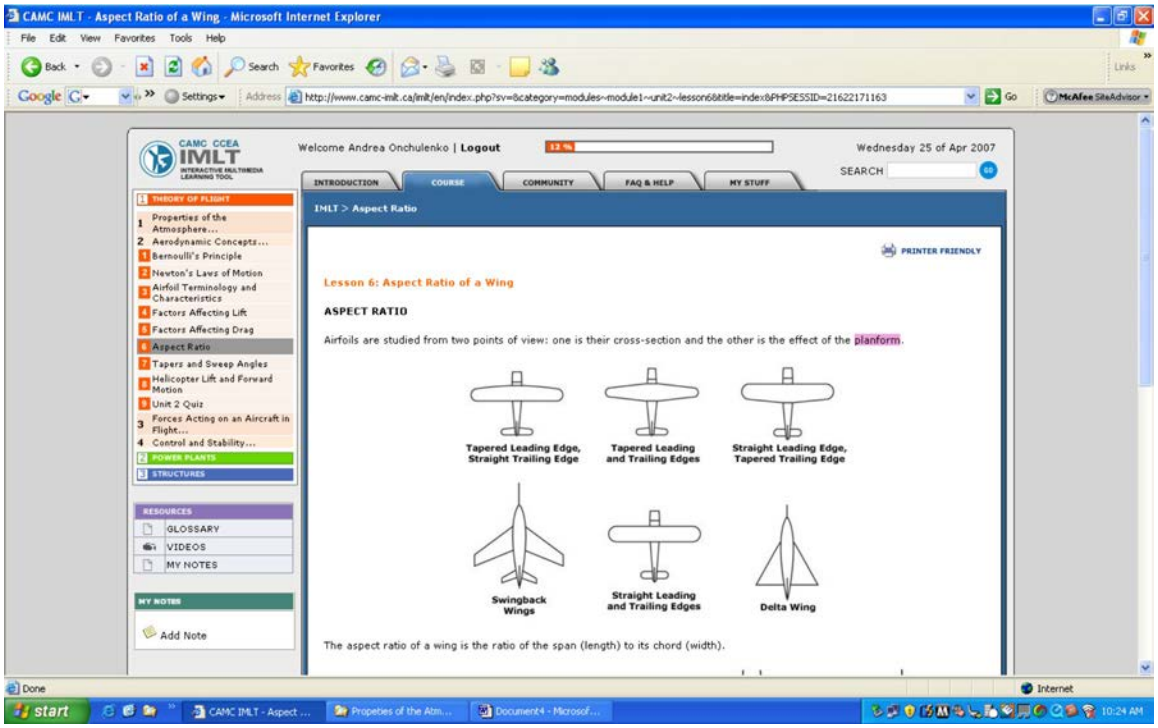
"CAMC", IMLT, Factors Affecting Lift. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-7 Home Index Theory of Flight: Factors Affecting Lift



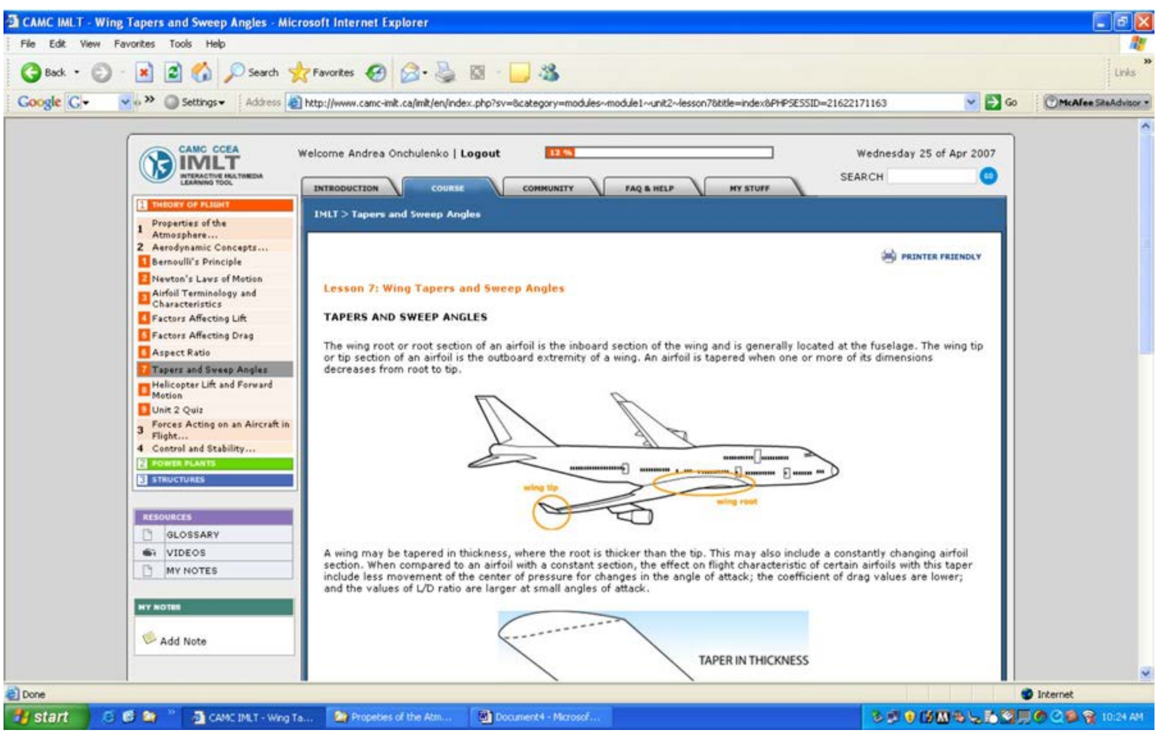
"CAMC", IMLT, Factors Affecting Drag. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-8 Theory of Flight: Factors Affecting Drag



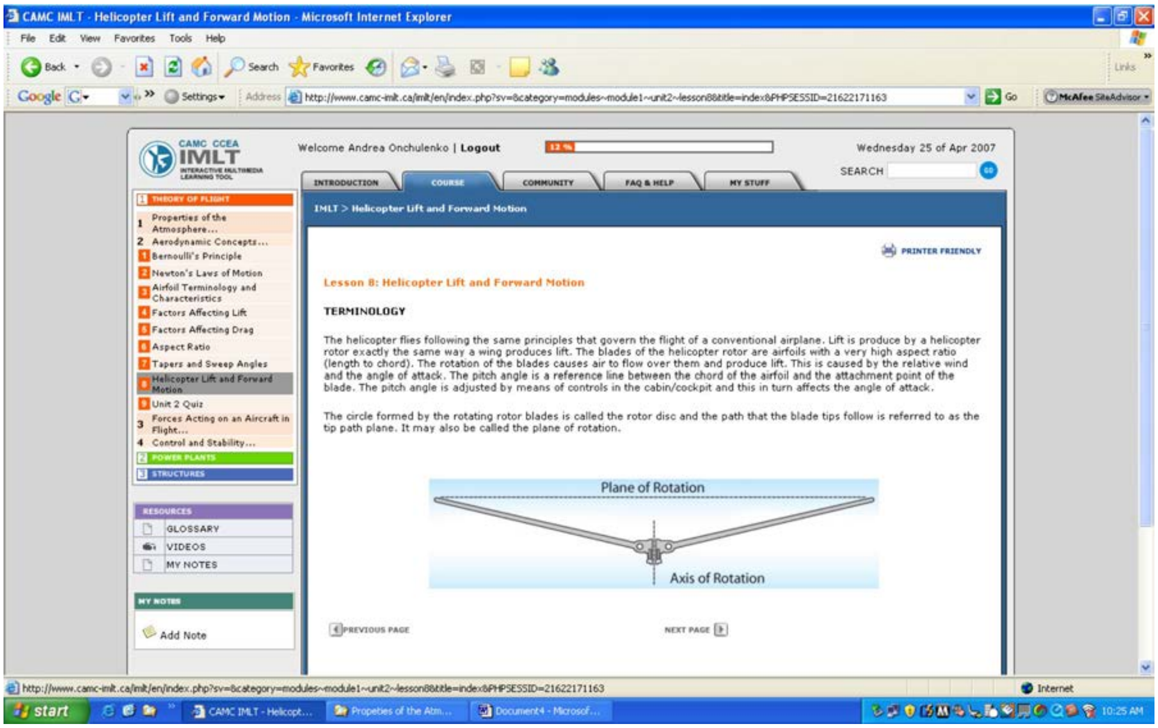
"CAMC", IMLT, Aspect Ratio of a Wing. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-9 Theory of Flight: Aspect Ratio of a Wing



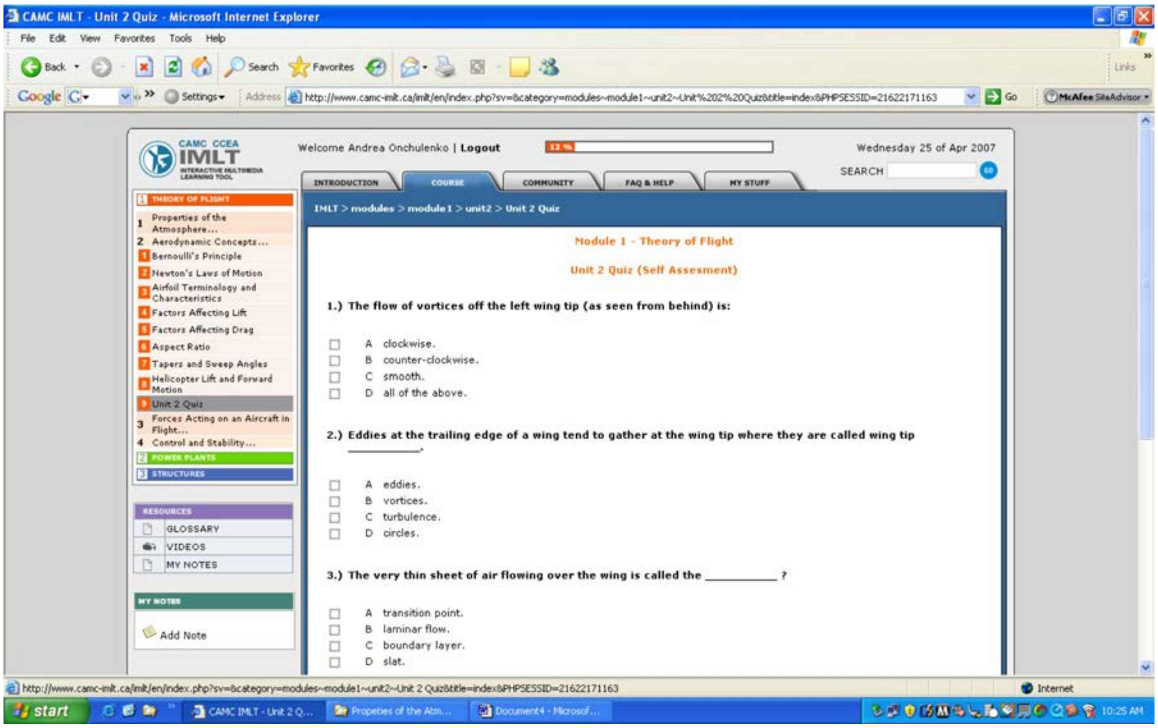
"CAMC", IMLT, Wing Tapers and Sweep Angles. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-10 Theory of Flight: Wing Tapers and Sweep Angles



"CAMC", IMLT, Helicopter Lift and Forward. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-11 Theory of Flight: Helicopter Lift and Forward Motion



"CAMC", IMLT, Quiz. Retrieved 23 April 2007, from www.camc-imlt.ca

Figure B-12 Theory of Flight: Quiz (Self Assessment)

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 5

EO C270.04 – WATCH WORLD'S BIGGEST AIRLINER: THE AIRBUS A380 – COMING TOGETHER

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Copy the handout located at Annex A for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An in-class activity was chosen for TP1 as it is an interactive way to provoke thought and stimulate an interest among cadets.

A group discussion was chosen for TP2 as it allows the cadet to interact with their peers and share their knowledge, experience, opinions and feelings about aircraft manufacturing.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have watched the *World's Biggest Airliner: The Airbus A380*, participated in a discussion on aircraft assembly and to stimulate an interest in the aircraft manufacturing industry.

IMPORTANCE

It is important for cadets to develop an interest in how aircraft are manufactured because this lesson will lead to future summer training opportunities in aircraft manufacturing and maintenance. This EO will assist in stimulating an interest in aircraft manufacturing and maintenance in the Air Cadet Program.

Teaching Point 1	**Watch and Discuss the *World's Biggest Airliner: The Airbus A380 – Coming Together***
Time: 45 min	Method: In-Class Activity

The *World's Biggest Airliner: The Airbus A380* is a three-part DVD series. The cadet is required to watch the second DVD of the three-part series in order to complete this EO.

The following is a summary of the scenes included in this DVD. Do not stop the DVD to review each scene.

Scene: Toulouse, France. The process of assembling the major components of this aircraft is five weeks. The fuselage is assembled and the wing is attached to the fuselage.

Scene: Guided Tour. The tour takes place at the Airbus headquarters in France and takes the viewer through a realistic mock-up of the interior of the Airbus A380. There is also a focus on the horizontal tail plane and the materials used to construct it. The landing gear installation and testing is addressed. The landing gear is tested at the Goodrich Corporation outside of Toronto in Oakville, Ontario.

Scene: First Fully Assembled A380. The Airbus A380 leaves the main assembly station, where it is moved to another hangar and prepared for its unveiling. The fly-by-wire technology used in the aircraft and how it performs when the pilot manipulates the controls is mentioned. The vertical tail plane and new camera technology are installed in the fin. The viewer observes the performance of the aircraft in a flight simulator as it is taken through a worst-case scenario test.

Scene: Another Test Engine. The new Trent 900 engine custom made for the Airbus A380 is tested. The outcome of turbine fan blade failure is tested.

Scene: The Airbus A380 Goes Public. The Airbus A380 is unveiled to the stakeholders and heads of state involved in the construction of the aircraft.

ACTIVITY

OBJECTIVE

The objective of this activity is to familiarize the cadet with the aircraft manufacturing industry by presenting this DVD to develop an interest and understanding of the many occupations involved in designing and manufacturing an aircraft.

RESOURCES

- *World's Biggest Airliner: The Airbus A380* (second DVD of the series),
- TV, and
- DVD player.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Provide each cadet with a copy of the handout located at Annex A to be completed as they watch the DVD.
2. Watch the DVD.
3. After viewing the DVD confirm the correct answers to the handout located at Annex A.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 1

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

Teaching Point 2	Conduct a Group Discussion on the *World's Biggest Airliner*
Time: 10 min	Method: Group Discussion

BACKGROUND KNOWLEDGE

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Ask questions that help facilitate discussion; in other words, avoid questions with yes or no answers.
- Prepare question ahead of time.
- Be flexible (you are not bound to only the prepared questions).
- Encourage cadets to participate by using praise such as "great idea" or "excellent response, can anyone add to that?"
- Try to involve everyone by directing questions to non-participants.

SUGGESTED QUESTIONS

Q1. How did this DVD help you to understand more about how an aircraft is assembled?

Q2. What did you like most about this segment of the Airbus A380?

Q3. What careers interested you in this DVD and why?

Other questions and answers will develop throughout the discussion stage. The discussion should not be limited to only those suggested.

SAFETY

N/A.

END OF LESSON CONFIRMATION

The cadets' participation in the group discussion will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Watching the *World's Biggest Airliner: Airbus A380* will develop the cadets' interest in how aircraft are manufactured and introduce the cadet to future summer training opportunities in aircraft manufacturing and maintenance. The knowledge gained in this lesson will assist in stimulating an interest in the aircraft manufacturing and maintenance field in the Air Cadet Program.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

C3-105 Brisley, T. Pascaud, S. (Executive Producer), and Bowie, B. (Writer/Director), (2003). *World's Biggest Airliner: The Airbus A380* [Motion Picture]. United States: The Learning Channel.

WORLD'S BIGGEST AIRLINER: AIRBUS A380 HANDOUT

Q1. WHAT ARE SOME OF THE CHARACTERISTICS OF THE AIRBUS A380?

____

____

____

____

____

Q2. WHAT WERE THE TWO MAJOR COMPONENTS TESTED?

1. ______________________________

2. ______________________________

Q3. THE ____________________ IS THE MANUFACTURER OF THE LANDING GEAR FOR THE AIRBUS A380 AND THEY ARE LOCATED IN __________________.

Q4. ____________________ IS THE MANUFACTURER OF THE TURBINE ENGINE FOR THE AIRBUS A380.

Q5. WHAT WERE SOME OF THE MATERIALS USED IN THE CONSTRUCTION OF THIS AIRCRAFT?

1. ______________________________

2. ______________________________

Q6. NAME A PROFESSION MENTIONED THAT CONTRIBUTED TO THE MANUFACTURING OF THE AIRCRAFT.

____

____

THIS PAGE INTENTIONALLY LEFT BLANK

WORLD'S BIGGEST AIRLINER: AIRBUS A380 ANSWER KEY

A1. The characteristics of the Airbus A380 are:

- It is a 555 seat double-decker aircraft (It has the capacity to hold just over 800 seats if they were all economy class).
- It can fly non-stop one-third around the globe.
- It uses state-of-the-art methods and materials for its construction.
- It was the largest airliner ever built at the time of it's unveiling.

A2. The two major components tested?

(1) the landing gear, and

(2) the engine.

A3. The Goodrich Corporation is the manufacturer of the landing gear for the Airbus A380 and they are located outside of Toronto in Oakville, Ontario.

A4. Rolls-Royce is the manufacturer of the turbine engine for the Airbus A380.

A5. Some of the materials used in the construction of this aircraft are:

(1) titanium, and

(2) carbon fibre.

A6. The professions mentioned that contributed to the manufacturing of the Airbus A380 are:

- structural assembler – operation leader,
- senior test engineer (landing gear),
- head of fan engineer (engine),
- vertical tail plane engineer,
- head of equipping,
- chief flight test pilot, and
- flight test pilot director.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 17

PO 290 – PARTICIPATE IN A FIELD EXERCISE

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 1

EO M290.01 – CONSTRUCT, LIGHT, MAINTAIN, AND EXTINGUISH A SIGNAL FIRE

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 and TP2 to present basic material and give direction on emergency signal fires.

Demonstration and performance was chosen for TP3 and TP4 as it allows the instructor to explain and demonstrate preparing a signal fire while providing an opportunity for the cadets to practice this skill under supervision.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to construct a luminous cone fire, apply fire safety principles and to light, maintain, and extinguish a signal fire.

IMPORTANCE

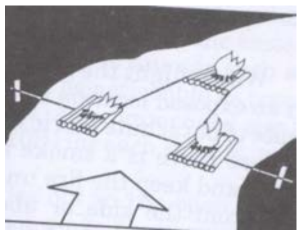
It is important for cadets to safely construct, light, maintain, and extinguish a signal fire. Signal fires will alert rescuers to your location if lost or injured.

Teaching Point 1	**Determine Types of Emergency Signal Fires**
Time: 5 min	Method: Interactive Lecture

EMERGENCY SIGNAL FIRES

Three Fire Triangle Pattern

- Three fires is the internationally recognized distress signal. Ideally they should be placed in a triangle at equal distances apart, an arrangement which also makes them easier to feed with fuel. If that is not possible, any grouping will serve, provided that the fires are clearly separated. However, if fuel is scarce, or if you are too badly injured or too weak from hunger to maintain several fires, use only your campfire.



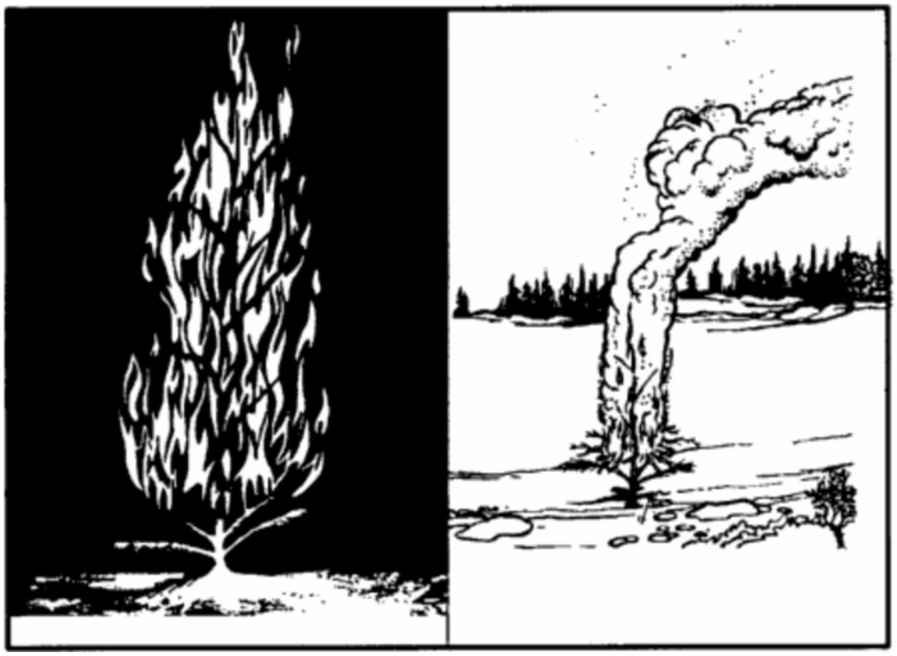
Wiseman, J., The SAS Survival Handbook, HarperCollins Publishers (p. 505)

Figure 1 Three Fire Triangle Pattern

A Torch Tree

- Small isolated trees make excellent fire signals. Build a fire between the boughs. Place dry wood in the lower branches and ignite it so that the flames flare up and ignite the foliage. Before the primary tree is consumed, cut and add more small green trees to the fire to produce more smoke. If a tree is dead, start a fire at its base. It will burn for a long time, leaving you free to attend to other signals.

> Always select an isolated tree so that you do not start a forest fire and endanger yourself or others.



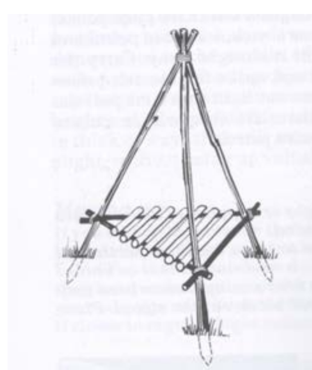
"Signalling Techniques", Wilderness Survival. Copyright 2007 by Jalic Inc.
Retrieved 12 March 2007, from http://www.wilderness-survival.net/chpt19.php

Figure 2 A Torch Tree

A Luminous Cone Fire

- On a clear and open site, make a tripod with a platform to support a fire. The platform keeps the tinder off damp ground and you can store more firewood beneath it. Use a covering of evergreen boughs to keep the cone dry; they will burn brightly and give off good smoke. Cover the complete cone with brightly coloured material when the fire is not lit. This will not only keep the fire dry and ready to burn, but the material itself will be noticeable during the day, the material itself my attract attention. Take off the bright coloured material when you ignite the fire.

Keep these tripods well maintained, ensuring that wood is dry enough to light at a moment's notice and that the supply is not poached for other uses. Drive the pole ends into the ground to prevent tipping over in strong winds.



Wiseman, J., The SAS Survival Handbook, HarperCollins Publishers (p. 506)

Figure 3 A Luminous Cone Fire

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Name three types of emergency signal fires.

Q2. What is a consideration when building a torch tree signal fire?

Q3. What is the internationally recognized distress signal?

ANTICIPATED ANSWERS

A1. A three fire triangle pattern, a torch tree, and a luminous cone fire.

A2. Always select an isolated tree so that you do not start a forest fire and endanger yourself and others.

A3. Three fires.

Teaching Point 2	Identify a Location To Be Seen From the Air
Time: 5 min	Method: Interactive Lecture

LOCATIONS FOR A SIGNAL FIRE WHICH CAN BE SEEN FROM THE AIR

Elevated Ground. Choose the highest points of terrain for light signals.

Highly Visible. Find a natural clearing or edge of a stream where you can build fires that the foliage will not hide.

Fuel Source

- Being in an area where there are readily available fuel sources for the signal fire would be highly beneficial.
- Some examples of fuel sources include:
    - dry, standing wood, and dry, dead branches;
    - dry inside (heart) of fallen tree trunks and branches;
    - green wood that is finely split;
    - dry grasses twisted into bunches;
    - peat dry enough to burn;
    - dried animal dung;
    - animal fats;
    - coal, oil shale, or oil laying on the surface; and
    - rubber, plastic or heavy oil to produce thick black smoke.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. Is high terrain or low terrain best for choosing a location for a signal fire?

Q2. What is a highly visible location?

Q3. What are some examples of fuel sources?

ANTICIPATED ANSWERS

A1. The highest point of terrain is the best location.

A2. A natural clearing or edge of a stream.

A3. Dry, standing wood, and dry, dead branches; dry inside (heart) of fallen tree trunks and branches; green wood that is finely split; dry grasses twisted into bunches; peat dry enough to burn; dried animal dung; coal, oil shale, or oil laying on the surface; and rubber, plastic or heavy oil to produce thick black smoke.

Teaching Point 3	**Demonstrate and Have Cadets Collect Combustible Materials and Construct a Luminous Cone Signal Fire**
Time: 20 min	Method: Demonstration and Performance

COMBUSTIBLE MATERIALS

Examples of combustible materials include birch bark, dry grass, fine wood shavings, bird down, waxed paper and cotton fluff from clothing.

The instructor shall construct a luminous cone fire previous to the cadets' arrival for demonstration purposes.

PREPARING TO BUILD A FIRE

1. **Selecting and Preparing Tinder**
   (a) Tinder is any kind of material that a minimum amount of heat will ignite.
   (b) Good tinder needs only a spark to set it ablaze.
   (c) Birch bark, dry grass, fine wood shavings, bird down, waxed paper and cotton fluff from clothing all make good tinder.
   (d) Tinder must be dry.
   (e) It is a good idea to carry tinder in a waterproof container.
2. **Selecting and Preparing Kindling**
   (a) Kindling is the wood used to raise flames from the tinder so larger, less combustible materials can be burned.
   (b) The best kindling consists of small, dry twigs and small pieces of soft wood.
   (c) Kindling should not be collected straight from the earth because it is usually damp. It should be gathered from standing deadwood.
3. **Selecting and Preparing Fuel**
   (a) Fuel is anything that will burn in the fire.

(b) Dry wood from standing trees should be used to get fires going.

(c) Once the fire is established, greener and damp wood may be used.

(d) Hardwoods include hickory, beech, maple and oak. These hardwoods burn well, give off heat, and last a long time as coals.

(e) The fire can be maintained for a long period of time using hardwoods.

(f) Softwoods burn very quickly and give off sparks. They can be used when lighting the fire.

(g) Softwoods include cedar, alder, hemlock, spruce, pine, chestnut and willow.

(h) After the fire is burning steadily, fuel that is three to four times the size of the kindling can be added.

ACTIVITY

Time: 15 min

OBJECTIVE

The objective of this activity is to have cadets build a luminous cone fire in groups of no more than 15.

RESOURCES

- String,
- Wood,
- Boughs,
- Tinder, and
- Kindling.

ACTIVITY LAYOUT

The area must be previously selected and the appropriate authorities must be notified. The area should be in an open space where there is no chance of spreading the fire to other trees or flammable sources.

ACTIVITY INSTRUCTIONS

Working as a member of a group of no more than 15, the cadets shall gather wood, green boughs (if available), tinder, and kindling to build the luminous cone fire. Each group shall construct a luminous cone fire according to the following steps:

1. Make a tripod to support a fire.
2. Using the string, lash the top of the tripod together and the side supports together.
3. Ensure pole ends are driven into the ground to prevent tipping.
4. Make a platform to hold the tinder, kindling and fuel.
5. Place tinder and kindling in the centre of the platform.
6. Ensure tinder and kindling are placed together in a fashion that will ignite the cone.
7. Ensure there is sufficient ventilation allowing oxygen to feed the fire when lit.
8. A fire will suffocate if there is too much fuel.

9. Cover with green boughs (if available) to keep the cone dry.

10. Ensure there is a heat and smoke outlet at the top of the cone.

The instructor will ensure that all the cadets in the group participate in the activity. The questions in the confirmation of TP3 should be asked as the instructor moves from one group to the next.

SAFETY

Cadets will be supervised during the construction of the luminous cone fire.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What holds the tinder and kindling in the centre of the tripod?

Q2. What do you use to keep the cone dry?

Q3. What prevents the tripod from tipping?

ANTICIPATED ANSWERS

A1. A platform.

A2. Green boughs.

A3. Ensure pole ends are driven into the ground to prevent tipping.

Teaching Point 4 **Explain, Demonstrate, and Have the Cadets Practice Lighting, Maintaining, and Extinguishing One Signal Fire**

Time: 20 min Method: Demonstration and Performance

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets practice lighting, maintaining and extinguishing one signal fire.

RESOURCES

- String,
- Matches,
- Wood/kindling/tinder,
- Water,
- Fire extinguishing equipment, and
- Shovel.

ACTIVITY LAYOUT

Provide each group of cadets with a match to light the signal fire.

ACTIVITY INSTRUCTIONS

The instructor will review lighting a fire, maintaining a fire and extinguishing a fire.

LIGHTING A FIRE

1. **Lighting Using a Match**
   (a) Matches are the easiest way to start a fire.
   (b) They produce a flame instantly when struck against a striking pad.
   (c) The biggest problem with matches is that in windy or wet conditions they may not be useful.
   (d) They will not ignite if the striking pad becomes wet or worn.
   (e) The matches should be packed in waterproof containers so that they cannot rub or rattle together and accidentally ignite.
   (f) Waterproof matches are the most effective kind to include in a survival kit.

MAINTAINING AND EXTINGUISHING A FIRE

1. **Maintaining a Fire**
   (a) A fire should never be left unattended.
   (b) It takes only seconds for a fire to begin burning out of control.
   (c) Immediately after a fire has been started, it requires a modest amount of wood to build up heat.
   (d) The fire requires very little wood to keep it burning once a good amount of wood is built up.
   (e) Too much wood should not be put on the fire at once as it may smother the fire.
   (f) Suitably sized wood should only be put on the fire (e.g. less than 45 cm).
   (g) The fire must have proper ventilation so that oxygen may feed the fire.
   (h) A fire is only to be built to a controllable size.

2. **Extinguish a Fire**
   (a) Water is the easiest way to put out a fire.
   (b) Water should be dumped on the fire until it results in no heat emanating from the centre.
   (c) All of the sparks are to be out prior to decamping. The fire is to be smothered completely with wet earth or sand.

SAFETY

Ensure all safety precautions are taken when the cadets are lighting, maintaining and extinguishing the fires.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What is fuel?

Q2. What is the purpose of kindling?

Q3. Name two of the methods of extinguishing a fire.

ANTICIPATED ANSWERS

A1. Fuel is anything that burns (wood, oil, animal fats, etc.).

A2. Kindling is the wood used to raise flames from the tinder so that larger, less combustible materials can be burned.

A3. The ways to extinguish a fire are with water, wet earth, or wet sand.

END OF LESSON CONFIRMATION

The cadets' participation in TPs 3 and 4 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Safety is a key concern when dealing with fire. Principles of fire safety must be applied before beginning the steps in lighting a fire. Knowing how to construct a signal fire in a survival situation is important as a signal fire will help attract help to the survival location.

INSTRUCTOR NOTES/REMARKS

- The instructor shall demonstrate lighting the first of the prepared signal fires.
- Additional supervision is required during the lighting of the signal fires. Fire safety equipment shall also be present.
- Appropriate authorities (e.g. local police, forestry service, and/or airport authority) shall be notified of the lighting of the signal fires to include: squadron contact name, squadron contact number, location including grid reference, estimated time of lighting, and the duration the fire is expected to be lit.

REFERENCES

C2-016 (ISBN 0-517-88783-5) Curtis, R. (1998). *The Backpacker's Field Manual: A Comprehensive Guide to Mastering Backcountry Skills.* New York, NY: Three Rivers Press.

C2-042 (ISBN 0-7566-0946-1) Berger, K. (2005). *Backpacking and Hiking.* New York, NY: DK Publishing, Inc.

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

C3-003 (ISBN 1-896713-00-9) Tawrell, P. (1996). *Camping and Wilderness Survival: The Ultimate Outdoors Book.* Green Valley, ON: Falcon Distribution.

C3-118 Wilderness Survival. (2007). *Signalling Techniques.* Retrieved 12 March 2007, from http://www.wilderness-survival.net/chpt19.php.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 2

EO M290.02 – CONSTRUCT A LEAN-TO-STYLE SHELTER

Total Time:	90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to present basic material and give direction on procedures for constructing a lean-to-style shelter.

Demonstration was chosen for TP2 as it allows the instructor to explain and demonstrate the skill the cadet is expected to acquire.

Performance was chosen for TP3 as it provides an opportunity for the cadets to practice building a lean-to-style shelter under supervision.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to have constructed a lean-to-style shelter.

IMPORTANCE

It is important for cadets to know how to construct a lean-to-style shelter as it can protect them from weather, animals and insects in a survival situation. Shelters can also provide warmth, shade and comfort.

Teaching Point 1 | **Explain the Importance of Site Selection**

Time: 20 min | Method: Interactive Lecture

SELECTING A SITE FOR CONSTRUCTION OF A LEAN-TO-STYLE SHELTER

- The site selection should begin before darkness, if possible.
- The shelter should be built near materials to build the shelter (trees, boughs) and fuel for the fire.

> Ensure cadets understand that although trees may offer protection, those with dead branches or on windswept fields may be dangerous. Check above and around the lean-to site for dead and standing trees or branches.

Land Considerations

- The area selected must be large enough to accommodate the planned shelter.
- The area selected should not be at the bottom of a hill.
- The area should be relatively flat with only a slight slope to allow for drainage.
- Dry river gullies, canyons and flood plains should be avoided.

Water Considerations

- The shelter should be built away from still water in order to avoid insects.
- The shelter should be built away from the source of drinking water.

Animal and Insect Considerations

- Avoid setting up a shelter where there are animal trails or water holes.
- Fast flowing streams will have fewer insects nearby than still water.
- Avoid areas infested with ants or bees.

Other Considerations

- There should be an area nearby to construct signals.
- The entrance of the shelter should face the sun to add warmth and increase morale.
- Very thick woods should be avoided as it will be hard to dry the shelter or fuel.
- Try to find a natural windbreak or a place that is away from strong wind currents.
- Avoid swampy terrain.
- A place for a fire should be located in front of the opening of the shelter.
- Be aware of the prevailing winds.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Name three land considerations when building a shelter.

Q2. Name three animal considerations when building a shelter.

Q3. Name three other considerations when building a shelter.

ANTICIPATED ANSWERS

A1. The area must be large enough for the planned shelter; the area should not be at the bottom of a hill; and it should be relatively flat with only a slight slope to allow for drainage.

A2. Avoid building shelters near animal trails or water holes; fast flowing streams will have fewer insects than still water; and areas infested with ants or bees should be avoided.

A3. There should be an area nearby to construct signals; the entrance should face the sun for warmth and morale; thick woods should be avoided as it will make drying difficult; look for a natural windbreak or place away from strong wind currents; avoid swampy terrain; and choose a place where a fire can be located in front of the opening of the shelter.

Teaching Point 2 — **Explain and Demonstrate the Procedure for Constructing a Lean-to-style Shelter**

Time: 20 min — Method: Demonstration

While in the field you must adhere to the policies in CATO 11-08, *Environmental Protection and Stewardship*.

The lean-to-style shelter that was previously constructed is for demonstration purposes and is to be shown to the cadets while providing an explanation of its construction.

The procedure for constructing the lean-to-style shelter are to include:

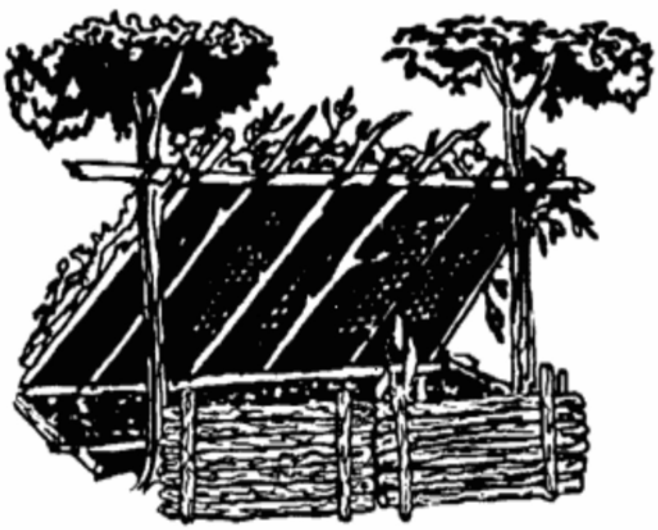
1. obtaining the appropriate supplies to include:
   (a) ground sheets,
   (b) knife,
   (c) shovel,
   (d) pegs,
   (e) rope/twine, and
   (f) natural materials.
2. tying and lashing cross-pieces and the vertical supports between the trees and ground;
3. checking each ground sheet for fatigue and holes;
4. tying each end of the ground sheet to the cross-pieces and supports, ensuring they are to waist height of the tallest person;
5. substituting the ground sheet for the boughs illustrated in Figure 1;

6. ensuring the ground sheet is pulled tight between the cross-pieces and supports and along the sides;
7. pulling the bottom of the ground sheet out and pegging each grommet to the ground; and
8. digging small trenches around the shelter to allow for effective drainage.

SAFETY

Review safe handling of a knife to include:

- always cut away from the body;
- do not let others stand too close to you;
- do not leave a knife unattended on the ground;
- sheath a knife when not in use; and
- never throw a knife for any reason.



"Shelters", Wilderness Survival. Copyright 2007 Jalic Inc. Retrieved 9 March 2007, from http://www.wilderness-survival.net/shelters-s.php

Figure 1 Lean-to-style Shelter

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What three items are required to build a shelter?

Q2. What is the purpose of digging small trenches around a shelter?

Q3. What is the purpose of the ground sheet and why is it pegged down?

ANTICIPATED ANSWERS

A1. Rope/twine, ground sheets, pegs, branches, sticks and leaves are required.

A2. The small trenches provide drainage.

A3. The ground sheet will keep the occupant dry and the pegs are to secure the ground sheet to the ground.

Teaching Point 3 **Construct a Lean-to-style Shelter**

Time: 40 min Method: Performance

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets, in groups of no more than four, construct a lean-to-style shelter.

RESOURCES

- Ground sheets,
- Rope/twine,
- Shovel,
- Items found in a natural setting, and
- Pegs.

ACTIVITY LAYOUT

Select an area that is large enough to construct the lean-to-style shelters.

ACTIVITY INSTRUCTIONS

Working as a member of a group of no more than four, the cadets shall choose a location for the lean-to-style shelter and gather sticks and branches that will be required to build the shelter. Each group shall make sure they have the necessary resources to complete a shelter. Each group shall construct a lean-to-style shelter following these steps:

1. Tie a cross-piece between two trees so that it is to waist height of the tallest person.
2. Lash the support pieces to the cross-piece.
3. Pull the ground sheet tight and tie it to the crosspiece and supports.
4. Pull the bottom of the ground sheet out and peg each grommet to the ground.
5. Dig small trenches for drainage around the lean-to-style shelter.

The questions in the confirmation of TP3 should be asked of the groups as the instructor moves from one group to the next.

SAFETY

Adequate supervision will ensure the cadets do not misuse the equipment.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Why was that location chosen to build the shelter?

Q2. How are the supports anchored?

Q3. What challenges were encountered while building the shelter?

ANTICIPATED ANSWERS

A1. It was built on a flat area, with a little slope; away from animal trails or water holes; away from still water; away from areas infested with ants and bees; having a natural wind break and facing the sun.

A2. They are lashed together between the cross-pieces and the ground.

A3. Answers will vary. Encourage the cadets to elaborate their responses.

END OF LESSON CONFIRMATION

The cadets' construction of a lean-to-style shelter will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important for the cadets to know how to construct a lean-to-style shelter in a survival situation. A shelter will help protect a person from weather, animals and insects. Shelters can also provide warmth, shade and comfort. The lean-to-style shelter provides an effective shelter for squadron survival exercises.

INSTRUCTOR NOTES/REMARKS

If lean-to-style shelters cannot be constructed, another style shelter (e.g. a bivouac tent, or a tarpaulin between trees) may be substituted.

The directives found in CATO 11-08, *Environmental Protection and Stewardship*, are to be followed during this lesson.

REFERENCES

A0-039 CATO 11-08 D Cdts 3. (1997). *Environmental Protection and Stewardship*. Vol. 1 General (pp. 1-11). Ottawa, ON: Department of National Defence.

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

C3-003 (ISBN 1-896713-00-9) Tawrell, P. (1996). *Camping and Wilderness Survival: The Ultimate Outdoors Book.* Green Valley, ON: Falcon Distribution.

C3-118 Wilderness Survival. (2007). *Shelters.* Retrieved 9 March 2007, from http://www.wilderness-survival.net/shelters-2.php.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 3

EO M290.03 – CONSTRUCT A SIMPLE SNARE

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Cut one 60 cm length of non-ferrous wire for each pair of cadets. Have spares on hand in case extras are needed.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

Demonstration was chosen for TP1 as it allows the instructor to explain and demonstrate the skill the cadet is expected to acquire.

Performance was chosen for TP2 as it is an interactive way to introduce cadets to constructing a simple snare.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to construct a simple snare.

IMPORTANCE

It is important for cadets to learn to construct a simple snare because in a survival situation the ability to catch food is essential. Consumption of protein will satisfy hunger and enable the cadet to ward off fatigue.

Teaching Point 1 | **Explain and Demonstrate the Procedure for Constructing a Simple Snare**

Time: 15 min | Method: Demonstration

Site selection is important when constructing a simple snare. The simple snare should be placed in an area frequented by small animals or near where they store their food. In all seasons, small animal tracks and their feces can be seen. These give a good indication of where small animals frequent or are travelling.

A simple snare may be made of brass wire, string, plant cordage, roots, horse hair, rawhide, dried animal guts, etc. The best material for constructing a simple snare is non-ferrous wire because it keeps its round shape and is easily twisted to make a loop through which the moving part of the wire will slide.

Ensure the instructor has practiced constructing a simple snare before demonstrating this procedure to cadets.

To construct a simple snare:

1. Using the non-ferrous wire, make a loop, fist width wide, and twist the end of the loop to ensure its stability while allowing the moving part to slide easily. (See Figure 1).
2. Set the loop vertically four fingers above the ground using twigs. Ensure the loop is a hand's width away from obstructions on either side of the path. (See Figure 1).
3. Anchor the remaining wire to a stake/tree/obstruction. (See Figure 1).

Wiseman, J., The SAS Survival Handbook, HarperCollins Publishers (p. 187)

Figure 1 A Simple Snare

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Where should a simple snare be placed?

Q2. Name three materials which can be used for constructing a simple snare?

Q3. What is the best material for constructing a simple snare?

ANTICIPATED ANSWERS

A1. The simple snare should be placed in an area frequented by small animals or near where they store their food.

A2. A simple snare may be made of brass wire, string, plant cordage, roots, horse hair, rawhide, dried animal guts, etc.

A3. The best material for a simple snare is non-ferrous wire because it keeps its round shape and is easily twisted to make a loop through which the moving part of the wire will slide.

Teaching Point 2	**Construct a Simple Snare**
Time: 35 min	Method: Performance

ACTIVITY

OBJECTIVE

The objective of this activity is for cadets to construct a simple snare.

RESOURCES

Non-ferrous wire 60 cm in length, one per group.

ACTIVITY LAYOUT

This activity must be conducted outdoors during daylight hours.

ACTIVITY INSTRUCTIONS

1. Divide cadets into groups of two.
2. Distribute one non-ferrous wire 60 cm in length to each group.
3. Instruct cadets to find an appropriate site to construct a simple snare.
4. Have cadets construct a simple snare.
5. Supervise and give feedback on the construction of simple snares.
6. After each group has finished constructing a simple snare, bring all groups back to one central location.
7. Have the entire group look at each simple snare if time permits.
8. Have cadets disassemble the simple snares and return materials to the instructor.

SAFETY

Adequate supervision will ensure cadets do not misuse the equipment.

Watch where you are walking and be careful not to step on a simple snare.

END OF LESSON CONFIRMATION

The cadets' participation in TP2 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Constructing a simple snare is essential in a survival situation. The ability to feed yourself will ward off fatigue and eliminate one of the seven enemies of survival.

INSTRUCTOR NOTES/REMARKS

All snares will be disassembled immediately after completion of the practical exercise.

REFERENCES

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

C3-003 (ISBN 1-896713-00-9) Tawrell, P. (1996). *Camping and Wilderness Survival: The Ultimate Outdoors Book.* Green Valley, ON: Falcon Distribution.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 4

EO M290.04 – CONSTRUCT GROUND-TO-AIR SIGNALS

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Photocopy the handout located at Annex A for each cadet.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to introduce methods of signalling to the cadets.

A practical activity was chosen for TP2 as it is an interactive way to introduce cadets to methods of signalling and allows the cadets an opportunity to practice. This activity contributes to the development of survival skills in a fun and challenging setting.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have constructed a ground-to-air signal.

IMPORTANCE

It is important for cadets to know how to construct ground-to-air signals as they may help them get rescued in a survival situation. Many ground-to-air signals are internationally recognized and can be made with almost any substance; in the snow, with logs, with rocks, or by trampling grass. The purpose of ground-to-air signals is to be located, noticed, or to convey a message to rescuers.

Teaching Point 1 | **Discuss Ground-to-air Signals Employed To Communicate With Aircraft**

Time: 15 min | Method: Interactive Lecture

GROUND-TO-AIR SIGNALS

Signal Dimensions

- Signals should be large with the letters or lines 3 metres (10 feet) wide and if possible 10 metres (40 feet) long, with 3 metres (10 feet) between signals.
- The markings should be deep or high and positioned so that the shadows cast by the sun are the longest.
- Experience teaches one to associate an object with its shape or outline. At a distance, the outline of an object can be clearly recognized long before the details that make up the object can be determined. Geometric shapes can tell the rescuer that the sign is man-made.

Creating Contrasting Shades or Colours

- Colour is an aid to an observer when there is contrast between the colour of an object and its background. The greater the colour contrast the more visible the object.
- While colour alone will not usually identify an object, it is often an aid in locating the object. Usually the darker shades of any given colour will be less likely to attract an observer's attention than the lighter, more brilliant shades.
- An object may cast a shadow beside it, which may be visible although the object itself is out of sight. Objects in shadow may be missed because the eye tends to accept conspicuously dark or light areas as uniform, and does not seek minor differences in darkness or lightness within them.
- To construct a signal on a lighter background dig a shallow ditch and build a low wall of dirt or logs, etc. to cast a shadow larger than your construction.
- Place the signal in an open area easily spotted from the air.

Signals

- Require assistance.
- Require medical assistance.
- Proceed in this direction.
- All is well.
- Require food and water.

Distribute copies of the handout located at Annex A.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What should the signal dimensions be?

Q2. Name two of the signals.

Q3. How do you construct a signal on a lighter background?

ANTICIPATED ANSWERS

A1. Signals should be large with the letters or lines 3 metres (10 feet) wide and if possible 10 metres (40 feet) long, with 3 metres (10 feet) between signals.

A2. Require assistance, require medical assistance, proceeding in this direction, all is well, and require food and water.

A3. To construct a signal on a lighter background dig a shallow ditch or build a low wall of dirt or logs, etc. to cast a shadow larger than your construction.

Teaching Point 2	Construct a Ground-to-air Signals as a Member of a Group
Time: 35 min	Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets construct a ground-to-air signal as a member of a group.

RESOURCES

- Shovel,
- Items found in nature,
- Rope, and
- Handout.

ACTIVITY LAYOUT

An area must be selected that is large enough to construct the ground-to-air signals.

ACTIVITY INSTRUCTIONS

1. Divide cadets into groups of four.
2. Distribute given materials to the groups.
3. Assign a ground-to-air signal to each group.
4. The cadets shall choose a location for the ground-to-air signals. If the cadets have access to beaches or fields they may use the area accordingly (e.g. drawing signals in the sand).
5. Have groups gather resources needed for signals.
6. Each group shall construct a ground-to-air signal.
7. Ensure that the final constructed signal looks the same as the picture.
8. Disassemble signals after completion of the activity.

9. Return natural resources back to the environment.

Give each group of cadets a different ground-to-air signal from the list to construct. If there are more than 5 groups restart the list from the top and work your way through it again.

SAFETY

Ensure parameters are established so the cadets do not go outside the training area or get lost.

END OF LESSON CONFIRMATION

The cadets' participation in TP2 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important for the cadets to know how to construct ground-to-air signals in a survival situation to improve their chances of a quick rescue. Many ground-to-air signals are internationally recognized and can be made with almost any substance; in the snow, with logs, with rocks, or by trampling grass. The purpose of ground-to-air signals is to be located, noticed, or to convey a message to rescuers.

INSTRUCTOR NOTES/REMARKS

All materials used in the construction of ground-to-air signals will be from the surrounding environment.

All ground-to-air signals should be removed and returned to the environment after the completion of the practical activity.

REFERENCES

C2-044 Transport Canada (2007). *Ground-to-Air Signals.* Retrieved 9 February 2007, from http://www.tc.gc.ca/CivilAviation/publications/tp14371/SAS/4-0.htm.

C3-003 (ISBN 1-896713-00-9) Tawrell, P. (1996). *Camping and Wilderness Survival: The Ultimate Outdoors Book.* Green Valley, ON: Falcon Distribution.

C3-118 Wilderness Survival. (2007). *Signalling Techniques.* Retrieved 12 March 2007, from http://www.wilderness-survival.net/chpt19.php.

GROUND-TO-AIR SIGNALS

	MESSAGE	SYMBOL
1	REQUIRE ASSISTANCE	V
2	REQUIRE MEDICAL ASSISTANCE	X
3	PROCEEDING IN THIS DIRECTION	↑
4	ALL IS WELL	LL
5	REQUIRE FOOD AND WATER	F

D Cdts 3, 2007, Ottawa, ON: Department of National Defence

Figure A-1 Ground-to-air Signals

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 5

EO M290.05 – IDENTIFY HIKING TECHNIQUES

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

PRE-LESSON ASSIGNMENT

Create slides or copy the handouts located at Annex A for each cadet.

The instructor may bring in examples of hiking footwear, if available, for demonstration purposes.

APPROACH

An interactive lecture was chosen for TP1 to TP3 to present background material to the cadets.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify hiking techniques. The cadets will be able to recognize how to monitor their daily water requirements, identify characteristics of hiking footwear and identify a personal hiking rhythm.

IMPORTANCE

It is important for cadets to know how to use hiking techniques to allow for a more comfortable and satisfying experience. Hiking is low-impact and this makes it suitable for virtually everyone; providing good aerobic exercise, toning muscles and improving general physical condition.

Teaching Point 1 **Explain Potable Water Requirements for Consumption During a Day Hike**

Time: 15 min Method: Interactive Lecture

DAILY WATER REQUIREMENTS

Performance-related Water Loss

- Water is lost from sweating, urinating, breathing, and defecating.
- When working hard and sweating heavily, a person can lose up to a litre of water per hour.
- At high altitudes where the air is dry, a person can dehydrate merely by breathing at rest.
- Under “normal” conditions, a person’s thirst mechanism, dry mouth and hormones in the kidneys, stimulates them to drink enough water to stay hydrated.
- If a person is working very hard or sweating profusely, if they are in a very hot or dry climate, or if they have an aggravating condition such as diarrhea or nausea that causes vomiting, they will have to drink water deliberately and regularly regardless of how thirsty they feel.
- Dehydration impairs humans, both physically and mentally.
- As a person becomes dehydrated, their blood plasma volume drops and, consequently, their hearts must work harder to keep body tissues supplied with blood. The result is a decrease in cardiovascular performance.
- When dehydrated, one’s body is also less able to dissipate heat through sweat (thermoregulation).
- Finally, the body’s ability to digest and metabolize food is impaired when it is low on water.

Daily Water Intake by Weight

- When as little as 1 percent of body weight in water is lost, a person’s physical performance begins to decline.
- If a 68 kg (150-pound) person is short just 0.95 litres (a quart) of water, heat regulation and exercise performance starts to decline.
- When a person is down 2.84 litres (three quarts) of water, that same 68 kg (150-pound) person will lose 20–30 percent of their exercise performance.

Present a slide or distribute a photocopy of Figure A-1.

Present a slide or distribute a photocopy of Figure A-2.

MAINTAINING SAFE HYDRATION LEVELS

Pre-hydrating

- Drink extra water before a strenuous activity.

- The best thing to drink is plain, cool water.

Drinking Small Amounts Often

- Drink small amounts of cool water when possible.
- Cool water is absorbed more easily by the intestines than warm water.

Avoiding Sugar and Caffeine Drinks

- Sugar impedes the body's ability to absorb fluid.
- Alcohol and caffeine inhibit one of the kidney's hormones that regulates water loss, so drinking either alcohol or caffeine will accelerate dehydration.

Routinely Drinking Water

- Incorporate drinking water into your routine by keeping a water bottle in a convenient place or using a dromedary bag (e.g. camel pack).
- Make drinking water a habit. If only a sense of thirst is relied on, chances are a hiker will get behind in hydration.
- Make a point of drinking at least 0.24 litres (8 ounces) of water for every half hour of strenuous activity.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is the best thing to drink when pre-hydrating?

Q2. What impedes the body's ability to absorb fluid?

Q3. How can you incorporate drinking water into your routine?

ANTICIPATED ANSWERS

A1. The best thing to drink when pre-hydrating is plain, cool water.

A2. Sugar impedes the body's ability to absorb fluid?

A3. Incorporate drinking water into your routine by keeping a water bottle in a convenient place or using a dromedary bag (e.g. camel pack).

Teaching Point 2	**Explain the Optimum Characteristics of Hiking Footwear**
Time: 15 min	Method: Interactive Lecture

CHARACTERISTICS OF HIKING FOOTWEAR

The most important factor to consider when selecting hiking footwear is the fit. It should provide protection for the feet and a firm foundation for walking and scrambling. Today's boots are derived from athletic shoe technology. They are light, comfortable and functionally suited. Common characteristics to look for when selecting a hiking boot are:

Sturdy and Lightweight

- The boot should support the feet and ankles from twisting on uneven surfaces.
- Higher boots with stiff ankle support provide lateral rigidity.

- The boot should also support the foot from over bending when placing too much weight on the toe or heel.
- The lighter the boot the easier walking will be.
- Every extra kg of footwear weight can be compared to 2.27 kg (5 pounds) of added backpack weight.

Comfortable (Snug Fit). When worn, footwear shall fit snugly with the heel snug against the wall of the shoe and a small amount of space for the toes to move.

Sized Correctly (Can Wiggle Toes). Boots that fit will ensure comfort during the hike. A boot fits correctly when:

- it is wide enough so that the boot matches the width of the foot with a little extra room;
- the tongue rests comfortably along the top of the foot; and
- the toes have room to wiggle.

SOCKS

The boot is only one part of the footwear system; socks are the first line of defence for the feet. A two sock system is common in many activities. Unless regularly hiking in hot, damp conditions, consider wearing one pair of heavy socks and one pair of light inner socks.

Inner Socks. This is a thin layer that helps wick, or pull moisture away from the foot. They are usually made of polypropylene material.

Outer Sock. This layer is most often made of thick wool, which can absorb moisture. This layer cushions the foot and provides insulation.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is the most important factor when selecting hiking footwear?

Q2. Every extra kg of footwear can be compared to what?

Q3. What is the first line of defence for the feet?

ANTICIPATED ANSWERS

A1. The most important factor to consider when selecting hiking footwear is the fit.

A2. Every extra kg of footwear weight can be compared to 2.27 kg (5 pounds) of added backpack weight.

A3. Socks.

Teaching Point 3	**Explain Personal Hiking Rhythm**
Time: 20 min	Method: Interactive Lecture

DETERMINING STRIDE RHYTHM AND SPEED

A steady hiking rhythm is generally more enjoyable as hikers overexert themselves less and generally keep the physical strain at enjoyable levels. Having a steady rhythm will enable a hiker to stick to a fixed schedule and lessen the strain put on the feet, legs, lungs and overall body. This allows a hiker to travel while being less fatigued.

Developing a Hiking Rhythm. A hiking rhythm is very personal and is developed over the course of many hikes. To develop a rhythm there are some guidelines to follow:

- Choose a specific stride rhythm and speed and keep to it. A comfortable rhythm is one that allows a hiker to walk at the same intensity level for at least one hour without having to take a break.
- Adjust rhythm to terrain, weather and weight. The point where a person can no longer carry on a conversation indicates the hiker has gone beyond a comfortable tempo.
- Make the rhythm a full body movement where breathing and the swing of the arms happen in harmony with the body.
- Uneven surfaces like uphill and downhill slopes of varying incline can make it difficult to maintain a steady hiking rhythm.

CONTROLLING FATIGUE

The purpose of resting is to slow down the heart rate and breathing, thereby allowing the heart and lungs to rest. Resting gives the body time to get rid of the lactic acid built up in the muscles, and to recover from hot spots or sores.

Resting Guidelines

- Rest in regular intervals; try 10 minutes for every hour hiked (make the rest intervals part of the rhythm).
- Stick to 10 minute rest breaks. Use only lunch and supper breaks as extended rest periods.
- Ten minutes is the most effective rest duration for body recovery.
- Ensure to take off backpacks, rest in the shade, and sit down during rests.
- During the extended rest breaks, allow feet to rest and dry by removing shoes and airing out footwear.

ADJUSTING RHYTHM

Generally, hiking rhythm on a flat surface can be maintained easily; however, when weather and additional weight are included, hiking becomes more difficult. Speed depends on the fitness level of the entire group, the terrain, the altitude and pack weight. One of the best ways to measure and regulate pace is to pay close attention to the tempo of breathing.

If breathing determines pace then, for example, on level ground one takes three steps per inhalation, and three steps per exhalation. Climbing a hill, while maintaining the same breathing rate, the steps per inhalation fall to two steps. A good rule of thumb to follow is to walk at a pace that still allows one to carry on a conversation.

When travelling in different conditions, one’s pace will change according to:

- **Weather.** Poor weather will reduce pace and force the hiker to reduce step size for safety.
- **Weight.** Weight will affect pace size as the more weight one carries, the more energy must be expelled.
- **Terrain.** Travelling uphill will reduce pace size and distance travelled.

EMPLOYING FULL BODY SYNCHRONIZATION

Hiking rhythm is a full body affair. Just like marching, hiking requires coordinated movements where every action has a reaction. The swing of arms provides momentum, breathing controls pace, etc. To control rhythm, one must first learn what body parts work in unison with each other.

To employ full body synchronization during movement, the arms should be in motion at a natural swing opposite the forward foot. The swing of the arms provides momentum to help carry the body forward for the next step. Breathing will control pace (keeping in mind that a comfortable rhythm allows a person to carry on a conversation while hiking).

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. What is involved with developing a hiking rhythm?

Q2. How long should a rest break be?

Q3. How does travelling in different conditions change one's pace?

ANTICIPATED ANSWERS

A1. A hiking rhythm is very personal and is developed over the course of many hikes. Choose a specific stride rhythm and speed and keep to it. A comfortable rhythm is one that allows a hiker to hike at the same intensity level for at least one hour without having to take a break. Adjust rhythm to terrain, weather and weight. The point where a person can no longer carry on a conversation indicates the hiker has gone beyond a comfortable tempo. Make the rhythm a full body movement where breathing and the swing of the arms happen in harmony with the body.

A2. Rest breaks should be 10 minutes.

A3. Poor weather will reduce pace and force the hiker to reduce step size for safety, weight will affect pace size as the more weight one carries the more energy must be expelled and travelling uphill will reduce pace size and distance travelled.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. Where can you dehydrate merely by breathing at rest?

Q2. How much water can you lose when working hard and sweating heavily?

Q3. What does comfortable footwear mean?

ANTICIPATED ANSWERS

A1. You can dehydrate merely by breathing at rest at high altitudes.

A2. You can lose up to a litre of water per hour when working hard and sweating heavily.

A3. When worn, footwear shall fit snugly with the heel snug against the wall of the shoe and a small amount of space for the toes to move.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important for cadets to know how to use hiking techniques to allow for a more comfortable and satisfying experience. Hiking is an opportunity for cadets to enjoy the outdoors while engaging in physical activity.

INSTRUCTOR NOTES/REMARKS

Examples of hiking footwear should be brought into the class for demonstration purposes.

REFERENCES

C2-009 (ISBN 0-684-85909-2) Harvey, M. (1999). *The National Outdoor Leadership School's Wilderness Guide.* New York, NY: Fireside.

C2-010 (ISBN 0-375-70323-3) Rawlins, C., and Fletcher, C. (2004). *The Complete Walker IV.* New York, NY: Alfred A. Knopf.

C2-012 (ISBN 0-89886-643-X) Weiss, H. (1988). *Secrets of Warmth for Comfort or Survival.* Seattle, WA: The Mountaineers.

C2-017 (ISBN 0-7627-0476-4) Roberts, H. (1999). *Basic Essentials, Backpacking.* Guilford, CT: The Globe Pequot Press.

THIS PAGE INTENTIONALLY LEFT BLANK

WATER REQUIREMENTS

Water Loss as a Percentage of Body Weight Related to Performance and Symptoms

0%	Normal heat regulation and performance.
1%	Thirst is stimulated, heat regulation during exercise is altered, performance begins to decline.
2%-3%	Further decrease in heat regulation, increased thirst, worsening performance.
4%	Exercise performance cut by 20-30%.
5%	Headache, irritability, “spaced-out” feeling, fatigue.
6%	Weakness, severe loss of thermoregulation.
7%	Collapse is likely unless exercise is stopped.

M., Harvey, The National Outdoor Leadership School’s Wilderness Guide, Fireside (p. 140)

Figure A-1 Water Loss Table

Recommended Daily Water Intake According to Weight

Body Weight in Kg	Litres H_2O at Rest
36.29 (80 lb)	2.4
45.35 (100 lb)	3
54.43 (120 lb)	3.6
63.5 (140 lb)	4.2
72.58 (160 lb)	4.8
81.65 (180 lb)	5.4
90.72 (200 lb)	6

M., Harvey, The National Outdoor Leadership School’s Wilderness Guide, Fireside (p. 141)

Figure A-2 Daily Water Intake Table

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 6

EO M290.06 – OPERATE A HAND-HELD RADIO

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-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to introduce a new subject and describe parts of a radio.

Demonstration and performance was chosen for TP2, TP4 and TP5 as it allows the instructor to explain and demonstrate the skill the cadet is expected to acquire, while providing and opportunity for the cadets to practice operating a hand-held radio under the supervision of an instructor.

Demonstration was chosen for TP3 as it allows the instructor to explain and demonstrate the skills the cadet is expected to acquire.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to identify parts, change channels, operate the push-to-talk button and change batteries in a hand-held radio.

IMPORTANCE

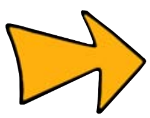
It is important for cadets to know how to operate hand-held radios in order to communicate between groups in the field.

Teaching Point 1 | **Identify the Parts of the Radio**

Time: 5 min | Method: Interactive Lecture

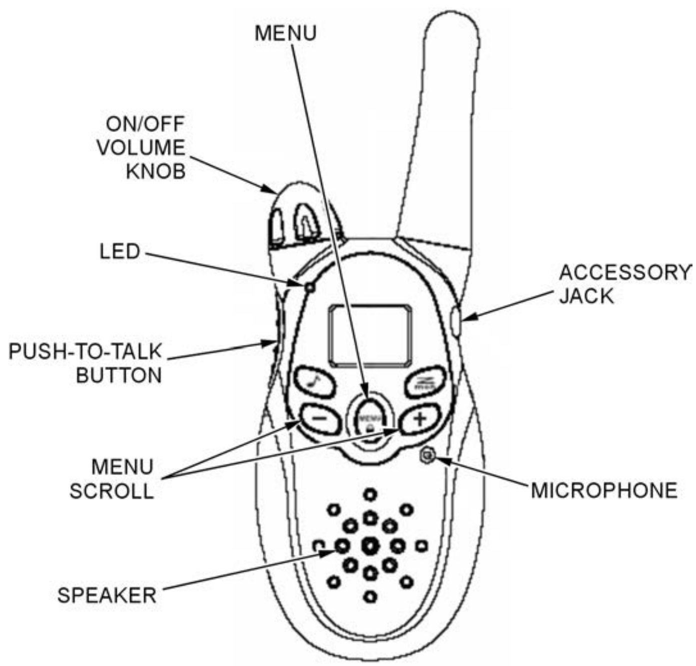
Radios presented in this lesson are the Talkabout FRS/GMRS Recreational Two-way Radios Models T5000, T5500, and T5550. Models may vary in each squadron. Refer to the user's guide as required.

Divide cadets into groups to a maximum of four and assign each group a radio.



Cadets will point to specific parts as they are explained.

PARTS OF THE RADIO AND THEIR FUNCTIONS

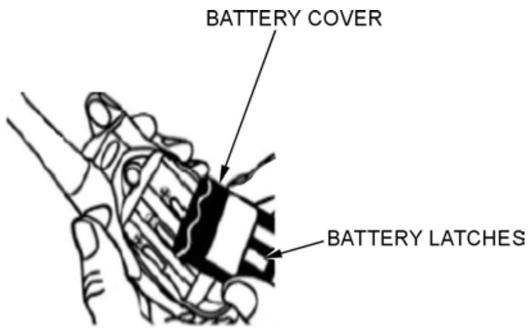


Motorola Inc., Talkabout FRS/GMRS Recreational Two-way Radios Models T5000, T5500, T5550 User's Guide, Motorola, Inc. (p. 11)

Figure 1 Hand-held Radio

- **On/Off Volume Knob.** Controls volume and power to the unit.
- **Light Emitting Diode (LED).** This light will be illuminated when the radio is on.
- **Push-To-Talk (PTT) Button.** A depressible button that allows transmissions.

- **Speaker.** Converts electric current into audible sound.
- **Antenna.** An electrical device designed to transmit or receive radio waves.
- **Accessory Jack.** This is used to insert accessory items such as a headset.
- **Microphone.** Converts sound into an electrical signal.
- **Menu Scroll.** Push to scroll through the menu options and channels. Use the “+” and “-” symbol in order to scroll through the menu options.



Motorola Inc., Talkabout FRS/GMRS Recreational Two-way Radios Models T5000, T5500, T5550 User’s Guide, Motorola, Inc. (p. 13)

Figure 2 Battery Compartment

- **Battery Cover.** Covers the storage compartment of the battery (located on the reverse side of the radio).
- **Battery Cover Latches.** Secures the cover to the radio (located on the reverse side of the radio).

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Name the parts of the radio.

Q2. What function does the antenna perform?

Q3. What function does the microphone perform?

ANTICIPATED ANSWERS

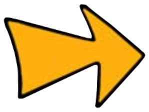
A1. The 10 parts of the Talkabout radio are: on-off/volume knob, LED, PTT, speaker, antenna, accessory jack, menu scroll, microphone, battery cover, and battery cover latches.

A2. It transmits and receives radio waves.

A3. It converts sound into an electrical signal.

Teaching Point 2	**Demonstrate Turning the Radio On and Off**
Time: 5 min	Method: Demonstration and Performance

Radio operations differ from model to model. Refer to the user’s guide for operating instructions.



Explain and demonstrate turning a hand-held radio on and off and have cadets practice.

TURNING THE RADIO ON/OFF

- To turn the radio **ON**, turn the on-off/volume knob clockwise. The radio will beep and the radio display will briefly show all feature icons of the radio.
- To turn the radio **OFF**, turn the on-off/volume knob counterclockwise. A clicking sound will indicate the radio is turned off.

CONFIRMATION OF TEACHING POINT 2

The cadets' participation in TP2 will serve as the confirmation of this lesson.

Teaching Point 3	**Demonstrate Adjusting Frequencies**
Time: 5 min	Method: Demonstration

Explain and demonstrate selecting and changing radio stations.

ADJUSTING FREQUENCIES

Selecting a Channel (Frequency)

The radio operates on a group of frequencies that are accessed through radio channels. To set the channel of the radio, push the Menu button, this will cause the current channel to flash. Using the Menu scroll button, scroll through the channels and push the PTT button to select the desired channel.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. How are the frequencies accessed on a hand-held radio?

Q2. If channel eight was desired, how would one change the channels?

ANTICIPATED ANSWERS

A1. The radio operates on a group of frequencies that are accessed through radio channels.

A2. To set the channel of the radio, push the Menu button, this will cause the current channel to flash. Using the Menu scroll button, scroll through the channels and push the PTT button to select the desired channel.

Teaching Point 4	Demonstrate Operating the Push-To-Talk (PTT) Button
Time: 5 min	Method: Demonstration and Performance

OPERATING THE PTT BUTTON

To send and receive messages, check the channel activity by pressing the push-to-talk (PTT) button. Static will be heard if the channel is clear to use. Do not transmit if someone is talking on the channel.

- To send messages, press the PTT button, pause, speak into the microphone, pause, and then release (to maximize clarity, hold the radio three to five centimetres from the mouth).
- The LED will glow continuously when sending messages.
- To listen to messages, release the PTT button.

ACTIVITY

Time: 3 min

OBJECTIVE

The objective of this activity is to allow cadets to become familiar with sending and receiving transmissions.

RESOURCES

One hand-held radio per group of four cadets.

ACTIVITY LAYOUT

Divide cadets into groups (maximum of four per group). Separate groups from each other giving enough room to avoid radio feedback.

ACTIVITY INSTRUCTIONS

- Provide each group of cadets with a radio.
- Assign each cadet in each group a number (one through four).
- Pair the groups and assign each pair of groups a frequency.
- Cadet one from the sending group will transmit any message to cadet one in their receiving group.
- Cadets will go in turn until all have had a turn.
- The message should be enunciated clearly and spoken at a moderate pace and at a volume that is readable.

The intent of this activity is for the cadets to operate the radio while transmitting and receiving radio message. Be cognizant of the process the cadets use when speaking into the radio. Ensure the cadets press the PTT button, wait two to three seconds before speaking, and release the PTT button after the message is fully transmitted.

Considering the cadets have yet to be trained on voice procedures, this activity will not focus on the rules of radio procedures. A few sample messages have been provided here for the cadets to transmit to their peers:

Message 1 – The sun shines very brightly at noon.

Message 2 – During the night you can see the Big Dipper.

Message 3 – The best method to start a fire is a box fire.

Message 4 – CF-18s are very loud when they take off.

SAFETY

Make sure the cadets do not hold the hand-held radio too close to their ears while receiving messages.

CONFIRMATION OF TEACHING POINT 4

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

Teaching Point 5	**Demonstrate Changing Batteries**
Time: 5 min	Method: Demonstration and Performance

BATTERIES

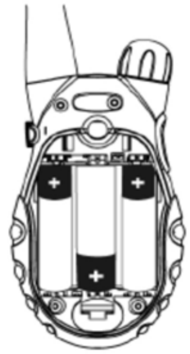
A battery is a device that stores chemical energy and makes it available in an electrical form. Radios require batteries to operate. Batteries are everywhere – in cars, remote controls, laptops, and cell phones to name a few places.

Explain to the cadets what type of battery is required to operate the hand-held radio. Consult the user's guide to ensure the proper size and type of battery is being used. The Talkabout radios discussed in this lesson use three AA batteries.

CHANGING THE BATTERY

Many hand-held radios will use three AA batteries for power. To insert or replace these batteries, follow these steps:

1. Turn the radio so the back is facing up. Lift the battery latch to release the battery cover.
2. Remove the battery cover.
3. Insert three AA batteries as shown on the inside of the battery compartment.
4. Replace the battery cover and clip the battery latch to secure.



Motorola Inc., Talkabout FRS/GMRS Recreational Two-way Radios Models T5000, T5500, T5550 User's Guide, Motorola, Inc. (p. 13)

Figure 3 Batteries

Motorola Inc., Talkabout FRS/GMRS Recreational Two-way Radios Models T5000, T5500, T5550 User's Guide, Motorola, Inc. (p. 13)

Figure 4 Changing the Batteries

Batteries may corrode over time if left in radios and can cause permanent damage; therefore, they should be removed before storing radios for extended periods of time.

BATTERY METER

The battery icon shows the battery charge level, from full to empty. When the battery is empty, the radio chirps periodically after releasing the PTT button. The radio powers off when the voltage drops below a predetermined level.

SAFELY DISCARDING SPENT BATTERIES

Batteries are made of various materials comprised of heavy metals including nickel cadmium, alkaline, mercury, nickel metal hydride, and lead acid. These elements can harm the environment if not properly discarded. As such, batteries are one of the most complex items to dispose of or recycle.

Batteries, if not properly disposed of, may cause:

- the pollution of lakes and streams as the metals vaporize into the air when burned;
- the leaching of heavy metals from solid waste landfills;
- exposure of the environment and water to lead and acid;
- corrosion from the strong acid; and
- burns or other injury to eyes and skin.

Batteries are not all the same and each have specific instructions for their proper disposal and/or recycling. The batteries most people use are household types; however, due to the variety of different rules and regulations, check with the local community recycling facility to determine the household battery recycling options or supporting unit/base POL/HAZMAT section.

This is a good opportunity to encourage cadets to care for their environment. By developing a unit battery-recycling program, the unit can collect spent batteries from cadets' households and deliver the batteries to the local community recycling depot or supporting unit/base HAZMAT section.

ACTIVITY

Time: 3 min

OBJECTIVE

The objective of this activity is to allow the cadets to change the batteries of a hand-held radio.

RESOURCES

- One hand-held radio per group of four cadets, and
- Batteries.

ACTIVITY LAYOUT

Divide cadets into groups (maximum of four per group).

ACTIVITY INSTRUCTIONS

One or two cadets in the group (depending on time) will change the batteries of a hand-held radio IAW the user's guide.

SAFETY

N/A.

CONFIRMATION OF TEACHING POINT 5

The cadets' observation and/or participation in the activity will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' participation in TPs 2, 4 and 5 will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

Cadets should be encouraged to recycle discarded batteries and contact recycling centres for appropriate methods for discarding/recycling household batteries.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Radios are used during field exercises and other cadet activities. Proper use of this equipment is essential to ensure effective communication.

INSTRUCTOR NOTES/REMARKS

Hand-held radio models may vary from region to region. The instructor will be responsible for consulting the user's guide for detailed instructions on radio operation.

Dispose/recycle the batteries in accordance with local regulations.

REFERENCES

C0-069 Motorola Inc. (2004). *Talkabout FRS/GMRS Recreational Two-way Radios Models T5000, T5500, T5550 User's Guide.* Motorola Inc.

THIS PAGE INTENTIONALLY LEFT BLANK

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 7

EO C290.02 – PARTICIPATE IN A DISCUSSION ON SKINNING AND COOKING A SMALL ANIMAL

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-802/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.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for this lesson to present basic material.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to participate in a discussion on skinning and cooking a small animal.

IMPORTANCE

It is important for cadets to understand how to skin and cook a small animal in a survival situation. Along with feeding the body, cooking also relieves boredom.

Teaching Point 1	**Discuss Skinning a Small Animal**
Time: 10 min	Method: Interactive Lecture

SKINNING A SMALL ANIMAL

For best results, the steps for skinning a small animal should be done in the sequence outlined below.

Removing Urine. Remove the urine by holding the animal's forelegs and gradually squeezing down on the body from the chest to the bowels.

Cutting. Cut a hole into the belly area.

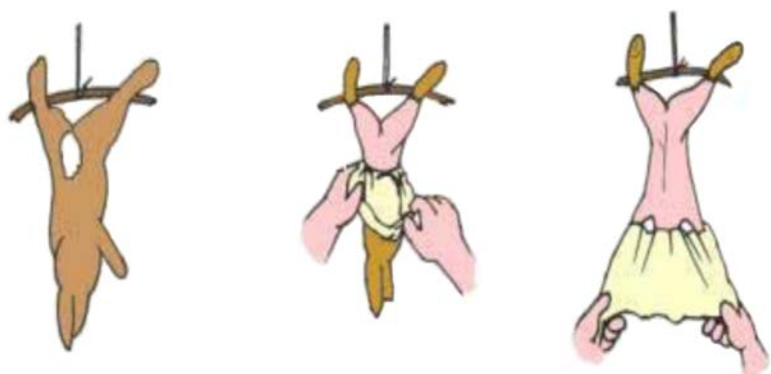
Pulling the Skin and Removing the Guts. Pull the skin apart at the hole and insert the first fingers of each hand. Pull the skin apart exposing the guts. Remove the guts.

Cutting the Skin. Cut the skin around the front and hind paws and between the hind legs.

Hanging. Hang the rabbit and pull off the skin. (See Figure 1).

Removing Skin and Dismembering

- The last step in removing the skin is by pulling it over the head and cutting off the head.
- Dismember in the same way as a chicken.



"Dressing", Simple Survival. Retrieved 15 March 2007, from http://www.simplesurvival.net/dressing.htm

Figure 1 Skinning a Small Animal

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What is the first step in skinning a small animal?

Q2. What is the step after cutting a hole in the belly?

Q3. What is the last step in skinning?

ANTICIPATED ANSWERS

A1. Remove the urine by holding the animal's forelegs and gradually squeezing down on the body from the chest to the bowels.

A2. Pull the skin apart at the hole and insert the first fingers of each hand. Pull the skin apart exposing the guts. Remove the guts.

A3. The last step in removing the skin is by pulling it over the head and cutting off the head.

Teaching Point 2	Discuss Cooking a Small Animal
Time: 15 min	Method: Interactive Lecture

BOILING

The following are some considerations of boiling food:

- Although boiling does destroy some food elements it conserves the natural juices and retains all the fat – provided that you drink all the liquid as well as eat the remaining food.
- Each time you throw away cooking water you lose valuable nutrients, though you will have to discard it if boiling out toxic substances.
- Boiling will make tough and stringy roots and older game softer and more edible.
- Cooking in boiling water requires a container.
- Tin cans and metal boxes are ideal.
- Make a handle, hang the tin cans or metal boxes from a pot support or use pot tongs to take them on and off the fire.
- Puncture holes in pots can be repaired by hammering in small plugs of wood – when wet they will expand and stop leaks.
- Containers can also be made of birch bark – but be careful that they do not boil dry.
- Boiling will kill worms and flukes (parasites) and can even make spoiled meat fit to eat.

ALUMINUM FOIL COOKING

The following are some considerations of aluminum foil cooking:

- Wrap food in foil.
- Place wrapped food on coals or place food in a hole in the coals and cover the food. By burying the food it is cooked more rapidly and space is left on the surface of the coals for other items.
- A downside to burying the food in hot coals is that it will be difficult to check if the food has finished cooking.

CLAY BAKING

The following are some considerations of clay baking both fish and birds:

Fish

- Find some large leaves and wrap them around the fish. It is not necessary to remove the scales.
- Mould a thin layer of clay or mud around the wrapped fish and let it dry slightly.
- Wrap a thick layer of clay or mud around the package and place it before the fire to dry.
- When sufficiently dry, bury it in the hot coals and bake for 7 minutes per 0.5 kg (pound).
- When cooked, break open the clay, pull apart the leaves and peel back the skin.

Birds

- Find some large leaves and wrap them around the bird. It is not necessary to remove the feathers.
- In the case of fowl, do not pluck the feathers but place the clay directly on the bird. For other birds mould a layer of clay around the wrapped bird.

- When cooked, the feathers of the fowl will come off as they will be stuck in the hard clay.

GRILLING

The following are some considerations of grilling food:

- Grilling is the quick way of cooking large amounts of food but it requires a support—such as a mesh wire – rested on rocks over the embers of the fire.
- It should only be used when food is plentiful since it wastes most of the fat from the meat.
- Hot rocks beside the fire can be used as grilling surfaces.

ROASTING

The following are some considerations of roasting food:

- Roasted meat cooks in its own fat.
- Continually turning the meat keeps the fat moving over the surface.
- The easiest method is to skewer the meat on a spit and turn it over the hot embers of a fire or beside a blazing fire where it is hot enough to cook.
- Roasting makes a very tasty dish but has two disadvantages:
    - Valuable fat is lost unless a drip tray is placed beneath the spit. Regularly baste the meat with fat from the tray.
    - Roasting by a fierce fire can cook and seal the outside, the inner flesh remaining uncooked, leaving harmful bacteria alive. A slow roast is preferable, and if cooking continues after the outer meat has been cut off the inner flesh can go on cooking.

STEAMING

The following are some considerations of steaming food:

- Make a simple steamer by punching holes in a can and suspending it in a larger can, or putting something in the bottom of the larger can to keep the inner one above the water.
- Cover the outer can so that steam is not dissipated, but not so tightly that it is sealed or pressure could build up and cause it to explode.
- Steaming does not overcook the food and it preserves nutritional values.
- It is an excellent way of cooking fish and green vegetables.
- Fresh young leaves take very little cooking.
- The food stuff needs to be suspended in the steam above the boiling water.

FRYING

The following are some considerations of frying:

- Frying is an excellent way of varying a diet, if fat and a container are available to fry in.
- Any sheet of metal that can be fashioned into a curve or give a slight lip will serve as a pan.
- In some areas, a large leaf can be found which contains enough oil not to dry out before the cooking is done.
- Try leaves out before risking valuable food on them and, if one is used, fry only over embers, not over flames.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What different methods of cooking were discussed?

Q2. How can puncture holes be fixed in a pot?

Q3. What type of cooking cooks meat in its own fat?

ANTICIPATED ANSWERS

A1. Boiling, baking, aluminum foil cooking, clay baking, grilling, roasting, steaming, and frying.

A2. Puncture holes in pots can be repaired by hammering in small plugs of wood—when wet they will expand and stop leaks.

A3. Roasting cooks meat in its own fat.

END OF LESSON CONFIRMATION

QUESTIONS

Q1. What is the first step in skinning a small animal?

Q2. What will kill worms and flukes and can even make spoiled meat fit to eat?

Q3. What are two disadvantages of roasting?

ANTICIPATED ANSWERS

A1. Remove the urine by holding the animal's forelegs and gradually squeezing down on the body from the chest to the bowels.

A2. Boiling.

A3. Valuable fat is lost unless a drip tray is placed beneath the spit. Roasting by a fierce fire can cook and seal the outside, the inner flesh remaining uncooked, leaving harmful bacteria alive.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

It is important for cadets to know how to clean and cook an animal when they are in a survival situation. As well as helping cadets fend for themselves, cooking provides nourishment and relieves boredom.

INSTRUCTOR NOTES/REMARKS

N/A.

REFERENCES

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

C3-003 (ISBN 1-896713-00-9) Tawrell, P. (1996). *Camping and Wilderness Survival: The Ultimate Outdoors Book.* Green Valley, ON: Falcon Distribution.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 8

EO C290.03 – CONSTRUCT A SNOW CAVE

Total Time:	90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Recce the area to locate sites for snow cave construction prior to the lesson.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to present basic material and give direction on procedures.

Demonstration was chosen for TP2 as it allows the instructor to explain and demonstrate the skill the cadet is expected to acquire.

Performance was chosen for TP3 and TP4 as it provides an opportunity for the cadets to practice building a snow cave under supervision.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall have constructed a snow cave.

IMPORTANCE

It is important for cadets to know how to construct a snow cave as it can protect them from the elements and animals in a survival situation.

Teaching Point 1 | **Identify Factors To Consider in Selecting a Site for a Snow Cave**

Time: 5 min | Method: Interactive Lecture

SNOW CAVE SITE FACTORS

When choosing a snow cave site, ensure the following are present:

- a hard snow drift;
- a slope with a firm crust. This is usually found on the lee side (the opposite side from which the wind is blowing) of a steep ridge or river bank; and
- ensure that the drift is not below a cornice or in an avalanche area.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What type of snow drift should be used for building a snow cave?

Q2. Where is a slope with a firm crust found?

Q3. What areas should be avoided when building a snow shelter?

ANTICIPATED ANSWERS

A1. A hard snow drift should be used.

A2. A slope with a firm crust is usually found on the lee side (the opposite side from which the wind is blowing) of a steep ridge or river bank.

A3. Avoid drifts below cornices or in avalanche areas.

Teaching Point 2 | **Demonstrate Appropriate Site Selection and Construct a Snow Cave**

Time: 35 min | Method: Demonstration

SELECTING A SITE

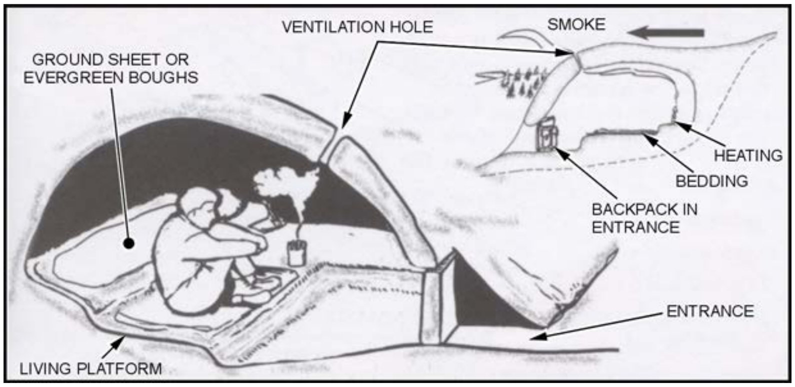
Construction of the snow caves must be started at least 90 minutes before sundown to ensure the snow cave is completed before dark.

CONSTRUCTING A SNOW CAVE

The procedure for constructing a snow cave includes:

1. burrowing a small tunnel that is one metre into the lowest level of the chamber;
2. clearing the chamber of snow at right angles to the tunnel;
3. clearing the chamber of snow to a height that is comfortable for sitting;

4. constructing the outside of the roof to be well arched without sharp angles, to provide maximum support;
5. constructing a sleeping and sitting platform above the level of the entrance. This will be the warmest area of the cave;
6. constructing a ventilation hole in the roof of the snow cave. This will allow carbon monoxide gases and smoke to escape to avoid asphyxiation. There should also be a ventilation hole in the door to allow fresh air to enter; and
7. constructing a door using a block of snow or a ground sheet. Keep the door loose fitting and on the inside so that it will not freeze up and jam. If it does, a block on the inside will be much easier to free.



Tawrell, P., Camping and Wilderness Survival, Falcon Distribution (p. 117)

Figure 1 Snow Cave

Ensure the cadets enter and observe the finished snow cave.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. Why is the outside of the roof well arched and constructed without sharp angles?

Q2. What is the warmest area of the cave?

Q3. What will allow carbon monoxide gases and smoke to escape and help to avoid asphyxiation?

ANTICIPATED ANSWERS

A1. To provide maximum support.

A2. The sleeping and sitting platform above the level of the entrance of the cave.

A3. A ventilation hole in the roof of the snow cave.

Teaching Point 3 **Ensure Cadets Choose an Appropriate Site for Construction of a Snow Cave and Have Cadets Construct a Snow Cave**

Time: 35 min Method: Performance

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadets, in groups of no more than four, construct a snow cave.

RESOURCES

- Shovel, and
- Ground sheet.

ACTIVITY LAYOUT

Select an area that has the appropriate snow to construct the snow cave.

ACTIVITY INSTRUCTIONS

Working as a member of a group of no more than four, the cadets shall choose a location for the snow cave. Each group shall construct a snow cave following these steps:

1. Burrow a small tunnel that is one metre into the lowest level of the chamber.
2. Clear the chamber of snow at right angles to the tunnel.
3. Clear the chamber of snow to a height that is comfortable for sitting.
4. Ensure the outside of the roof is well arched and has no sharp angles.
5. Construct a sleeping and sitting platform above the level of the entrance.
6. Hollow out a ventilation hole in the roof of the snow cave.
7. Hollow out a ventilation hole in the door to allow fresh air to enter.
8. Construct a door using a block of snow or a ground sheet. If using a ground sheet, pull the sheet a small amount from the side of the wall to ensure ventilation.

The questions in the confirmation of TP3 should be asked of the groups as the instructor moves from one group to the next.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. Why was this location chosen to build the snow cave?

Q2. Where should the sitting and sleeping platform be constructed?

Q3. How do you construct a door in the snow cave?

ANTICIPATED ANSWERS

A1. This location was chosen because it is a hard snow drift with a slope and a firm crust.

A2. Above the level of the entrance.

A3. With a block of snow or a ground sheet.

Teaching Point 4	**Disassemble the Snow Caves When the Exercise Is Completed**
Time: 5 min	Method: Performance

DISASSEMBLE THE SNOW CAVES

Disassembling the snow caves includes the following steps:

1. cadets will remove ground sheets from the snow caves;
2. collapse or fill in the spaces with the removed snow; and
3. ensure the ground looks as natural as possible.

CONFIRMATION OF TEACHING POINT 4

The cadets' participation in the disassembly of the snow cave will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' construction of the snow cave will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Snow caves provide shelter from the elements and animals in a survival situation.

INSTRUCTOR NOTES/REMARKS

Cadets will not sleep in the snow cave.

Additional supervision is required during the construction of the snow cave.

REFERENCES

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

C3-003 (1-896713-00-9) Tawrell, P. (1996). *Camping and Wilderness Survival: The Ultimate Outdoors Book.* Green Valley, ON: Falcon Distribution.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 9

EO C290.04 – COLLECT DRINKING WATER USING A SOLAR STILL

Total Time:	60 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Find a suitable water collection area for construction of the solar still. Ensure the area has enough ground coverage for all groups to have ample space to construct their solar stills.

PRE-LESSON ASSIGNMENT

This class should not be taught during the winter months.

APPROACH

An interactive lecture was chosen for TP1 and TP3 to present basic material and give direction on procedures.

Demonstration was chosen for TP2 as it allows the instructor to explain and demonstrate building a solar still.

Performance was chosen for TP4 and TP5 as it provides an opportunity for the cadets to practice the skill under supervision.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall construct a solar still and collect water from it.

IMPORTANCE

It is important for cadets to know how to construct a solar still and be able to collect water from it because in a survival situation water may not be readily available. Cadets will have to use other resources to find water. Thirst is one of the enemies of survival.

Teaching Point 1 **Explain How to Find an Appropriate Water Collection Site by Digging a Hole in the Ground**

Time: 5 min Method: Interactive Lecture

FINDING AN APPROPRIATE COLLECTION SITE

A hole can be dug in almost any type of ground to find water. The hole has to be deep enough to let water seep in.

Dig a shallow well when you see damp sand or find plant growth.

Dry meandering stream beds might have water deposited just below the surface at outside bends. Dig in these bends for water.

Along sandy beaches or salt lakes, dig a hole in a sand depression 30.5 m (100 feet) from the shore or in the first depression behind the first sand dune. Rain water from local showers will collect between the dunes.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. Where will rain water collect along sandy beaches?

Q2. What would you dig if you saw damp sand or plant growth?

Q3. A hole can be dug in what type of ground to find water?

ANTICIPATED ANSWERS

A1. Rain water from local showers will collect between the dunes.

A2. Dig a shallow well when you see damp sand or find plant growth.

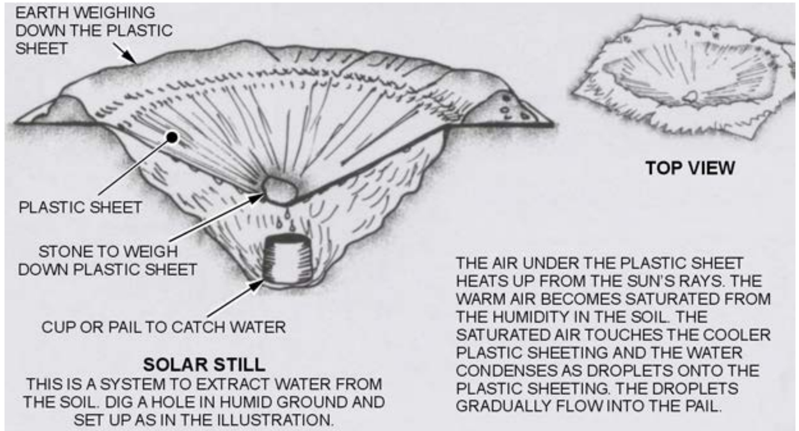
A3. A hole can be dug in almost any type of ground to find water. The hole has to be deep enough to let water seep in.

Teaching Point 2 **Demonstrate the Construction of a Solar Still**

Time: 15 min Method: Demonstration

CONSTRUCTION OF A SOLAR STILL

- Dig a hole in the ground approximately 90 cm (36 inches) across and 45 cm (18 inches) deep.
- Place a collecting can in the centre of the hole and cover the hole with a sheet of plastic formed into a cone.
- Weigh down the edges of the plastic sheet with heavy stones or use the dirt dug from the hole.
- Place a fist-sized stone in the centre of the bottom of the plastic sheet, above the collecting can.



Tawrell, P., Camping and Wilderness Survival, Falcon Distribution (p. 151)

Figure 1 A Solar Still

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What are the dimensions of the hole that is to be dug?

Q2. After placing the collecting can in the centre of the hole, what is the next step?

Q3. What weighs down the edges of the plastic sheet?

ANTICIPATED ANSWERS

A1. The dimensions of the hole in the ground are approximately 90 cm (36 inches) across and 45 cm (18 inches) deep.

A2. Cover the hole with a sheet of plastic formed into a cone.

A3. Heavy stones.

Teaching Point 3	**Explain How the Solar Still Collects Water**
Time: 5 min	Method: Interactive Lecture

WATER CONDENSATION

The sun's heat raises the temperature of the air and soil below the surface and vapour is produced. As the air becomes saturated, water condenses on the underside of the plastic, running down into the container. This is especially effective in desert regions and elsewhere when it is hot during the day and cold at night. The plastic cools more quickly than the air, causing heavy condensation. This kind of still should collect at least 450 ml (1 pint) over a 24-hour period.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS

Q1. How is vapour produced?

Q2. What happens when the air becomes saturated?

Q3. How much water should this type of still collect?

ANTICIPATED ANSWERS

A1. The sun's heat raises the temperature of the air and soil below the surface and vapour is produced.

A2. As the air becomes saturated, water condenses on the underside of the plastic, running down into the container.

A3. This type of still should collect at least 450 ml (1 pint) over a 24-hour period.

Teaching Point 4 — **Construct a Solar Still**

Time: 25 min — Method: Performance

ACTIVITY

OBJECTIVE

The objective of this activity is to have cadets, in groups of no more than five, construct a solar still.

RESOURCES

- Clear plastic bags,
- Cup or pail, and
- Shovel.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

Working as a member of a group of no more than five, the cadets shall choose a location for the solar still and find heavy stones to hold down the plastic sheet. Each group shall construct a solar still following these steps:

1. Dig a hole in the ground approximately 90 cm (36 inches) across and 45 cm (18 inches) deep.
2. Place a collecting can in the centre of the hole and cover the hole with a sheet of plastic formed into a cone.
3. Weigh down the edges of the plastic sheet with heavy stones or the dirt dug from the hole.
4. Place a fist-sized stone in the centre of the bottom of the plastic sheet, above the collecting can.

> The questions in the confirmation of TP4 should be asked of the groups as the instructor moves from one group to the next.

> The stills may remain overnight to collect water.

SAFETY

Ensure cadets stay within the set boundaries of the solar still construction area.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS

Q1. What challenges were encountered while building the solar still?

Q2. Where is the collecting can placed?

Q3. What is the purpose of a solar still?

ANTICIPATED ANSWERS

A1. Answers will vary. Encourage the cadets to elaborate on their challenges.

A2. The collecting can is placed in the centre of the hole.

A3. The purpose of a solar still is to collect water when none is readily available.

Teaching Point 5	**Disassemble the Solar Still**
Time: 5 min	Method: Performance

TP5 will be conducted on day two of the exercise.

DISASSEMBLE THE SOLAR STILL

Disassemble the solar stills by:

- checking the solar stills for water collection;
- measuring the amount in the containers;
- removing all items from the hole and fill in the hole with the removed dirt; and
- ensuring the ground looks as natural as possible.

CONFIRMATION OF TEACHING POINT 5

The cadets' participation in the disassembly of the solar still will serve as the confirmation of this TP.

END OF LESSON CONFIRMATION

The cadets' construction of a solar still will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Having the skills to construct a solar still and collect water in a survival situation can be essential to your survival. If water is not readily available you must be able to use your own resources to find water.

INSTRUCTOR NOTES/REMARKS

The solar still must remain in place overnight as both the heat from the sun and the cool air at night are required for the water condensation process to occur. For scheduling purposes, TPs 1-4 will be done on day one of the schedule and TP5 will occur on day two.

REFERENCES

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

C3-003 (ISBN 1-896713-00-9) Tawrell, P. (1996). *Camping and Wilderness Survival: The Ultimate Outdoors Book.* Green Valley, ON: Falcon Distribution.

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL TWO

INSTRUCTIONAL GUIDE

SECTION 10

EO C290.05 – PARTICIPATE IN A HIKE

Total Time:	90 min

PREPARATION

PRE-LESSON INSTRUCTIONS

Resources needed for the delivery of this lesson are listed in the lesson specification located in A-CR-CCP-802/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.

Recce the hike route and have a map available prior to the start of the hike.

The hike will be on a predetermined route of 3 km on a Class 1 terrain.

Place flagging tape along the route prior to the commencement of the hike.

Cadets will be led by an officer and senior cadets may take charge of the syndicates while on the hike.

PRE-LESSON ASSIGNMENT

N/A.

APPROACH

An interactive lecture was chosen for TP1 to give directions on procedures for the hike.

Demonstration and performance was chosen for TP2 as it is an interactive way to allow cadets to experience hiking in a safe, controlled environment. This activity contributes to the development of the cadets' hiking skills and knowledge in a fun and challenging setting.

A group discussion was chosen for TP3 as it allows the cadets to interact with their peers and share their knowledge, experiences, opinions and feelings about the hike.

INTRODUCTION

REVIEW

The review for this lesson is from EO M290.05 (Discuss Hiking Techniques) and includes:

- Explain potable water requirements for consumption during a day hike;
- Explain the characteristics of proper footwear; and
- Explain, demonstrate and have cadets practice personal hiking rhythm.

OBJECTIVES

By the end of this lesson the cadet shall have participated in a hike and used trailblazing techniques.

IMPORTANCE

It is important for cadets to participate in outdoor activities like hiking; it promotes physical well-being and an interest in the outdoors. Trailblazing techniques are signals that can be left behind if you leave your camp so others can see the signals. They can also help you to find your way back to camp should you go in search of survival items.

Teaching Point 1	Describe Trail Etiquette Methods That Accomplish the "Leave No Trace" Ideologies While Hiking
Time: 10 min	Method: Interactive Lecture

TRAIL ETIQUETTE

Proper planning before entering an outdoor environment serves as one of the key elements in having a safe and successful experience. No-trace camping involves avoiding or reducing the damage caused by humans in the environment.

Staying on Established Trails. Constant trampling and travel will cause erosion over environmental surfaces. Avoid taking shortcuts and, when travelling cross-country where no trails exist, try to remain on the most durable surfaces.

Walking on Durable Surfaces. Surfaces vary from soft marshes to solid rock and trekkers will continuously cross many different types of terrain. It is imperative to take the time to travel on surfaces that will not be significantly affected, rather than taking the straightest line to get to a destination, trampling whatever lies in the way.

Travelling in Small Groups. Increased group numbers can have a greater impact than smaller ones. Stick to appropriate group sizes of 10 or less. Take the necessary precautions when travelling in a group. Every action has the potential to impact the natural environment.

Avoiding Making Loud Noises. When travelling through the wilderness, allow nature's sounds to prevail. Avoid using loud noises, secure all pots and pans on the backpack and only use the whistle in an emergency situation.

WEARING PROPER SAFETY EQUIPMENT

- a whistle,
- a hat,
- sunscreen, and
- appropriate footwear.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What does no-trace camping involve?

Q2. Why is it important to stay on established trails?

Q3. What is one piece of proper safety equipment?

ANTICIPATED ANSWERS

A1. No-trace camping involves avoiding or reducing the damage caused by humans in the environment.

A2. Constant trampling and travel will cause erosion over environmental surfaces. Avoid taking shortcuts and, when travelling cross-country where no trails exist, try to remain on the most durable surfaces.

A3. A whistle, a hat, sunscreen, or appropriate footwear.

Teaching Point 2	**Demonstrate and Have Cadets Practice Trailblazing Techniques**
Time: 60 min	Method: Demonstration and Performance

Have cadets pre-hydrate by consuming at least 500 ml of water prior to the start of the hike.

Prior to the hike explain and demonstrate the following trailblazing techniques.

Have the cadets look for previously marked signals on the route. Have the cadets trailblaze using flagging tape.

TRAILBLAZING

These are signals to leave behind if you leave the scene of the crash or abandon camp.

- Make a large arrow shape to indicate the direction in which you have set off which will be visible from the air and other direction markers which can be interpreted at ground level.
- Signs on the ground will draw attention to your presence or past presence and the direction markers will help rescuers follow your trail.
- Continue to make them, not only for people to follow but to establish your own route if you wish to retrace it and as a guide if you lose your sense of direction and start going back on your trail.
- At camp, leave written messages in containers to detail your plans. Hang them from tripods or trees and draw attention to them with markers.
- Direction markers could include:
  - rocks or debris placed in an arrow shape;
  - a stick left in a crooked support, with the top pointing in the direction taken;
  - grasses tied in an overhand knot with the end hanging in the direction followed;

- forked branches laid with the fork pointing in the direction followed;
- arrowhead-shape notches cut out of tree trunks indicating a turn;
- small rocks set upon larger rocks, with small rocks beside; and
- a cross of sticks or stones meaning ‘Not this way’.

ACTIVITY

The cadets will not damage the environment while participating in trailblazing.

OBJECTIVE

The objective of this activity is to have cadets practice trailblazing techniques in a natural environment.

RESOURCES

Flagging tape.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Cadets are to depart the training area, travelling a distance of no greater than 3 km along a predetermined route, on Class 1 terrain.
2. The cadets will be led by an officer and senior cadets may take charge of the syndicates.
3. Divide the cadets into three syndicates (e.g. 1:8–1:10 ratio). The cadets will travel as a syndicate while on the hike.
4. Have cadets identify markers along the hiking route and have them make their own markers with flagging tape, stones and sticks along the route.
5. On the return trip the cadets will retrieve the flagging tape they placed on the foliage.

SAFETY

N/A.

The instructor shall provide advice to the cadets who experience difficulty. Ensure enough water is available for the cadets and accompanying staff members.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is trailblazing?

Q2. What will signs on the ground draw attention to?

Q3. What forms the signal “Not this way”?

ANTICIPATED ANSWERS

A1. Trailblazing is signals which are left behind if you leave the scene of the crash or abandon camp.

A2. Signs on the ground will draw attention to your presence or past presence and the direction markers will help rescuers follow your trail.

A3. A cross of sticks or stones.

Teaching Point 3 — **Conduct a Group Discussion and Debrief the Cadets on Their Experiences While on the Hike**

Time: 15 min — Method: Group Discussion

BACKGROUND KNOWLEDGE

The point of the group discussion is to draw trailblazing experiences from the group using the tips for answering/facilitating discussion and the suggested questions provided.

GROUP DISCUSSION

TIPS FOR ANSWERING/FACILITATING DISCUSSION

- Establish ground rules for discussion, e.g. everyone should listen respectfully; don't interrupt; only one person speaks at a time; no one's ideas should be made fun of; you can disagree with ideas but not with the person; try to understand others as much as you hope they understand you; etc.
- Sit the group in a circle, making sure all cadets can be seen by everyone else.
- Ask questions that will provoke thought; in other words avoid questions with yes or no answers.
- Manage time by ensuring the cadets stay on topic.
- Listen and respond in a way that indicates you have heard and understood the cadet. This can be done by paraphrasing their ideas.
- Give the cadets time to respond to your questions.
- Ensure every cadet has an opportunity to participate. One option is to go around the group and have each cadet answer the question with a short answer. Cadets must also have the option to pass if they wish.
- Additional questions should be prepared ahead of time.

SUGGESTED QUESTIONS

Q1. What was the most significant aspect of the hike?

Q2. What was the most practical part of trailblazing?

Q3. Can anyone think of other ways to trailblaze?

Q4. Why did the syndicate use flagging tape instead of foliage?

Q5. What signal means "Not this way"?

Other questions and answers will develop throughout the group discussion. The group discussion should not be limited to only those suggested.

Reinforce those answers given and comments made during the group discussion, ensuring the teaching point has been covered.

CONFIRMATION OF TEACHING POINT 3

The cadets' participation in the group discussion will serve as the confirmation of TP3.

END OF LESSON CONFIRMATION

The cadets' participation in the hike and trailblazing activity will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

N/A.

CLOSING STATEMENT

Hiking is an important outdoor activity which promotes physical fitness. In a survival situation trailblazing can help searchers find your camp and it can help you find your way back to your camp should you leave in search of survival items.

INSTRUCTOR NOTES/REMARKS

A whistle will be carried by every cadet as a safety precaution.

REFERENCES

A2-001 A-CR-CCP-951/PT-002 D Cdts 3. (2006). *Royal Canadian Army Cadets Adventure Training Safety Standards.* Ottawa, ON: Department of National Defence.

THIS PAGE INTENTIONALLY LEFT BLANK