ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL FOUR

INSTRUCTIONAL GUIDE

SECTION 1

EO C429.01 – EXPLAIN REGULATIONS AND OPERATING PROCEDURES FOR AVIATION TRANSMISSION AND LICENSING

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-804/PG-001, *Proficiency Level Four Qualification Standard and Plan*, 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 *Study Guide for the Restricted Operator Certificate With Aeronautical Qualification (ROC-A)* (RIC-21) available at http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01397.html, for each cadet.

PRE-LESSON ASSIGNMENT

Nil.

APPROACH

An interactive lecture was chosen for this lesson to clarify, emphasize and summarize regulations and operating procedures for aviation transmission and licensing.

INTRODUCTION

REVIEW

Nil.

OBJECTIVES

By the end of this lesson the cadet shall have explained regulations and operating procedures for aviation transmission and licensing.

IMPORTANCE

It is important for cadets to explain regulations and operating procedures as the knowledge gives the cadets a better understanding of aviation transmission and licensing procedures. This knowledge is required to obtain the Industry Canada Restricted Operator Certificate with Aeronautical Qualification (ROC-A).

Distribute one copy of the *Study Guide for the Restricted Operator Certificate With Aeronautical Qualification (ROC-A) (RIC-21)* to each cadet. Have the cadets follow along with the study guide as content is presented.

Teaching Point 1 **Explain priorities, privacy, and control of communication.**

Time: 5 min Method: Interactive Lecture

PRIORITIES

The priority of messages by flight service stations are:

- emergency communications, to include:
  - distress communication, and
  - urgency communications;
- flight safety communications, such as:
  - air traffic control (ATC) clearances,
  - airport advisories,
  - position reports, and
  - air file flight plans;
- scheduled broadcasts,
- unscheduled broadcasts,
  - notices to airmen (NOTAMS),
  - significant meteorological information (SIGMET), and
  - pilot weather report (PIREP); and
- other air-ground communications.

PRIVACY

No person shall reveal the contents, or the existence of communications transmitted, received, or intercepted by a radio station. Exceptions to this rule include revealing the contents to:

- the addressee of the message,
- authorized officials of the Government of Canada,
- officers of the court, and
- the operator of a telecommunication system necessary to forward or deliver the message.

The restrictions do not apply to the following messages:

- distress,
- urgency,
- safety, and
- ALL STATIONS addressed, such as:
    - weather reports, and
    - storm warnings.

CONTROL OF COMMUNICATION

An aircraft station will comply with instructions given by a ground station relating to:

- the order and time of transmission,
- the choice of frequency, and
- the duration and suspension of communications.

The ground station normally retains transmission control with communications between ground and aircraft stations.

The aircraft station called by another aircraft becomes the controlling station.

Radio communication between stations should be restricted to safety and flight regularity. Unauthorized communication, profane or obscene language, and calls that interfere with or interrupt the working of another radio station can result in a fine not exceeding $5 000 and / or imprisonment for a term not exceeding one year. Anyone who knowingly sends, transmits, or causes any false or fraudulent distress signal, message, call, or radiogram of any kind may receive similar fines and / or imprisonment. A corporation can be fined up to $25 000.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS:

Q1. What messages have highest priority?

Q2. Which station retains transmission control between ground and aircraft stations?

Q3. What is the maximum fine given to an individual for unauthorized communications or interference with another radio station?

ANTICIPATED ANSWERS:

A1. Emergency communications.

A2. Ground station.

A3. $5 000.

Teaching Point 2 **Explain time, date, and transmission of numbers.**

Time: 5 min Method: Interactive Lecture

Have the cadets follow along with the study guide as content is presented.

TIME

The 24-hour system is used to express time during radiocommunication. Time is expressed using four figures; the first two representing the hour past midnight and the last two representing the minutes past the hour.

Time is usually referenced to one standard time zone. If communication is conducted in a single time zone, local time is used.

Standard time zones are indicated as the following:

- Newfoundland N
- Atlantic A
- Eastern E
- Central C
- Mountain M
- Pacific P
- Yukon Y

Examples of time references include:

- 12:45 a.m. expressed as 0045,
- 7:40 a.m. expressed as 0740,
- 12:00 p.m. expressed as 1200,
- 1:35 p.m. expressed as 1335,
- 4:07 p.m. (EST) expressed as 1607 E,
- 7:40 p.m. expressed as 1940, and
- 9:50 p.m. (PST) expressed as 2150 P.

Coordinated Universal Time (UTC), also known as Zulu time (Z) or Greenwich Mean Time (GMT), is used to avoid confusion between different time zones. An example of UTC is 0539Z expressed as ZERO FIFE TREE NINER ZULU.

To convert local time to Zulu time add:

- 2.5 hours to Newfoundland Daylight Time (NDT),
- 3.5 hours to Newfoundland Standard Time (NST),
- 3 hours to Atlantic Daylight Time (ADT),
- 4 hours to Atlantic Standard Time (AST),
- 4 hours to Eastern Daylight Savings Time (EDT),
- 5 hours to Eastern Standard Time (EST),
- 5 hours to Central Daylight Savings Time (CDT),
- 6 hours to Central Standard Time (CST),
- 6 hours to Mountain Daylight Savings Time (MDT),
- 7 hours to Mountain Standard Time (MST),
- 7 hours to Pacific Daylight Savings Time (PDT), and
- 8 hours to Pacific Standard Time (PST) .

DATE

The date is expressed as a six-figure group. The first two figures represent the day of the month and the last four figures indicate the time.

TRANSMISSION OF NUMBERS

When referring to numbers, each digit is pronounced separately, except whole thousands. Whole thousands are communicated by pronouncing each digit in the number of thousands followed by the word thousand expressed as TOU-SAND. The word hundred is expressed as HUN-DRED. If a decimal is within the number, the word decimal is pronounced DAY-SEE-MAL. For example:

- 8 000 is expressed as AIT TOUSAND,
- 150 is expressed as WUN FIFE ZERO, and
- 75 is expressed as SEVEN FIFE.

Monetary denominations are transmitted with groups of digits including the decimal. Dollars is expressed if monetary denomination is higher than one dollar. For example, $28.45 is expressed as DOLLARS TOO AIT DAY-SEE-MAL FOWER FIFE.

Altitude above sea level is expressed in thousands plus hundreds of feet. Separate digits are used to express flight level. For example:

- 2 800 is expressed as TOO TOUSAND AIT HUNDRED, and
- FL375 is expressed as FLIGHT LEVEL TREE SEVEN FIFE.

Aircraft type numbers are expressed in group forms. For example:

- Flight 498 is expressed as FLIGHT FOWER NINER AIT, and
- DC10 is expressed as DC TEN.

Wind speed and cloud formation heights are expressed in group forms. For example:

- Wind 270 / 10 is expressed as WIND TOO SEVEN ZERO DEGREES WUN ZERO KNOTS, and
- 36BKN is expressed as THIRTY SIX HUNDRED BROKEN.

Aircraft headings are given in groups of three digits. For example:

- 005 degrees is expressed as HEADING ZERO ZERO FIFE, and
- 350 degrees is expressed as HEADING TREE FIFE ZERO.

Aerodrome elevation is expressed in feet using the expression FIELD ELEVATION. For example:

- 178 is expressed as FIELD ELEVATION WUN SEVEN AIT, and
- 4900 is expressed as FIELD ELEVATION FOWER TOUSAND NINER ZERO ZERO.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS:

Q1. How is time expressed for the 24-hour system?

Q2. How many figures will be used to express date and time together?

Q3. How is aerodrome elevation expressed?

ANTICIPATED ANSWERS:

A1. Four figures.

A2. Six figures.

A3. In feet using the expression FIELD ELEVATION.

Teaching Point 3 **Explain operating procedures.**

Time: 5 min Method: Interactive Lecture

Have the cadets follow along with the study guide as content is presented.

OPERATING PROCEDURES

Words and Phrases

Slang expressions are not used during radiocommunication procedures including:

- ten-four,
- over and out,
- breaker-breaker, and
- come in please.

Standard phrases and words are used whenever applicable including:

Acknowledge	Let me know that you have received and understood this message.
Affirmative	Yes or permission granted.
Break	Indicates the separation between portions of the message (to be used where there is no clear distinction between the text and other portions of the message).
Channel	Change to Channel ____ before proceeding.
Cleared	Authorized to proceed under the conditions specified.
Confirm	Have I received the following ____? or Did you receive the message?
Correction	An error has been made in this transmission (or message). The correct version is ____.
Disregard	Consider this transmission as not sent.
Do you read?	I have called you more than once. If you are receiving me, reply.
Go ahead	Proceed with your message.
How do you read me?	What is the readability of my transmission?
I say again	I will repeat.
Monitor	Listen on (frequency).
Negative	No or that is not correct or I do not agree.
Out	Conversation is ended and no response is expected.
Over	My transmission is ended and I expect a response from you.
Read back	Repeat all or the specified part of this message back to me exactly as received (do not use the word Repeat).
Roger	Okay, I have received all of your last transmission.
Say again	Repeat.
Stand by	I must pause for a few seconds or minutes, please wait and I will call you.
Seelonce	International expression to indicate that silence has been imposed on the frequency due to a distress situation.
Seelonce feenee	International expression to indicate that the distress situation has ended.
That is correct	Self-explanatory.
Verify	Check coding or text to confirm with originator.

Wilco	Your instructions received, understood, and will be complied with.
Words twice	As a request, communication is difficult, please send each word or group of words twice, or As information, since communication is difficult, I will send each word or group of words twice.

Call Signs

Call signs are assigned for identification purposes and should be used when contact is being established and again when communications are concluded. An aircraft's call sign can be the same as the aircraft's markings. Transport Canada (TC) assigns call signs and marks to aircraft.

Aircraft marks include C- (Canadian nationality mark) followed by the four–letter registration marks with aircraft letters starting with G or F and ultralight letters starting with I.

Aircraft registered before January 1, 1974 are identified with the nationality mark CF.

Aeronautical call signs are pronounced phonetically. During the initial contact, the manufacturer's name or type of aircraft is included, followed by the four letters of the registration. In further communications, the caller letters can be abbreviated to the last three letters.

- Cessna 172 GFLR is expressed as CESSNA WUN SEVEN TOO GOLF FOXTROT LIMA ROMEO then FOXTROT LIMA ROMEO, and
- Ultralight IKKO is expressed as ULTRALIGHT INDIA KILO KILO OSCAR then KILO KILO OSCAR.

Air carriers. Companies use their name followed by the flight number or the last three characters of the aircraft registration.

Civil registration. Private aircraft use the manufacturer's name or the type of the aircraft followed by the last four letters of the registration.

Ground stations. The name of the airport or its geographical location followed by a suitable word indicating the function of the station.

Examples:

- Area control centre: OTTAWA CENTRE,
- Flight information service station: WINNIPEG INFORMATION,
- Surface movement control: TORONTO GROUND,
- Private aeronautical station: RADIO, and
- Company dispatch: DISPATCH.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS:

Q1. Why are call signs assigned?

Q2. Who assigns call signs?

Q3. How are ground station call signs created?

ANTICIPATED ANSWERS:

A1. Identification purpose.

A2. TC.

A3. Call signs are comprised of:

- name of the airport, or the airport geographical location, and
- suitable word indicating the function of the station.

Teaching Point 4 **Explain calling procedures.**

Time: 10 min Method: Interactive Lecture

Have the cadets follow along with the study guide as content is presented.

CALLING PROCEDURES

A ground station that has a radio message for an aircraft within its operational service area may call the aircraft. When a ground station receives calls from several aircraft, the ground station will decide the order to take the calls.

If the radio conditions are good, the station's call sign is stated once but if conditions are poor, it is stated three times.

All stations shall listen to the communication channel before transmitting to ensure the transmission will not interfere with communication already in progress.

A station that has distress, urgency, or safety communications to transmit can interrupt a transmission of lower priority that is in progress.

The call sign of the station or aircraft being called is always spoken first followed by THIS IS and the calling station's or aircraft's call sign.

Single Station Call

A transmission is sent to a single station by stating:

- the call sign of the station being called,
- this is,
- the call sign of the station calling,
- the frequency on which the calling station is transmitting, and
- over (invitation to reply).

Example:

OTTAWA TOWER, (OTTAWA TOWER, OTTAWA TOWER),
THIS IS,
CESSNA WUN SEVEN TOO FOXTROT ALFA DELTA TANGO,
ON FREQUENCY WUN WUN AIT DAY-SEE-MAL SEVEN,
OVER.

All Station General Call

When a station needs to establish communication with any station within range or in a certain area, the call should be made to all stations.

Example:

ALL STATIONS, ALL STATIONS, ALL STATIONS,
THIS IS,
TORONTO RADIO (say three times if necessary),
BE ADVISED OF ___ IN THE AREA ___,
OUT.

Multiple Station Call

When more than one station is being called, the call signs of the desired stations may be transmitted in any sequence followed by THIS IS. The operators replying to multiple station calls should reply in the order in which they were called.

Example:

CESSNA WUN SEVEN TOO FOXTROT NOVEMBER INDIA LIMA,
PIPER FOXTROT X-RAY QUEBEC QUEBEC,
PIPER GOLF LIMA LIMA DELTA,
THIS IS,
TORONTO RADIO (say three times if necessary),
OVER.

Replying

Operators hearing a call directed to their station shall reply as soon as possible and advise the calling station to proceed, GO AHEAD or not to proceed with the message, STAND BY followed by the anticipated number of minutes of delay.

Example:

CESSNA WUN SEVEN TOO FOXTROT NOVEMBER INDIA LIMA,
THIS IS,
TORONTO TOWER,
GO AHEAD.

PIPER GOLF LIMA LIMA DELTA,
THIS IS,
TORONTO TOWER,
STAND BY TOO MINUTES.

Corrections and Repetitions

If an error is made during a transmission, the word correction is spoken followed by the correct word or phrase.

Example: PROCEED TO DOCK FIFE CORRECTION DOCK SEVEN.

If the receiving station requires an entire message to be repeated, the operator states SAY AGAIN. If only a portion of the message is required, the receiving station says the following:

- SAY AGAIN ALL BEFORE ____ (the first word satisfactorily received);
- SAY AGAIN ____ (the word before the missing portion) TO ____ (the word after the missing portion); and
- SAY AGAIN ALL AFTER ____ (the last word satisfactorily received).

Example:

VANCOUVER RADIO,
THIS IS,
STINSON FOXTROT ALFA BRAVO CHARLIE,
SAY AGAIN ALL BEFORE HANGAR,
OVER.

WINNIPEG TOWER,
THIS IS,
STINSON FOXTROT ALFA BRAVO CHARLIE,
SAY AGAIN ALTITUDE TO DESCEND,
OVER.

MONTREAL CENTRE,
THIS IS,
STINSON FOXTROT ALFA BRAVO CHARLIE,
SAY AGAIN ALL AFTER FLIGHT PLAN,
OVER.

Message Handling Procedures

When transmitting a message, the radio operator should:

1. Plan the message content before transmitting.
2. Listen briefly before starting to transmit the message to avoid interfering with other transmissions.
3. Deliver the radio message clearly and concisely using standard phrases.

The message format normally consists of the following four parts:

1. The call sign indicating the addressee and the originator.
2. The addressee reply.
3. The message.
4. The acknowledgement or ending.

The words THIS IS and OVER can be omitted on subsequent calls once the initial contact has been made with the addressee.

Example:

Call-up by aircraft	BROCKVILLE RADIO, THIS IS, PIPER FOXTROT ALFA BRAVO CHARLIE, OVER.
Reply by ground station	PIPER FOXTROT ALFA BRAVO CHARLIE, THIS IS, BROCKVILLE RADIO, GO AHEAD.
Message–Aircraft	BROCKVILLE RADIO, PIPER FOXTROT ALFA BRAVO CHARLIE, FOWER MILES AT WUN THOUSAND, LANDING BROCKVILLE.
Message–Ground	PIPER FOXTROT ALFA BRAVO CHARLIE, BROCKVILLE RADIO, ROGER, WIND WUN SIX ZERO DEGREES AT WUN FIFE KNOTS, ALTIMETER TOO NINER NINER SEVEN.
Acknowledgement–Aircraft	BROCKVILLE RADIO, PIPER FOXTROT ALFA BRAVO CHARLIE, ROGER, OUT.

Signal (or Radio) Checks

Call using the appropriate frequency that will not interfere with the normal work of other aircraft or ground stations.

A signal (or radio) check is conducted by:

- calling another aircraft or ground station to request a signal check;
- stating signal (or radio) check 1, 2, 3, 4, 5. How do you read me? Over;
- including station call sign;
- transmitting the signal for less than 10 seconds; and
- replying or receiving a reply to a signal (or radio) check, use the following readability scale:
    - 1–bad (unreadable),
    - 2–poor (readable now and then),
    - 3–fair (readable but with difficulty),
    - 4–good (readable), and
    - 5–excellent (perfectly readable).

Communication checks are categorized as follows:

- signal check (made while aircraft is airborne),
- pre-flight check (made prior to departure), and
- maintenance check (made by ground maintenance).

Example:

Call-up by aircraft	WATSON LAKE RADIO, THIS IS, CESSNA FOXTROT ALFA BRAVO CHARLIE, REQUEST SIGNAL CHECK ON FREQUENCY FIFE SIX DAY-SEE-MAL AIT ZERO.
Response by station	CESSNA FOXTROT ALFA BRAVO CHARLIE, THIS IS, WATSON LAKE RADIO, READING YOU STRENGTH FIFE, OVER.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS:

Q1. When is the call sign not stated three times?

Q2. When can a station interrupt with the call of another station?

Q3. What does the radio operator do when transmitting a message?

ANTICIPATED ANSWERS:

A1. When the radio conditions are good.

A2. When it has a distress, urgency, or safety communication to transmit.

A3. The radio operator will:

- plan the message content;
- listen briefly before starting to transmit the message to avoid interfering with other transmissions; and
- deliver the radio message clearly and concisely using standard phrases.

END OF LESSON CONFIRMATION

QUESTIONS:

Q1. List the priority of messages.

Q2. How are date and time expressed?

Q3. What phrase is used when a station needs to establish communication with any station within range or in a certain area?

ANTICIPATED ANSWERS:

A1. Priority of messages include:

- emergency communications,
- flight safety communications,
- scheduled broadcasts,
- unscheduled broadcasts, and
- other air-ground communications.

A2. Six figures:

- first two figures represent the day of the month,
- next two figures represent the hour past midnight, and
- last two figures represent the minutes past the hour.

A3. ALL STATIONS.

CONCLUSION

HOMEWORK / READING / PRACTICE

Review the phonetic alphabet on page 6 in *Study Guide for the Radiotelephone Operator's Restricted Certificate (Aeronautical) (ROC-21)*.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-804/PG-001*Proficiency Level Four Qualification Standard and Plan*, Chapter 3, Annex B, 429 PC.

CLOSING STATEMENT

Being able to explain regulations and operating procedures gives the cadets a better understanding of aviation transmission and licensing procedures. This knowledge is required to obtain the Industry Canada Restricted Operator Certificate with Aeronautical Qualification (ROC-A).

INSTRUCTOR NOTES / REMARKS

If the squadron chooses to have cadets obtain the ROC-A, all complimentary EOs for this PO must be instructed and a qualified examiner must conduct 429 PC.

Cadets who are qualified Advanced Aviation may assist with this instruction.

REFERENCES

C3-116 ISBN 0-9680390-5-7 MacDonald, A. F., & Peppler, I. L. (2000). *From the ground up: Millennium edition*. Ottawa, ON: Aviation Publishers Co. Limited.

C3-182 *Study Guide for the Restricted Operator Certificate With Aeronautical Qualification (ROC-A) (RIC-21)*. (2008). Retrieved September 28, 2008, from www.ic.gc.ca/epic/site/smt-gst.nsf/en/sf01397e.html

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL FOUR

INSTRUCTIONAL GUIDE

SECTION 2

EO C429.02 – COMMUNICATE USING RADIO PROCEDURES FOR AVIATION TRANSMISSION

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-804/PG-001, *Proficiency Level Four Qualification Standard and Plan*, 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 the handouts located at Attachments A and B for each cadet.

PRE-LESSON ASSIGNMENT

Read and practice the phonetic alphabet on page 6 in *Study Guide for the Radiotelephone Operator's Restricted Certificate (Aeronautical) (ROC-A)*.

APPROACH

An interactive lecture was chosen for TP 1–4 to clarify, emphasize and summarize radio procedures for aviation transmission.

An in-class activity was chosen for TP 5 as an interactive way to confirm the cadets' comprehension of radio procedures for aviation transmission.

INTRODUCTION

REVIEW

Nil.

OBJECTIVES

By the end of this lesson the cadet shall have communicated using common phrases, identified priority communications and emergency transmissions and conducted a radio check.

IMPORTANCE

It is important to know the correct radio phrases while communicating over a radio (for aviation transmissions). The cadet will use accurate terminology to communicate messages clearly and concisely.

Teaching Point 1 **Explain the standard phrases used in a radio message.**

Time: 5 min Method: Interactive Lecture

Distribute the handout showing procedural words and phrases located at Attachment A to each cadet.

The way that one talks on the air is guided by national and international standards. In aviation, common phrases and words are used to communicate radio messages. Citizen Band (CB) phrases, such as Ten-Four, Over and Out and Breaker Breaker will not be used.

Word or Phrase	Meaning
Acknowledge	Let me know that you have received and understood this message.
Affirmative	Yes, or permission granted.
Break	Indicates the separation between portions of the message. (To be used where there is no clear distinction between the text and other portions of the message.)
Confirm	My version is … Is that correct?
Correction	An error has been made in this transmission (message indicated). The correct version is ….
Do you read	I have called you more than once. If you are receiving me, reply.
Go ahead	Self-explanatory.
How do you read?	Self-explanatory.
I say again	Self-explanatory (use instead of "I REPEAT").
Negative	No, or that is not correct, or I do not agree.
Out	Conversation is ended and no response is expected.
Over	My transmission is ended and I expect a response from you.
Read back	Repeat all of this message back to me exactly as received after I have given "OVER" (do not use the word "REPEAT").
Roger	I have received all of your last transmission.
Say again	Self-explanatory. (Do not use the word "REPEAT".)
Speak slower	Self-explanatory.
Stand by	I must pause for a few seconds or minutes, please wait.
That is correct	Self-explanatory.
Verify	Check coding, check text with originator and send correct version.
Wilco	Your instructions received, understood and will be complied with.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS:

Q1. What terminology will not be used when communicating an aviation radio message?

Q2. How do you say "Yes", or permission granted?

Q3. How do you say that the transmission has ended and a response is expected?

ANTICIPATED ANSWERS:

A1. CB phrases.

A2. Affirmative.

A3. Over.

Teaching Point 2 **Explain priority of communication.**

Time: 5 min Method: Interactive Lecture

PRIORITY OF COMMUNICATION

Radio transmissions are communicated in the following priority:

1. emergency communications, to include:
    a. distress,
    b. urgency,
    c. safety; and
2. flight safety communications, to include
    a. Air Traffic Control (ATC) clearance (authorization from ATC for an aircraft to land, take-off, etc),
    b. airport advisories (landing and takeoff information about wind direction and velocity, favoured runway, airport conditions such as snow, known hazards, etc),
    c. position reports (identification of surrounding aircraft, present position, altitude, type of flight plan and destination), and
    d. air filed flight plans, etc;
3. scheduled broadcasts (Automated Terminal Information Service (ATIS), recorded information for arriving and departing aircraft such as airport name, weather information, departure runways, etc);
4. unscheduled broadcasts, to include:
    a. Notices to Airmen (NOTAMS) (dangerous or restricted areas, airport construction, changes in navigation and control procedures),
    b. Significant Meteorological Information (SIGMET) (messages to aircraft in flight of severe and hazardous weather conditions which include severe turbulences, thunderstorms, etc), or
    c. Pilot Weather Report (PIREP) (unpredicted thunderstorms, turbulences, visibility, etc); and
5. other air-ground or air-to-air communications (conversations about personal information such as estimated time of arrival (ETA) for personal reasons, meals, etc).

CONFIRMATION OF TEACHING POINT 2

QUESTIONS:

Q1. What type of communication has highest priority?

Q2. ATC clearance is where on the communication priority position?

Q3. Unscheduled broadcasts include what types of communication?

ANTICIPATED ANSWERS:

A1. Emergency communications (distress, urgency and safety calls).

A2. Second.

A3. Notices to Airmen (NOTAMS), Significant Meteorological Information (SIGMET) or a Pilot Weather Report (PIREP).

Teaching Point 3 **Explain emergency transmissions.**

Time: 5 min Method: Interactive Lecture

EMERGENCY TRANSMISSIONS

Emergency transmissions have first priority in communications and are transmitted using specific terms which are repeated three times.

Distress

Distress calls have absolute priority over all other transmissions. Anyone hearing it will cease any transmission capable of interfering. Distress calls indicate that the aircraft is threatened by grave and / or imminent danger, such as an engine loss and require immediate assistance.

The transmission for distress is "MAYDAY" "MAYDAY" "MAYDAY".

Urgency

Urgency calls are addressed to all stations or a specific station. Urgency calls concern the safety of the aircraft, someone on board or within sight, such as a lost position but does not require immediate assistance.

The transmission for urgency is "PAN PAN" "PAN PAN" "PAN PAN".

Safety

Safety messages address the safety of navigation or important meteorological warning to aircraft in flight such as severe turbulences.

The transmission for safety is "SECURITY" "SECURITY" "SECURITY".

CONFIRMATION OF TEACHING POINT 3

QUESTIONS:

Q1. What word do you use to start your radio transmission when your engine stops?

Q2. What word do you use to start your radio transmission when you have lost your position?

Q3. What word do you use to start your radio transmission when you want to report an important meteorological warning to other aircraft in flight?

ANTICIPATED ANSWERS:

A1. "MAYDAY".

A2. "PAN PAN".

A3. "SECURITY".

Teaching Point 4 **Explain a radio check.**

Time: 5 min Method: Interactive Lecture

RADIO CHECK

Radio checks are used to assess the serviceability of the communication equipment. Radio checks use a 1–5 scale to assess the readability and strength of the transmission.

Readability

Readability assesses the ability to understand the communication. Readability is confirmed using the scale of 1–5 to relate to levels of understanding to include:

- 1–unreadable,
- 2–readable now and then,
- 3–readable with difficulty,
- 4–readable, and
- 5–perfectly readable.

Strength

Strength assesses how strong the radio signal is being received. Strength is confirmed using the 1–5 scale which relates to levels of radio strength to include:

- 1–bad,
- 2–poor,
- 3–fair,
- 4–good, and
- 5–excellent.

When a radio check is requested, the response uses the numerical scale for readability then strength, such as 4 / 3 (readable / fair strength) or 3 / 5 (readable with difficulty / excellent strength). If both readability and strength are at the maximum scale, the response is five.

Radio checks may be conducted as part of the pre-flight check, ground maintenance check and while airborne to check the serviceability of communication equipment. Radio checks should not be conducted on an active ATC frequency.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS:

Q1. Why is a radio check conducted?

Q2. A radio transmission is readable with difficulty and has good strength. What is the response?

Q3. Radio checks are done in three categories. Name each.

ANTICIPATED ANSWERS:

A1. To assess the serviceability of the communication equipment.

A2. Three by four.

A3. Signal check (when airborne), pre-flight check (prior to departure) and maintenance check (made by ground maintenance).

Teaching Point 5 **Have the cadets, in pairs, conduct station-to-station calls using the ITU phonetic alphabet and numbers, and conduct a signal check.**

Time: 5 min Method: In-Class Activity

ACTIVITY

Radios should be set to different frequencies. The cadets have previously learned this procedure during EO M290.06 (Operate a Hand-Held Radio).

The number of radios available per squadron varies. If necessary, one pair of cadets will complete the activity and a second pair of cadets will critique their technique. Groups will switch roles and repeat the activity.

OBJECTIVE

The objective of this activity is for the cadets to send and receive messages using the ITU phonetic alphabet and numbers.

RESOURCES

- Hand-held radio (one per group), and
- Radio Activity located at Attachment B.

ACTIVITY LAYOUT

Nil.

ACTIVITY INSTRUCTIONS

1. Divide the cadets into pairs.
2. Provide each pair of cadets with a hand-held radio and a copy of the radio activity.
3. Have the cadets complete the radio worksheet.
4. Have one cadet transmit the message to their partner by:
    a. turning the radio on;
    b. using message parts, to include:
        (1) initiating a call with "____" this is "____", over;
        (2) answering a call with "____" this is "____", go ahead, over";
        (3) requesting a signal check on a different frequency;
        (4) responding to the request; and
        (5) acknowledging the call and ending the call with "out";
    c. using radio techniques; and
    d. turning the radio off.
5. Have the cadets switch roles and repeat Step 4.

SAFETY

Nil.

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. How do you say that the transmission has ended and you expect a response?

Q2. Air-ground and air-to-air communication of a personal nature is where on the communication priority?

Q3. What three words are used and in what order, to announce emergency transmissions?

Q4. During a radio check, both readability and strength are at the maximum, what is the response?

ANTICIPATED ANSWERS:

A1. Over.

A2. Last.

A3. MAYDAY, PAN PAN, AND SECURITY.

A4. Five.

CONCLUSION

HOMEWORK / READING / PRACTICE

Nil.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-804/PG-001*Proficiency Level Four Qualification Standard and Plan*, Chapter 3, Annex B, 429 PC.

CLOSING STATEMENT

The cadets are better prepared to communicate using the standard radio phrases, priority of communications, emergency phrases and are able to conduct a radio check. The knowledge learned will ensure the cadets utilize the correct terminology and radio messages will be clear and concise.

INSTRUCTOR NOTES / REMARKS

If the squadron chooses to have cadets obtain the ROC-A, all complementary EOs for this PO must be instructed, and a qualified examiner must conduct 429 PC.

Cadets who are qualified Advanced Aviation may assist with this instruction.

REFERENCES

C3-116 ISBN 0-9680390-5-7 MacDonald, A.F., & Peppler, I.L. (2000). *From the ground up: Millennium edition*. Ottawa, ON: Aviation Publishers Co. Limited.

C3-182 *Study Guide for the Radiotelephone Operator's Restricted Certificate (Aeronautical)*. (1990). Retrieved October 23, 2007, from www.ic.gc.ca/epic/site/smt-gst.nsf/en/sf01397e.htm

Procedural Words and Phrases

Word or Phrase	Meaning
Acknowledge	Let me know that you have received and understood this message.
Affirmative	Yes, or permission granted.
Break	Indicates the separation between portions of the message. (To be used where there is no clear distinction between the text and other portions of the message.)
Confirm	My version is … Is that correct?
Correction	An error has been made in this transmission (message indicated). The correct version is ….
Do you read?	I have called you more than once. If you are receiving me, reply.
Go ahead	Self-explanatory.
How do you read?	Self-explanatory.
I say again	Self-explanatory (use instead of "I REPEAT").
Negative	No, or that is not correct, or I do not agree.
Out	Conversation is ended and no response is expected.
Over	My transmission is ended and I expect a response from you.
Read back	Repeat all of this message back to me exactly as received after I have given "OVER" (do not use the word "REPEAT").
Roger	I have received all of your last transmission.
Say again	Self-explanatory. (Do not use the word "REPEAT".)
Speak slower	Self-explanatory.
Stand by	I must pause for a few seconds or minutes, please wait.
That is correct	Self-explanatory.
Verify	Check coding, check text with originator and send correct version.
Wilco	Your instructions received, understood and will be complied with.

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Radio Activity

Send and receive the following message using the ITU phonetic alphabet and numbers.

Make a call sign for this exercise representing an aircraft, including:

- first name and age,
- C–G, and
- three letters.

Example call sign: DOUG 16 C–GABR (DOUG WUN SIX CHARLIE–GOLF ALPHA BRAVO ROMEO).

Make a call sign for this exercise representing the ground station, including:

- home community, and
- radio.

Example call sign: BROCKVILLE RADIO.

Radio Worksheet

Fill in the following sheet to assist with transmitting the message.

Cadet A (initial and age): _____ Aircraft: C–G

Cadet B (initial and age): _____ Aircraft: C–G

Call Sign (local community): _____ RADIO

After the initial call-up, stations do not have to repeat the words THIS IS and OVER.

Sending a Message

Call-up by aircraft:

_____ THIS IS _____ OVER.
Cadet B call sign Cadet A call sign

Reply by ground station:

_____ THIS IS _____ GO AHEAD, OVER.
Cadet A call sign Cadet B station

Message - aircraft:

_____ , _____ SIGNAL CHECK ON 5680.
Cadet B station Cadet A call sign

Message - ground station:

_____ , _____ READING YOU _____
Cadet A call sign Cadet B station (fill in response)

Acknowledgement - aircraft:

_____ , _____ ROGER, OUT.
Cadet B station Cadet A call sign

ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL FOUR

INSTRUCTIONAL GUIDE

SECTION 3

EO C429.03 – DESCRIBE RADIO WAVELENGTHS, SIGNALS, LICENCES AND EQUIPMENT

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-804/PG-001, *Proficiency Level Four Qualification Standard and Plan*, 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 Attachments A and C for each cadet.

Prepare slides located at Attachments B and D.

PRE-LESSON ASSIGNMENT

Nil.

APPROACH

An interactive lecture was chosen for this lesson to orient the cadets to the topic of radio wavelengths, signals, licences, and equipment and to create interest in the subject.

INTRODUCTION

REVIEW

Nil.

OBJECTIVES

By the end of this lesson the cadet shall describe radio wavelengths, signals, licences and equipment.

IMPORTANCE

It is important for cadets to describe radio wavelengths, signals, licences and equipment as it helps them to better understand radio theory and licencing procedures. This information is required knowledge for the Industry Canada Restricted Operator Certificate with Aeronautical Qualification (ROC-A).

Teaching Point 1 **Describe radio wavelengths, frequencies and bands.**

Time: 5 min Method: Interactive Lecture

Distribute the handout located at Attachment A to each cadet. Cadets will label the handout as the information is presented.

CYCLE

Show the slide of Figure B-1 to the cadets.

When a pebble is dropped into water, waves are made. The waves decrease in height or strength as they travel away from the point of origin. The lengths of the waves never vary.

A radio transmitter sends out waves known as wavelengths. The linear measurement of the wave is measured in metres (m). A wavelength is the distance between two successive crests or two successive troughs.

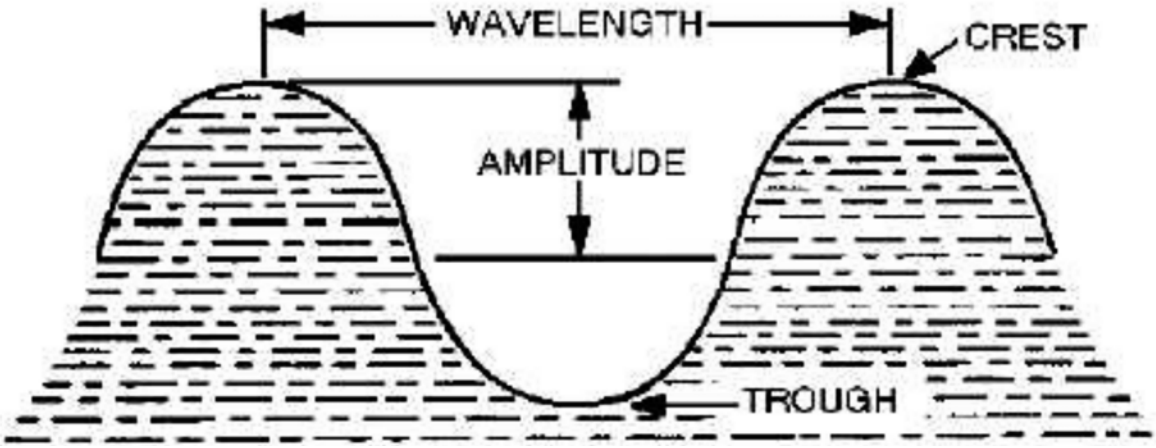

Figure 1 Wavelength

Note. From Integrated Publishing, *Transverse Wave*. Retrieved October 31, 2008, from http://www.tpub.com/content/neets/14182/css/14182_17.htm

Show the slide of Figure B-2 to the cadets.

Every crest (highest part of the wave) is separated by a trough (lowest part of the wave) to create an alternating pattern of crests and troughs known as cycles. A cycle is the period of time in which the wave vibrates up and down.

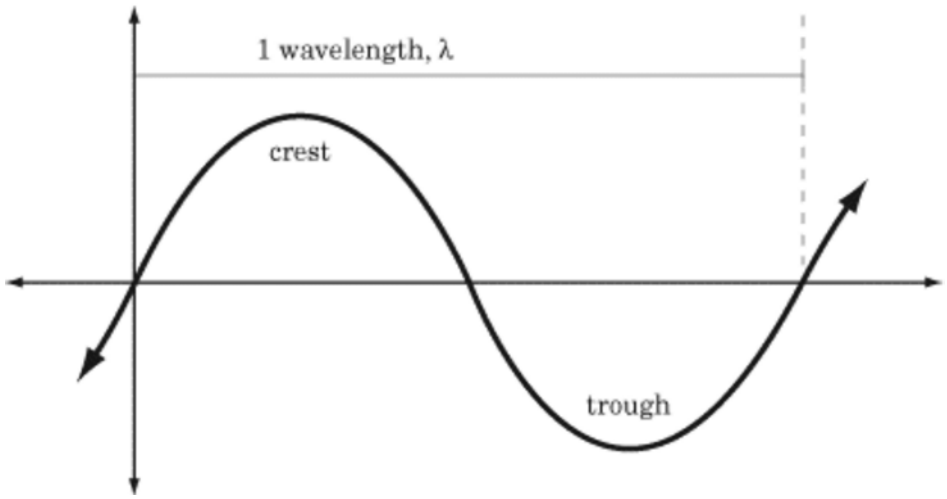

Figure 2 Crest and Trough

Note. From "SparkNotes", 2006, *Crests, Troughs, and Wavelength*. Retrieved October 24, 2008, from http://sparknotes.com/testprep/books/sat2/physics/chapter17section2.rhtml

The number of cycles per second is called frequency. The unit for frequency is the Hertz (Hz) where one Hz is equivalent to one cycle per second.

Show the slide of Figure B-3 to the cadets.

The lowest frequencies have the longest radio waves and the highest frequencies have the shortest radio waves.

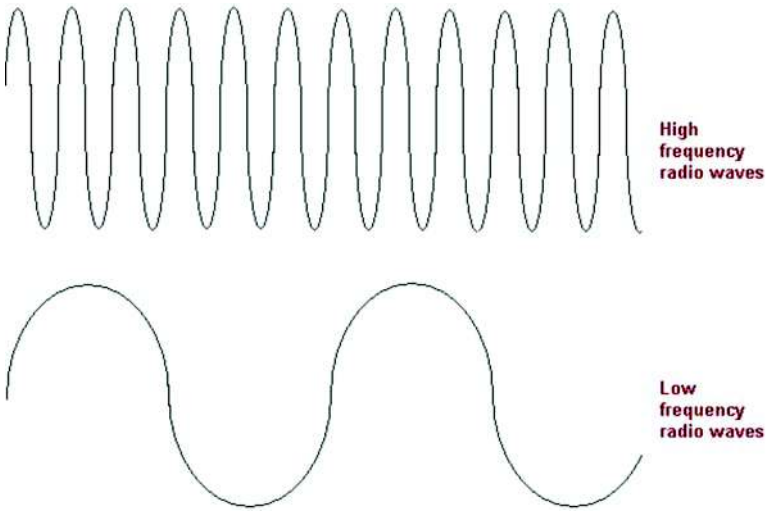

Figure 3 Radio Wave Frequencies

Note. From "Communications System", *What is Frequency?* Retrieved October 24, 2008, from http://qrg.northwestern.edu/project/vss/docs/Communications/1-what-is-frequency.html

KILOHERTZ

Very low to high frequencies are measured in kilohertz (kHz). kHz represents 1 000 waves passing a fixed point in one second.

MEGAHERTZ

Very high frequencies are measured in megahertz (MHz). MHz represents 1 000 kHz or 1 000 000 Hz passing a fixed point in one second.

The relationship between Hz, kHz and MHz can be explained as 1 000 000 Hz = 1 000 kHz = 1 MHz

LOW, MEDIUM, VERY HIGH, AND ULTRA HIGH FREQUENCY BANDS

Radio waves use the electromagnetic spectrum. The spectrum is divided into a number of frequency bands each possessing characteristics that determine the usage. Industry Canada, on behalf of the World Radio Communication Conference (WRC), allocates specific frequency bands to service domestic communication requirements.

Aviation radio communication facilities and radio navigation aids operate in different bands including:

- low frequency (LF),
- medium frequency (MF),
- high frequency (HF),
- very high frequency (VHF), and
- ultra high frequency (UHF).

Low Frequency (LF) Band

Non-directional and marker beacons transmit navigational signals as well as some voice transmissions in the 200–415 and 510–535 kHz band.

Medium Frequency (MF) Band

Commercial broadcasts can be used for directional bearings with automatic direction finding equipment in the 550–1 750 kHz band.

High Frequency (HF) Band

High frequencies are allocated in 100 kHz increments between 2 500–30 000 kHz. Numerous HF frequencies have been given to aviation. HF is excellent for air / ground communication. HF radio is the only way to maintain constant contact at ranges of 4 023 kilometres or more on transoceanic flights.

HF signals can be unpredictable, being affected by the day and night variations of the ionosphere as well as sunspots, auroras, etc.

HF stations in the upper range of HF bands get greater reception distance during daylight hours. Stations in the lower range get greater reception distance during the night.

Remember the mnemonic:

- sun up, frequency up, and
- sun down, frequency down.

Very High Frequency (VHF) Band

The most important band is between 30–300 MHz known as the VHF band. Certain ranges for frequencies have been allocated exclusively for aviation including:

- 108.00–117.98 MHz for navigational stations,
  - VHF omnidirectional range (VOR) stations,
  - instrument landing systems (ILS), and
  - voice reception;
- 118.00–136.00 MHz is allocated for civilian aviation voice communication, and
- 136.00–136.975 MHz is allocated for civilian aviation used mostly for air carriers for en route communication.

The most common VHF frequencies include:

- 121.50 MHz—universal VHF emergency,
- 122.20 MHz—flight service stations in Canada for both transmitting and receiving,
- 122.350–122.700 MHz—private advisory stations transmit and receive,
- 122.800 MHz—universal communications (UNICOM) facility is an air-to-ground communication facility operated by a private agency to provide private advisory station (PAS) service at uncontrolled airports,
- 122.90 MHz—used by aircraft engaged in various private aeronautical activities, such as:
  - parachute jumping,
  - aerial crop spraying, and
  - formation flying;
- 123.400 MHz—used for soaring activities, and
- 126.70 MHz—for transmitting position reports and general communication with a flight service station in uncontrolled airspace.

Ultra High Frequency (UHF) Band

Except for the glide slope portion of the instrument landing system (ILS) and distance measuring equipment (DME), the frequencies lying between 300–3 000 MHz are allocated for government use.

FREQUENCY ALLOCATION

With the numerous VHF channels in use and with changes occurring continuously, it is advisable to state the frequency on which the call is being made to any airway communication station, control tower or other facility.

VHF channels have been allotted for various aeronautical facilities under the Frequency Utilization Plan. Changes to the plan are made from time to time and published in Transport Canada (TC) Information Circulars.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS:

Q1. What is a cycle?

Q2. What does one Hz equal?

Q3. Airway radio communication facilities and radio navigation aids operate in what bands?

ANTICIPATED ANSWERS:

A1. A cycle is the period of time in which the wave vibrates up and down.

A2. One Hz equals one cycle per second.

A3. Airway radio communication facilities and radio navigation aids operate in different bands including:

- low frequency (LF),
- medium frequency (MF),
- high frequency (HF),
- very high frequency (VHF), and
- ultra high frequency (UHF).

Teaching Point 2 **Describe characteristics of radio signals.**

Time: 5 min Method: Interactive Lecture

Radio waves travel both along the Earth and into the atmosphere. Each has characteristics that assist the transmission of the radio signal. Ground waves (surface waves) travel along the contour of the Earth by diffraction. Sky waves (spaces waves) can travel through the air directly to the receiving antenna or can be reflected from the ionosphere.

Distribute the handout located at Attachment C to each cadet. Cadets will label the handout as the information is presented.

Ground Waves

Show the slide of Figure D-1 to the cadets.

Ground waves travel by following the contours of the Earth. Travelling in straight lines, the wave will bend or curve, known as diffraction, around objects. As part of the ground wave comes in contact with the surface, it

loses some of its energy, weakening or attenuating the ground wave. This loss of energy causes a downward tilt which helps the wave follow the Earth's curvature.

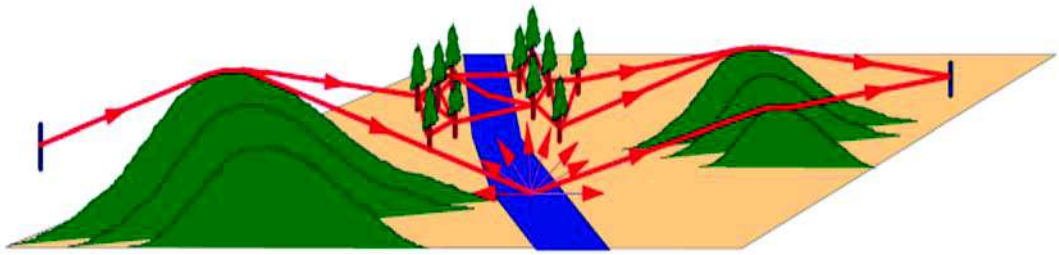

Figure 4 Ground Wave Transmission

Note. From Radio *Wave Diffraction and Scattering Models for Wireless Channel Simulation* (p. 5), by M. Casciato, 2001, Michigan: USA. Copyright 2001 by M. Casciato. Retrieved October 31, 2008, from http://www.eecs.umich.edu/RADLAB/html/NEWDISS/Casciato.pdf

Attenuation of the wave is affected by the nature of the surface. A radio wave will travel further over water, especially salty water, than land. Sand and ice cause poor conductivity compared to rich agricultural or marshy soil. Ground waves work best at lower frequencies.

Sky Waves

Show the slide of Figure D-2 to the cadets.

Transmission beyond the line of sight is possible through sky waves. Sky waves are radio waves that propagate into the atmosphere and bend back to the Earth from the ionosphere at some distance from the transmitter. Long-range communication is the result of sky wave transmission.

Two factors determine sky wave propagation: radio frequency and the level of ionization. Transmission of low, medium and high frequency radio waves vary by night and day. Sky waves travel at a flatter angle during the night. Sunspot activity or electromagnetic disturbances usually means more ionization of the ionosphere. HF communication is enhanced during times of greater sunspot activity.

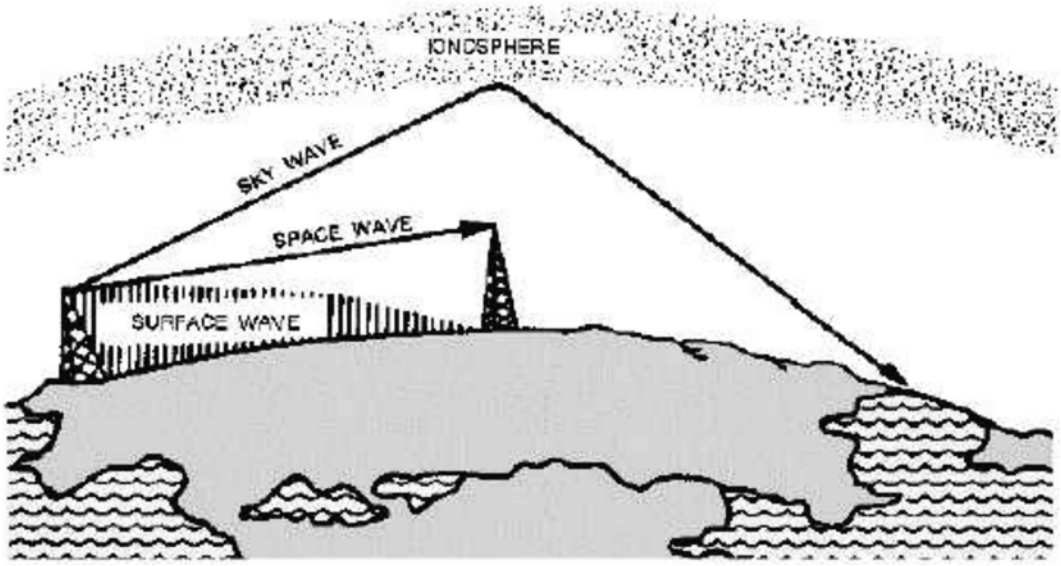

Figure 5 Sky Wave Transmission

Note. From "Integrated Publishing", *Radio Wave Transmission*. Retrieved October 31, 2008, from http://www.tpub.com/content/neets/14182/css/14182_75.htm

CONFIRMATION OF TEACHING POINT 2

QUESTIONS:

Q1. What do ground waves follow?

Q2. What is attenuation?

Q3. From where does a sky wave reflect back to the Earth?

ANTICIPATED ANSWERS:

A1. The curvature of the Earth.

A2. The loss of energy when part of the ground wave comes in contact with the surface.

A3. The ionosphere.

Teaching Point 3 **Describe aeronautical terms and definitions.**

Time: 5 min Method: Interactive Lecture

AERONAUTICAL TERMS AND DEFINITIONS

Aerodrome. Defined as any area, land or water, including any building, installations, and equipment used for the arrival or departure, movement, and servicing of aircraft.

Aeronautical service. A radio communication service that provides for the safety, navigation, and other operations of an aircraft including the exchange of air-to-ground messages.

Aircraft station. A mobile station in the aeronautical service other than a survival craft, located on board an aircraft.

Aeronautical Operation Control Communications (AOCC). Communications related to the regularity of flight.

Aeronautical station. Location on land, on board a ship, or on a platform at sea receiving an aeronautical service. An aeronautical station may be as simple as a hand-held radio.

Air Traffic Control (ATC) Service. A service provided for the purpose of:

- preventing collisions between:
    - aircraft,
    - aircraft and obstructions, and
    - aircraft and vehicles on the manoeuvring area; and
- expediting and maintaining an orderly flow of air traffic.

Controlled aerodrome. An aerodrome at which an ATC service is provided.

Flight Service Station (FSS). A service providing mobile and fixed communications, airport advisory service (AAS), flight information, search and rescue alerting and weather and flight planning services to pilots and other users.

General Aviation Communication (GAC). Communication relating to all civil aviation operations other than for scheduled air service and non-scheduled air transport operations for hire, remuneration, or military aviation.

Ground control communication. ATC service communication provided for the purpose of:

- preventing collisions on the manoeuvring area between aircraft, aircraft and obstacles, or vehicles; and
- expediting and maintaining the orderly flow of aircraft operating on the manoeuvring area.

Private advisory service. A communication service offered at controlled aerodromes for use in connection with company business such as the servicing of aircraft, availability of fuel, lodging, etc.

Private multiple station. An aircraft or aeronautical station established to provide air-to-ground multi-purpose communication of an operational nature.

CONFIRMATION OF TEACHING POINT 3

QUESTIONS:

Q1. What is an aircraft station?

Q2. What is an aeronautical station?

Q3. What is a controlled aerodrome?

ANTICIPATED ANSWERS:

A1. A mobile station in the aeronautical service other than a survival craft located on board an aircraft.

A2. A station located on land, on board a ship or on a platform at sea. It may be as simple as a hand-held radio.

A3. An aerodrome at which an ATC service is provided.

Teaching Point 4 **Describe radio station licences.**

Time: 5 min Method: Interactive Lecture

All radio stations in Canada must be licensed by Industry Canada. The licence specifies:

- call sign of the station,
- frequencies,
- special conditions,
- equipment, and
- fines.

Call Sign of the Station

A distinctive call sign is assigned to each radio station for identification purposes and should be used when initial contact is being established and again when the communication is concluded. Aeronautical call signs should always be pronounced phonetically.

Frequencies

The license will specify frequencies to be used for transmitting. The use of the frequency for activities includes:

- air-to-air,
- air-to-ground instructional, and
- air-to-ground aerodrome traffic communications.

Special Conditions

Each station receives conditions for operation, including: the tower size, interference, and special services.

Equipment

All radio equipment used in aeronautical services is required to be licensed by Industry Canada.

Fines

Any person who establishes a radio station without a radio authorization is liable to a fine not exceeding $5 000, or imprisonment for a term not exceeding one year, or both.

A corporation may receive a fine not exceeding $25 000.

CONFIRMATION OF TEACHING POINT 4

QUESTIONS:

Q1. Why is a call sign assigned?

Q2. What does the licence specify about frequencies?

Q3. What is required for all radio equipment used in aeronautical services?

ANTICIPATED ANSWERS:

A1. A call sign is assigned for identification.

A2. The licence specifies frequencies to be used for transmitting.

A3. All radio equipment used in aeronautical services is required to be licensed by Industry Canada.

Teaching Point 5 **Describe maintenance of equipment.**

Time: 5 min Method: Interactive Lecture

Avionics or radio equipment capable of two-way communication with ground stations or airborne stations include:

- a transceiver (transmitter and a receiver),
- a speaker (headset),
- a microphone, and
- antenna.

Equipment must be maintained and precautions need to be taken to ensure the serviceability of the avionics.

Transceiver (transmitter and a receiver)

A transmitter and a receiver are usually combined and called a transceiver. The transceiver should be warm but not hot to the touch. A cooling kit draws cool air from outside the airplane and pumps it around the equipment.

Headset (speaker)

The speaker(s) are included in the headset. The headset cables should not be knotted but coiled loosely when not being used.

Microphone and Antenna Connections

Microphone and antenna connections vary with the equipment. There should be no shorts or open wires when assembling connectors. Connections should be tight and clean. Where connections are exposed to the weather, they should be protected with a coating of silicone to prevent corrosion and to keep water from getting inside the outer casing of the cable.

Fuses

Electric circuits are protected against overload and short circuits by fuses, each rated for a given amperage. Fuses act as a safety valve. Fuses should never be replaced with one of a higher rating.

CONFIRMATION OF TEACHING POINT 5

QUESTIONS:

Q1. Why should radio equipment be maintained and precautions taken?

Q2. What precautions must be taken when assembling the microphone and antenna connections?

Q3. What is the function of a fuse?

ANTICIPATED ANSWERS:

A1. To ensure serviceability of the avionics.

A2. Ensure there are no shorts or open wires are present.

A3. Protects electric circuits against overload and short circuits.

END OF LESSON CONFIRMATION

QUESTIONS:

Q1. Name the three parts of a wavelength.

Q2. What two factors determine sky wave propagation?

Q3. What does Flight Service Station (FSS) provide?

ANTICIPATED ANSWERS:

A1. A wavelength consists of:

- amplitude,
- trough, and
- crest.

A2. Radio frequency and the level of ionization.

A3. FSS provides service to pilots and other users including:

- mobile and fixed communication,
- airport advisory,
- flight information,
- search and rescue alerting,
- weather, and
- flight planning.

CONCLUSION

HOMEWORK / READING / PRACTICE

Nil.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-804/PG-001*Proficiency Level Four Qualification Standard and Plan*, Chapter 3, Annex B, 429 PC.

CLOSING STATEMENT

Being able to describe radio wavelengths, signals, licences and equipment provides a better understanding of radio theory and licencing procedures. This knowledge is required to obtain the Industry Canada Restricted Operator Certificate with Aeronautical Qualification (ROC-A).

INSTRUCTOR NOTES / REMARKS

If the squadron chooses to have cadets obtain the ROC-A, all complementary EOs for this PO must be instructed and a qualified examiner must conduct the 429 PC.

Cadets who are qualified Advanced Aviation may assist with this instruction.

REFERENCES

C3-116 ISBN 0-9680390-5-7 MacDonald, A. F., & Peppler, I. L. (2000). *From the ground up: Millennium edition*. Ottawa, ON: Aviation Publishers Co. Limited.

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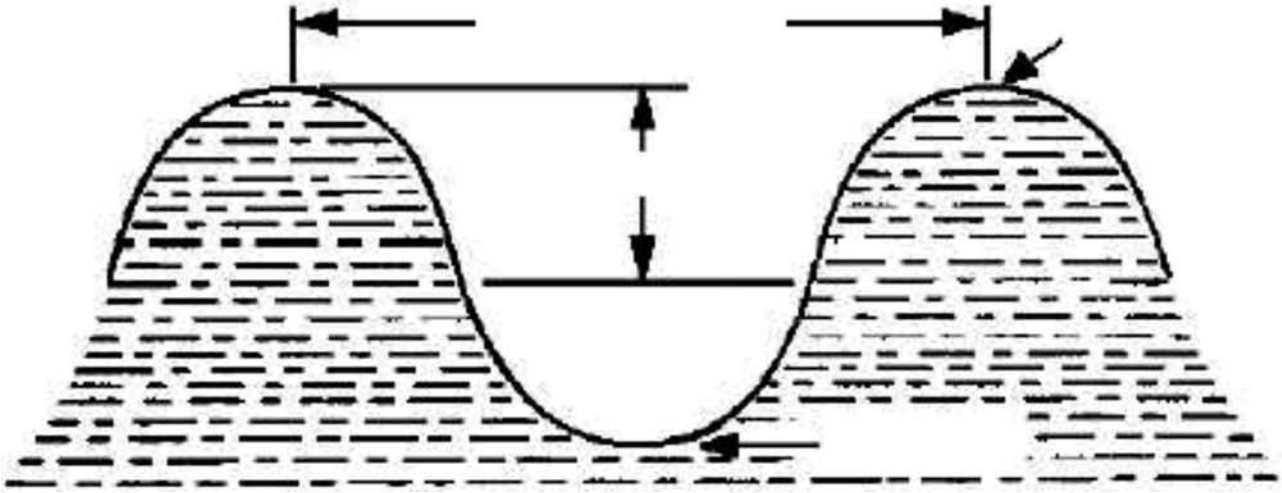


Figure A-1 Transverse Wavelength

Note. From Integrated Publishing, Transverse *Wave*. Retrieved October 31, 2008, from http://www.tpub.com/content/neets/14182/css/14182_17.htm

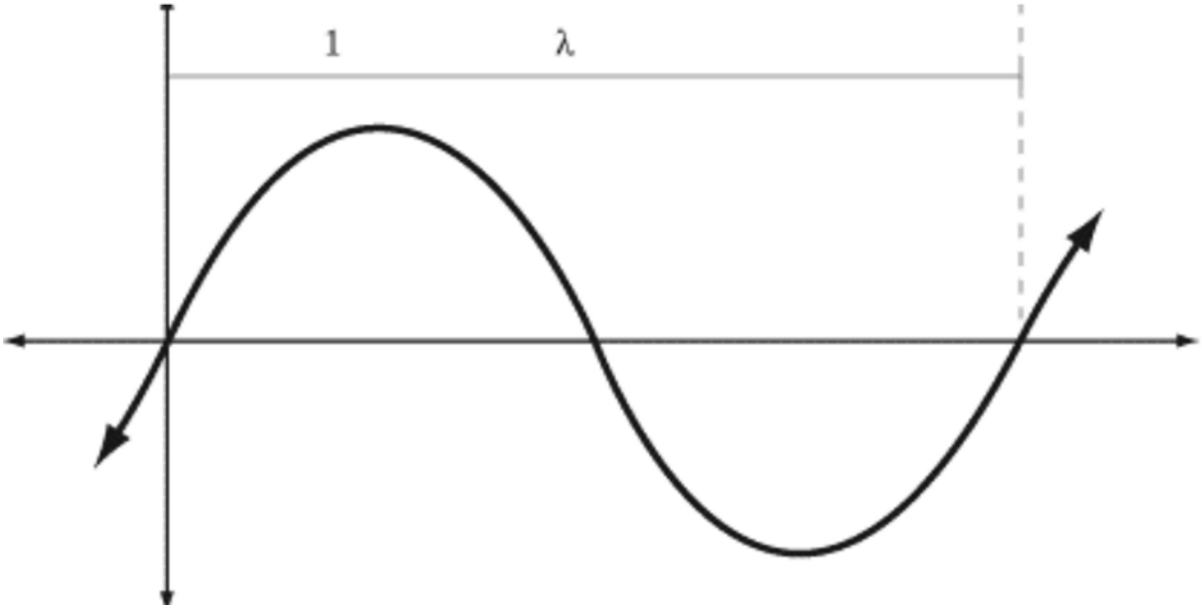


Figure A-2 Crest, Troughs and Trough

Note. From "SparkNotes", 2006, *Crests, Troughs, and Wavelength*. Retrieved October 24, 2008, from http://sparknotes.com/testprep/books/sat2/physics/chapter17section2.rhtml

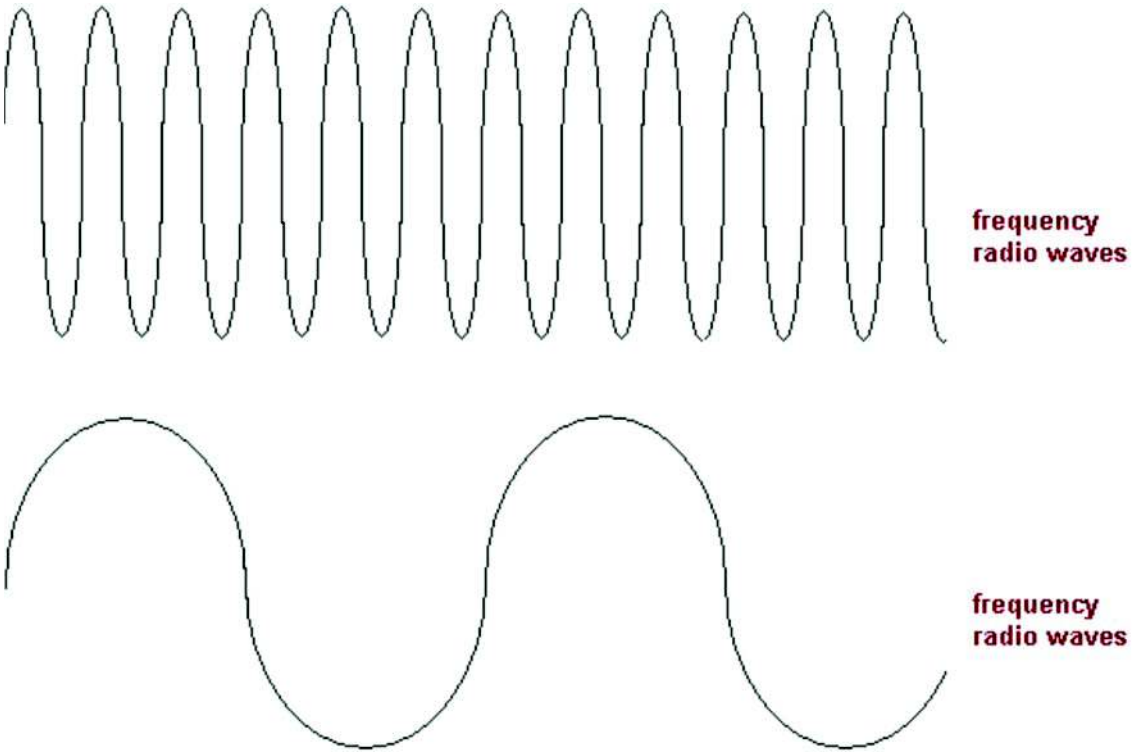
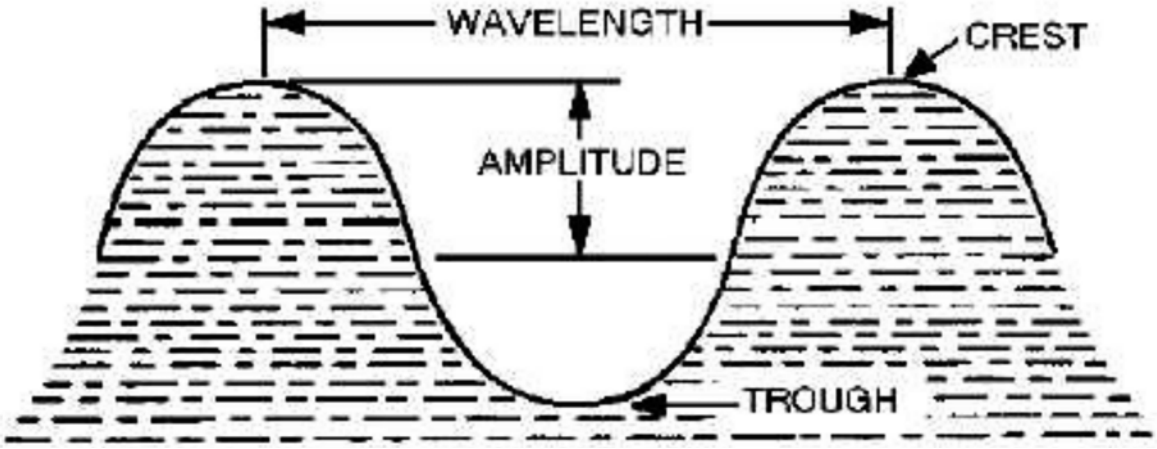


Figure A-3 Radio Wave Frequencies

Note. From "Communications System", *What is Frequency?* Retrieved October 24, 2008, from http://qrg.northwestern.edu/project/vss/docs/Communications/1-what-is-frequency.html



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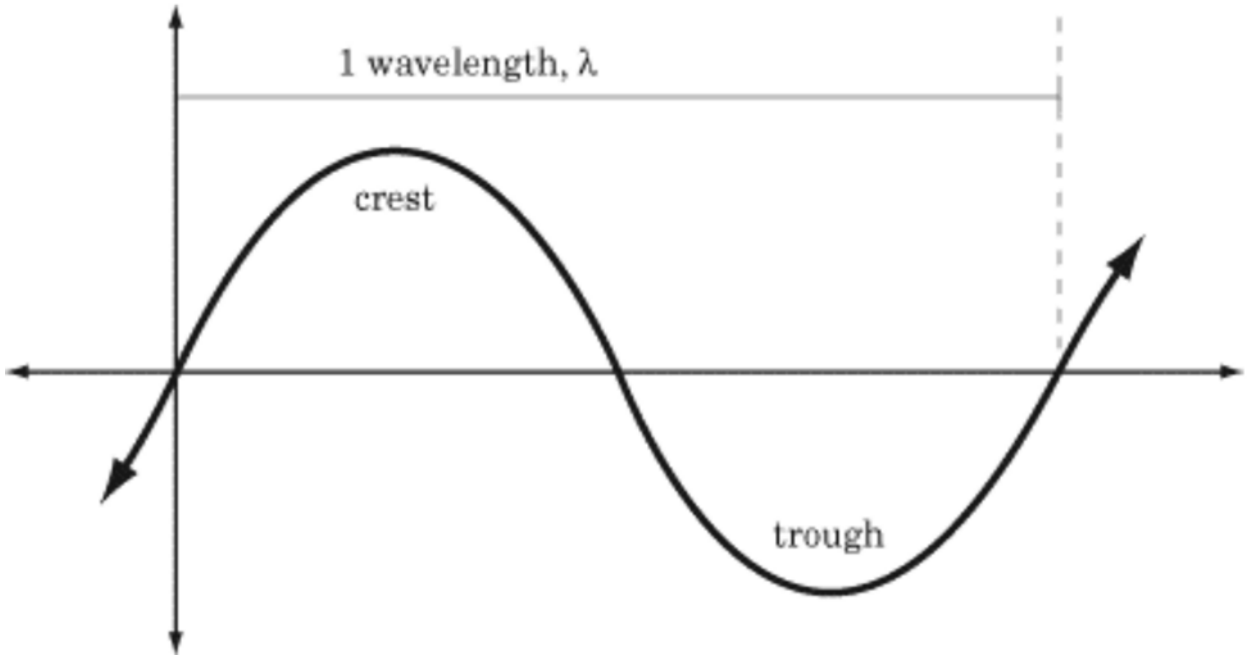

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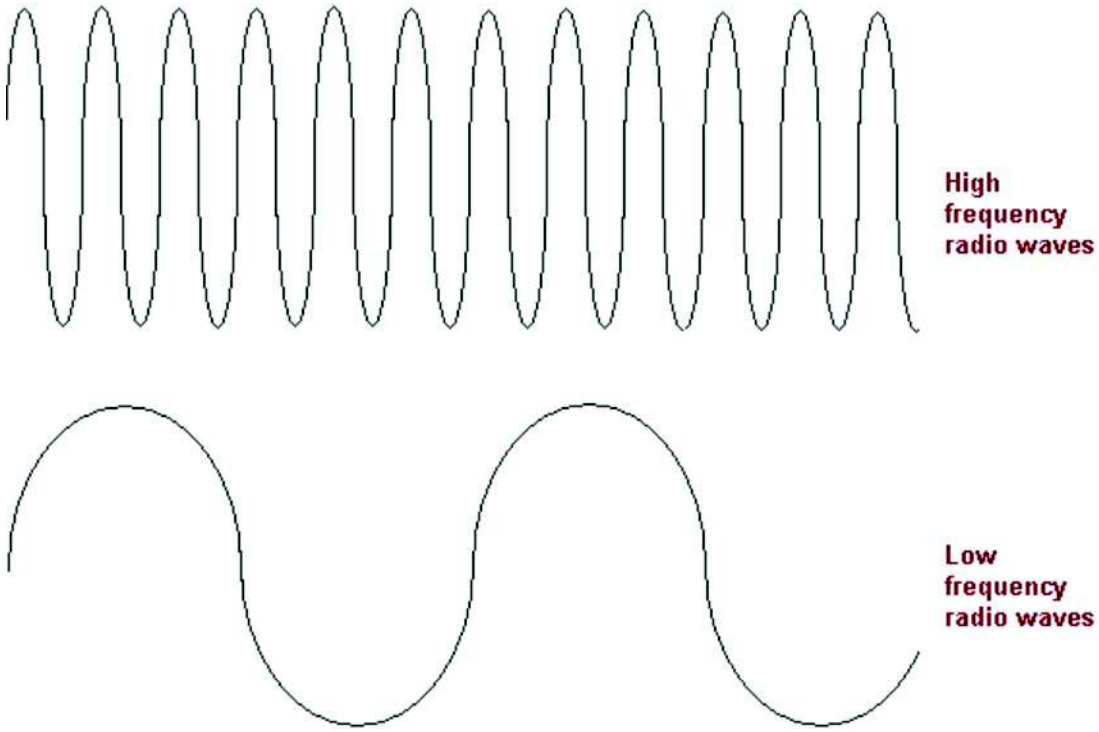

Figure B-3 Radio Wave Frequencies

Note. From "Communications System", *What is Frequency*? Retrieved October 24, 2008, from http://qrg.northwestern.edu/project/vss/docs/Communications/1-what-is-frequency.html

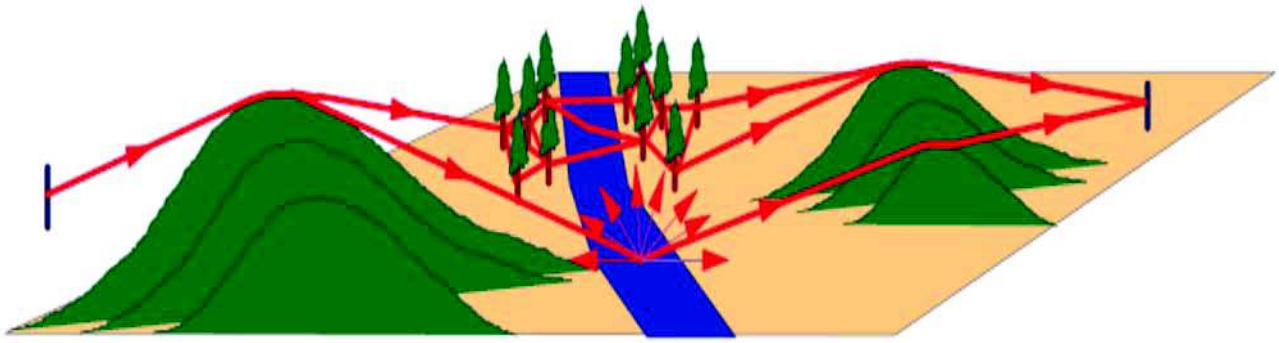

Figure C-1 Ground Wave Transmission

Note. From *Radio Wave Diffraction and Scattering Models for Wireless Channel Simulation* (p. 5), by M. Casciato, 2001, Michigan: USA. Copyright 2001 by M. Casciato. Retrieved October 31, 2008, from http://www.eecs.umich.edu/RADLAB/html/NEWDISS/Casciato.pdf

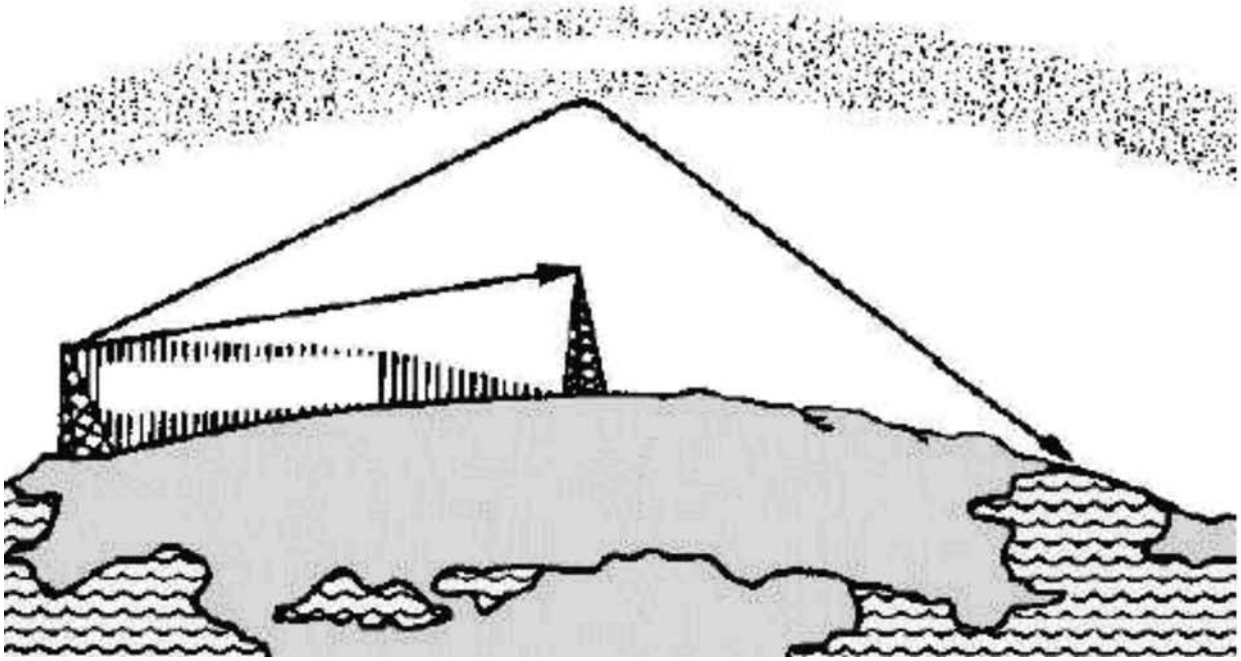

Figure C-2 Sky Wave Transmission

Note. From "Integrated Publishing", *Radio Wave Transmission*. Retrieved October 31, 2008, from http://www.tpub.com/content/neets/14182/css/14182_75.htm

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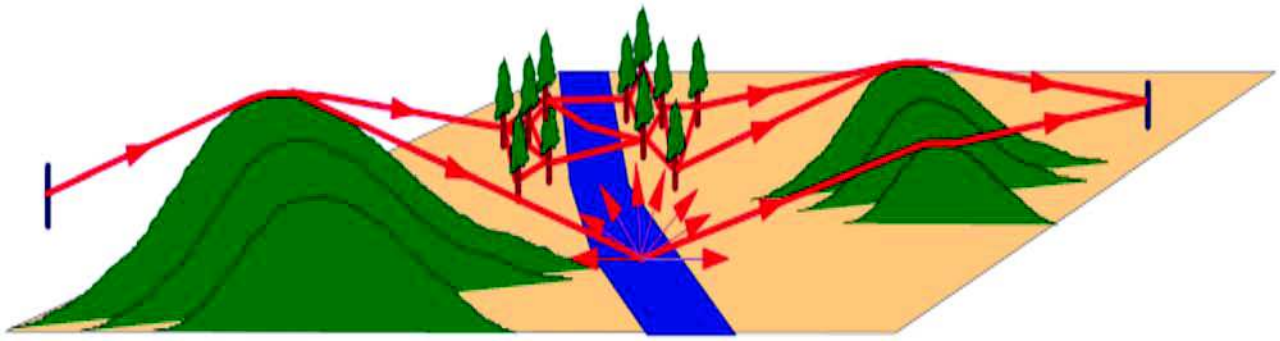

Figure D-1 Ground Wave Transmission

Note. From *Radio Wave Diffraction and Scattering Models for Wireless Channel Simulation* (p. 5), by M. Casciato, 2001, Michigan: USA. Copyright 2001 by M. Casciato. Retrieved October 31, 2008, from http://www.eecs.umich.edu/RADLAB/html/NEWDISS/Casciato.pdf

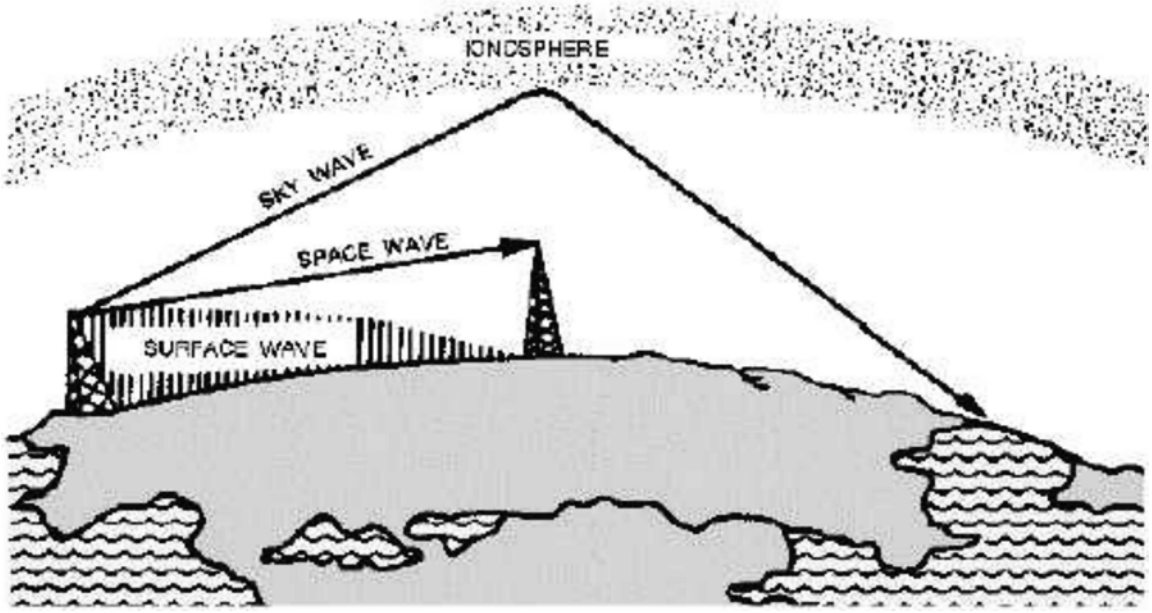

Figure D-2 Sky Wave Transmission

Note. From "Integrated Publishing", *Radio Wave Transmission*. Retrieved October 31, 2008, from http://www.tpub.com/content/neets/14182/css/14182_75.htm

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ROYAL CANADIAN AIR CADETS

PROFICIENCY LEVEL FOUR

INSTRUCTIONAL GUIDE

SECTION 4

EO C429.04 – EXPLAIN EMERGENCY, URGENCY AND SAFETY COMMUNICATIONS

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-804/PG-001, *Proficiency Level Four Qualification Standard and Plan*, 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

Nil.

APPROACH

An interactive lecture was chosen for this lesson to clarify, emphasize, and summarize emergency, urgency and safety communications.

INTRODUCTION

REVIEW

Nil.

OBJECTIVES

By the end of this lesson the cadet shall have explained emergency, urgency and safety communications.

IMPORTANCE

It is important for cadets to explain emergency, urgency and safety communications as the information is recognized worldwide to request assistance. The information is required knowledge to obtain the Industry Canada Restricted Operator Certificate with Aeronautical Qualification (ROC-A).

Teaching Point 1 **Explain emergency communications.**

Time: 15 min Method: Interactive Lecture

EMERGENCY COMMUNICATIONS

Distress Call

A distress call is defined as a situation of serious and / or imminent danger that requires immediate assistance. A distress call is sent by saying:

1. MAYDAY spoken three times,
2. THIS IS, and
3. the call sign of the aircraft in distress spoken three times.

Distress situations include:

- fire,
- engine failure, and
- explosive decompression.

Example:

MAYDAY, MAYDAY, MAYDAY,
THIS IS,
PIPER FOXTROT ALFA BRAVO CHARLIE,
PIPER FOXTROT ALFA BRAVO CHARLIE,
PIPER FOXTROT ALFA BRAVO CHARLIE.

Priority

A distress call has absolute priority over all other transmissions.

Frequencies to Use

The initial distress call should be made on the air-to-ground frequency that is in use at the time. If the station in distress cannot make contact on the initial air-to-ground frequency, attempt to make contact on the general distress frequency (121.50 MHz, 243 MHz or 3023.5 kHz) and then any other frequency that is available. If changing frequency, state which frequency is being changed to before leaving the first frequency.

Distress Message

The distress message shall follow the distress call as soon as possible. The message shall include as much information as possible, in the following order:

1. the distress signal MAYDAY once,
2. the call sign of the aircraft in distress once,
3. the nature of the distress condition and what assistance is required,
4. the intentions of the person in command,
5. the aircraft details including its position, airspeed, altitude, and heading,

6. the number of people on board and any injuries,

7. any other information which might assist the rescue, and

8. the call sign of the aircraft in distress.

Example:

MAYDAY,
PIPER FOXTROT ALFA BRAVO CHARLIE,
STRUCK BY LIGHTNING,
DITCHING AIRCRAFT,
POSITION: 20 MILES EAST OF WINNIPEG,
ALTITUDE: WUN TOUSAND FIFE ZERO ZERO FEET,
AIRSPEED: WUN TOO FIFE KNOTS,
HEADING: TOO SEVEN ZERO DEGREES,
ONE PERSON ON BOARD,
PIPER FOXTROT ALFA BRAVO CHARLIE.

Repetition of Distress Message

The distress message shall be repeated at intervals by the aircraft in distress until an answer is received or until it is no longer safe / possible to continue sending the message.

Action by Station in Distress

A person in command of an aircraft in distress shall direct the following actions:

1. transmit the distress call;

2. transmit the distress message;

3. listen for acknowledgement of message receipt;

4. exchange further distress information as applicable; and

5. activate automatic emergency equipment (eg, emergency locator transmitter [ELT]) if available and when appropriate.

Action by Stations Other Than the Station in Distress

An aircraft that is not in distress shall transmit the distress message when:

1. the aircraft in distress is not in a position to transmit the message;

2. the person in command of the aircraft not in distress believes that further help is necessary; and

3. the aircraft heard a distress message that has not been acknowledged.

When a distress message has been heard and the aircraft in distress is not in the immediate vicinity, allow time for stations nearer to the aircraft in distress to reply.

Stations hearing a distress message shall:

- continue to monitor the frequency on which the distress message was received;
- establish a continuous watch on appropriate distress and emergency frequencies;

- notify stations with direction finding or radar facilities and request assistance unless it is known that the action has been taken by the station acknowledging receipt of the distress message; and
- cease transmissions which interfere with the distress traffic.

Distress Traffic

Distress traffic is all transmissions relative to the immediate assistance required by the station in distress including all transmissions after the initial distress call.

The distress signal MAYDAY spoken once shall precede all distress traffic.

For stations not aware of the distress call, starting the message with the word MAYDAY will alert the stations of a distress situation. All stations will monitor the distress channel on which the distress call originated.

Any aircraft that has knowledge of the distress traffic and cannot assist the station in distress shall follow the traffic until it is evident that assistance is being provided.

All stations that are aware of the distress traffic and are not participating in the traffic are forbidden to transmit on the frequencies.

Communication can continue once a message has been received indicating that normal working traffic has resumed.

Acknowledgement of Receipt of a Distress Message

A station responding to a distress message shall acknowledge the message in the following form:

1. the distress signal MAYDAY;
2. the call sign of the station in distress spoken three times;
3. the phrase THIS IS;
4. the call sign of the station acknowledging receipt spoken three times; and
5. the words RECEIVED MAYDAY.

Example:

MAYDAY, MAYDAY, MAYDAY,
PIPER FOXTROT ALFA BRAVO CHARLIE,
PIPER FOXTROT ALFA BRAVO CHARLIE,
PIPER FOXTROT ALFA BRAVO CHARLIE,
THIS IS,
WINNIPEG TOWER,
WINNIPEG TOWER,
WINNIPEG TOWER,
RECEIVED MAYDAY.

Action by Stations Acknowledging Receipt of a Distress Message

Once the station has acknowledged the distress message, the station shall take the following actions:

1. taking control of the communications or clearly transferring the responsibility and informing the aircraft if a transfer is made;
2. taking immediate action to ensure all necessary information is provided as soon as possible to the air traffic service (ATS) unit concerned and the aircraft operating agency or representative concerned;
3. continuing to monitor the frequency on which the distress message was received and if possible any other frequency that may be used by the aircraft in distress;
4. warning other stations in order to prevent the transfer of aeronautical traffic to the frequency or the distress communication; and
5. ceasing all transmissions that may interfere with the distress traffic.

Relay of a Distress Message

If a distress message is repeated by an aircraft or station other than the aircraft in distress, the message will be comprised of:

- the signal MAYDAY RELAY spoken three times;
- the phrase THIS IS;
- the call sign of the station relaying the message spoken three times;
- the distress signal MAYDAY spoken once; and
- the details of the aircraft in distress, to include:
    - the call sign of the aircraft in distress spoken once;
    - the nature of the distress;
    - the action being taken;
    - its location;
    - the number of people on board; and
    - the call sign of the aircraft in distress spoken once.

Example:

MAYDAY RELAY, MAYDAY RELAY, MAYDAY RELAY,
THIS IS,
CESSNA GOLF SIERRA ROMEO TANGO,
CESSNA GOLF SIERRA ROMEO TANGO,
CESSNA GOLF SIERRA ROMEO TANGO,
MAYDAY,
PIPER FOXTROT ALFA BRAVO CHARLIE,
STRUCK BY LIGHTNING,
FORCED LANDING AIRCRAFT,
POSITION: 20 MILES EAST OF WINNIPEG,
ALTITUDE: WUN TOUSAND FIFE ZERO ZERO FEET,
AIRSPEED: WUN TOO FIFE KNOTS,
HEADING: TOO SEVEN ZERO DEGREES,
ONE PERSON ON BOARD,
PIPER FOXTROT ALFA BRAVO CHARLIE.

Imposition of Silence

Silence shall be imposed on all stations or individual stations in the area that are interfering with the distress traffic. The aircraft in distress or the station in control of distress traffic shall use the expression SEELONCE MAYDAY. Other stations near the aircraft in distress may impose silence during a distress situation by using the international expression SEELONCE DISTRESS.

All transmissions will cease immediately except for those involved in the distress traffic.

Example:

The aircraft in distress imposing silence to a specific station:	CHEROKEE GOLF OSCAR OSCAR PAPA, THIS IS, PIPER FOXTROT ALFA BRAVO CHARLIE, SEELONCE MAYDAY, OUT.
A station other than the aircraft in distress imposing silence to all stations:	ALL STATIONS, ALL STATIONS, ALL STATIONS, THIS IS, CHEROKEE GOLF OSCAR OSCAR PAPA, SEELONCE DISTRESS, OUT.

Cancellation of Distress

When the distress situation or when radio silence has ended, the station controlling the distress traffic shall transmit a message addressed to all stations on all frequencies used, advising that normal communication may resume. The message cancelling the distress message includes:

1. the distress signal MAYDAY spoken once;
2. the phrase HELLO ALL STATIONS spoken three times;
3. the phrase THIS IS;
4. the call sign of the station transmitting the message;
5. the filing time of the message;

6. the call sign of the station in distress spoken once;

7. the words SEELONCE FEENEE; and

8. the word OUT.

Example:

MAYDAY,
HELLO ALL STATIONS, HELLO ALL STATIONS, HELLO ALL STATIONS,
THIS IS,
WINNIPEG TOWER,
TIME WUN SIX TREE ZERO ZULU,
PIPER FOXTROT ALPHA BRAVO CHARLIE,
SEELONCE FEENEE,
OUT.

Ensure that search and rescue stations are advised that a station is no longer in distress by making a normal call to the nearest aeronautical station detailing the reasons for cancelling the distress call.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS:

Q1. Define a distress call.

Q2. What is included in a distress call?

Q3. What words are used to impose silence by the aircraft in distress?

ANTICIPATED ANSWERS:

A1. A situation of serious and / or imminent danger that requires immediate assistance.

A2. A distress call includes:

- MAYDAY spoken three times,
- THIS IS, and
- call sign of aircraft in distress spoken three times.

A3. SEELONCE MAYDAY.

Teaching Point 2 **Explain urgency and safety communications.**

Time: 10 min Method: Interactive Lecture

URGENCY AND SAFETY COMMUNICATIONS

Urgency Call

An urgency call is defined as a message from a station having a very urgent transmission but does not require immediate assistance, concerning the safety of:

- an aircraft, ship, or other vehicle, and
- a person.

The urgency call shall only be sent on the authority of the person in charge including situations involving:

- being lost;
- minor mechanical problems;
- serious health issues involving an individual on board; and
- security issues involving an individual on board.

The urgency call is sent using the words PAN PAN spoken three times at the beginning of the first urgency communication.

Priority

An urgency call has priority over all other transmissions except emergency (distress) calls.

All stations that hear the urgency call shall continue to listen for at least three minutes on the frequency which the signal was heard. After three minutes, and if no further message is heard, all stations can resume communications as normal.

Stations that are in communication on frequencies other than those used for the transmission of the urgency message may continue normal work without interruption unless the urgency message is addressed to all stations.

Frequencies to Use

The initial urgency call and message should be made on the air-to-ground frequency that is in use at the time. If the station in difficulty cannot make contact on the initial air-to-ground frequency, it shall attempt to make contact on the general aeronautical emergency frequency (121.50 MHz or 3023.5 kHz) or any frequency that is available to make contact with any aeronautical ground or aircraft station.

Urgency Message

The urgency call shall be followed by the urgency message. The message shall include further information including as many as possible, in the following order:

1. the urgency call PAN PAN spoken three times;
2. the call sign of the aircraft, station, or ALL STATIONS spoken three times;

3. the phrase THIS IS;

4. the call sign of the aircraft or station making the urgency call;

5. the nature of the urgency condition;

6. the intentions of the person in command;

7. the aircraft particulars of its position (airspeed, altitude, and heading);

8. any other useful information;

9. the call sign of the aircraft in distress; and

10. the word OVER.

Example:

PAN PAN, PAN PAN, PAN PAN,
ALL STATIONS, ALL STATIONS, ALL STATIONS,
THIS IS,
PIPER FOXTROT ALFA BRAVO CHARLIE,
LOST, REQUEST RADAR CHECK,
POSITION: UNKNOWN,
ALTITUDE: WUN TOUSAND FIFE HUNDRED FEET,
AIRSPEED: WUN TOO FIFE KNOTS,
HEADING: TOO SEVEN ZERO DEGREES,
PIPER FOXTROT ALFA BRAVO CHARLIE,
OVER.

Reply to Urgency Message

When the urgency message is addressed to all stations and is acknowledged by another aircraft or station, the acknowledging station shall forward the urgency information to the appropriate authorities.

Example:

PAN PAN,
PIPER FOXTROT ALFA BRAVO CHARLIE,
THIS IS WINNIPEG TOWER,
YOUR POSITION IS 28 MILES EAST WINNIPEG,
WINNIPEG TOWER,
STANDING BY.

Cancellation of Urgency Message

As soon as it is known that the action is no longer necessary, the cancellation message shall be directed to ALL STATIONS by the station responsible for the urgency message transmission.

Example:

PAN PAN,
HELLO ALL STATIONS, HELLO ALL STATIONS, HELLO ALL STATIONS,
THIS IS,
PIPER FOXTROT ALFA BRAVO CHARLIE,
PIPER FOXTROT ALFA BRAVO CHARLIE,
PIPER FOXTROT ALFA BRAVO CHARLIE,
28 MILES EAST OF WINNIPEG AIRPORT PROCEEDING NORMALLY,
PIPER FOXTROT ALFA BRAVO CHARLIE,
OUT.

Safety Signal

Aircraft or stations transmitting the safety signal SECURITE will then transmit a message to aircraft in flight, concerning:

- the safety of navigation, or
- important meteorological warnings.

The safety signal has priority over all communications except distress and urgency.

The safety signal SECURITE is spoken three times at the start of the message addressed to ALL STATIONS.

Example:

SECURITE, SECURITE, SECURITE,
ALL STATIONS, ALL STATIONS, ALL STATIONS,
THIS IS,
PIPER FOXTROT NOVEMBER KILO ECHO,
NOTICE TO ALL STATIONS IN AREA,
30 MILES EAST OF OTTAWA,
UNMANNED BALLOON DRIFTING,
PIPER FOXTROT NOVEMBER KILO ECHO,
OUT.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS:

Q1. Define an urgency call.

Q2. What word is repeated three times for an urgency call?

Q3. What word is repeated three times for the safety signal?

ANTICIPATED ANSWERS:

A1. A message from a station having a very urgent transmission but does not require immediate assistance, concerning the safety of:

- an aircraft, ship, or other vehicle, and
- a person.

A2. PAN PAN.

A3. SECURITE.

END OF LESSON CONFIRMATION

QUESTIONS:

Q1. What calls have absolute priority over all other communication?

Q2. On what frequency should the initial distress call be made?

Q3. To whom is the cancellation message directed?

ANTICIPATED ANSWERS:

A1. Distress.

A2. The air-to-ground frequency being used at the time.

A3. ALL STATIONS.

CONCLUSION

HOMEWORK / READING / PRACTICE

Nil.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-804/PG-001*Proficiency Level Four Qualification Standard and Plan*, Chapter 3, Annex B, 429 PC.

CLOSING STATEMENT

The ability to explain emergency, urgency and safety communications demonstrates the cadets understanding of the worldwide request for assistance. This knowledge is required to obtain the IC ROC-A.

INSTRUCTOR NOTES / REMARKS

If the squadron chooses to have cadets obtain the ROC-A, all complementary EOs must be conducted and a qualified examiner must conduct the 429 PC

Cadets who are qualified Advanced Aviation may assist with this instruction.

REFERENCES

C3-116 ISBN 0-9680390-5-7 MacDonald, A. F., & Peppler, I. L. (2000). *From the ground up: Millennium edition*. Ottawa, ON: Aviation Publishers Co. Limited.

C3-182 *Study Guide for the Radiotelephone Operator's Restricted Certificate (Aeronautical)*. (2008). Retrieved September 28, 2008, from www.ic.gc.ca/epic/site/smt-gst.nsf/en/sf01397e.htm

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