ROYAL CANADIAN ARMY CADETS

SILVER STAR

INSTRUCTIONAL GUIDE

SECTION 4

EO M324.04 – PREDICT WEATHER

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-703/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 TPs 1 and 2 to introduce the cadet to weather fronts and weather indicators that will influence predicting weather.

A practical activity was chosen for TP 3 as it is an interactive way to introduce cadets to predicting weather in a safe, controlled environment. This activity contributes to the development of survival skills and knowledge in a fun and challenging setting.

INTRODUCTION

REVIEW

N/A.

OBJECTIVES

By the end of this lesson the cadet shall be expected to predict weather for a 24-hour period.

IMPORTANCE

It is important for cadets to learn to predict weather so they can factor the weather into their survival plan if they become lost. The weather will play an important role when selecting the best action to take while waiting for assistance from rescuers, when deciding the type of shelter to seek and if/when making a decision to move.

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Teaching point 1 **Describe Weather Indicators**

Time: 10 min Method: Interactive Lecture



This TP allows the cadets to view the clouds while learning their different characteristics.

Some information on types of clouds was taken from EO M224.03, (Predict Weather Using Cloud Formations, A-CR-CCP-702/PF-001, Chapter 14, Section 3).

Allow the cadets to view cloud formations for a short time before describing the characteristics of each one.

CLOUDS

Cumulus. These clouds are large, individual puffy clouds. They resemble cauliflower or cotton balls, with bottoms which often appear dark and flat. They can often be seen on a warm day. When these clouds are in the sky one can expect fair weather, unless they begin to extend upward.

Cumulus clouds may bring the following associated weather:

- black or grey – possible thunderstorm,
- may develop into cumulonimbus – possible storm, and
- small isolated patches – good weather.



E. Brotak, Wild About Weather, Lark Books (p. 88)

Figure 1 Cumulus Clouds

Altocumulus. These clouds are very big and can be white or grey. They appear as a layer or a series of patches of rounded masses. Altocumulus clouds can be seen before fair or bad weather and have little value as an indicator of future weather developments.

Altocumuus clouds may bring the following associated weather:

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- domed shape – possible thunderstorm, and
- small isolated patches – good weather.



E. Brotak, Wild About Weather, Lark Books (p. 87)

Figure 2 Altocumulus Clouds

Stratocumulus. These appear as sheets of big puffy white or grey clouds. Stratocumulus clouds often appear in dark patches or rolls and are often thin with blue sky showing through the breaks. Snow or showers of rain are possible and can be heavy.

Stratocumulus clouds may precede or follow a storm.



E. Brotak, Wild About Weather, Lark Books (p. 88)

Figure 3 Stratocumulus Clouds

Cirrus. These clouds are wispy and look like cotton candy being pulled. They appear to be whitish wisps of cloud and are usually an indicator of fair weather.

Cirrus clouds may bring the following associated weather:

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- drifting slowly or standing still – fair weather; and
- moving rapidly, followed by more clouds – foul weather.



E. Brotak, Wild About Weather, Lark Books (p. 87)

Figure 4 Cirrus Clouds

Cirrostratus. These clouds are whitish sheets that completely cover the sky. Cirrostratus clouds are normally see-through. When these clouds are in the sky, one can expect precipitation in a day or two.

Cirrostratus clouds indicate changeable weather.



E. Brotak, Wild About Weather, Lark Books (p. 87)

Figure 5 Cirrostratus Clouds

Nimbostratus. These appear as dark grey layers of large, puffy clouds. When they produce precipitation, it is in the form of continuous rain or snow. The bottom of this cloud is often hidden by heavy falling rain or snow.

Nimbostratus clouds indicate upcoming rainfall.

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E. Brotak, Wild About Weather, Lark Books (p. 88)

Figure 6 Nimbostratus Clouds



A figure illustrating the cloud types in the atmosphere is included at Annex E. Distribute Annex E to each cadet.



Being able to forecast weather using clouds is a great tool in a survival situation.

Ask cadets if they know any signs that indicate weather may change.

SIGNS OF BAD WEATHER

When the weather is going to change for the worse, cloud formations will change. Signs of change for bad weather are:

- Clouds, regardless of their formation, are thicker (darker), increase in numbers or join together to form layers lower in the sky.
- Clouds form banks in the west with winds from the south.
- Clouds move in all directions or contrary to the wind on the ground.
- Altocumulus clouds move quickly across the sky or form towers in the morning.
- Cumulus clouds form in the morning and stack in the afternoon or move from the south or southwest.

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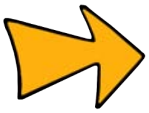

A halo around the sun or moon indicates bad weather.

SIGNS OF GOOD WEATHER

When the weather is going to change for the better, cloud formations will change. Signs of a change for good weather are:

- Cloud cover lifts, becomes lighter and small patches of blue sky develop.
- Cumulus clouds form in the afternoon or float alone.
- Stratocumulus clouds drift with the prevailing wind and remain scattered.
- The condensation trail (contrail) left by high altitude aircraft disperses quickly.
- Morning fog is burnt off before noon.

THUNDERSTORMS

Thunderstorms are most common in the summertime. They are formed by cumulus clouds, feeding off warm and moist air. These clouds grow quickly during the day, driven by the heat from the sun. When dark cumulonimbus clouds begin to approach, one can expect a thunderstorm. Thunderstorms not only have thunder, but very often lightning as well.

Lightning. Lightning is an electrical discharge in the atmosphere. When cumulus clouds grow tall, they develop an electrical field. The top of the cloud, where there are lots of ice crystals, is normally positive. The bottom part of the cloud, filled with rain droplets, is normally negative. The ground has a positive charge. An electrical charge builds up and the atmosphere produces lightning.

Ground Lightning. Ground lightning happens when the charges are exchanged by the clouds and ground. These flashes affect people greatly, often causing injury or death and disrupting power and communications and starting forest fires. People can be injured a significant distance from the point where the lightning strikes as the current travels through the ground.

Thunder. Thunder is the sound made when a lightning bolt heats the air and expands quickly. Since sound moves much slower than light, one can judge how far away a lightning bolt is by counting the seconds between seeing the flash and hearing the thunder. Each three-second interval equals about one km (0.6 miles).

Calculate the Speed of an Approaching Storm

Count the seconds between the flash and the thunder clap. (Each second represents a 300 m [984 feet] distance) from the lightning strike. The speed and distance of the approaching storm can be calculated by comparing the time delay between the lightning and the thunder from several lightning strikes.

ACTIONS TO TAKE IN THE EVENT OF A THUNDERSTORM

A thunderstorm can arrive quickly and lightning can strike in front of the storm. Seek shelter well before a storm hits.

Avoid High Points

Make sure not to be the prominent high point in the area (in a field, on a beach, in the water) and not next to a prominent high point (next to an isolated tree, steeple, flag pole).

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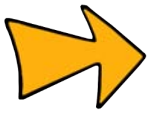
Avoid Running

Walk fast, but do not run as rapid movement may cause air currents that attract an electric strike.

Stay Low in Open Areas

If in the open, crouch very low and try to insulate the body from the ground by standing on a backpack (with no metal), raincoat, jacket or air mattress. The importance of this insulation is that the ground charge cannot rise through the body to attempt to reach the lightning discharge.



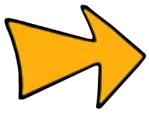
Keep hands off the ground especially if the ground is wet or if it is humid.

Avoid Metal Objects

Stay away from any metal tent poles, backpack frames, walking poles, etc. Abandon these items, in a flat field, as they may create a better potential impact point other than the body. Avoid being in a boat or in water during a storm.

Avoid Grouping Together

Do not group together during a storm. According to author Paul Tawrell, *Camping and Wilderness Survival: The Ultimate Outdoors Book*, Tawrell Books (p. 224) “a flash of lightning killed 504 sheep that had huddled together during a storm.”

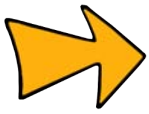


Make sure that the storm has completely passed before moving so that you do not attract the last lightning strike.

WIND

Defined as the horizontal motion of air across the earth’s surface. Wind is produced by air pressure and is different from place to place. Local winds result from thermal differences that generate local pressure gradient. Wind speed is expressed in kilometres per hour (km/h), metres per second (mps) or knots (kt).

The two principle properties of wind are speed and direction. Winds are named for the direction from which they originate. For example, a wind from the west is a westerly wind (it blows eastward). The most important factor affecting wind is the Coriolis effect. The Coriolis effect is zero at the equator and increases as it reaches the poles. The effect is proportional to the wind speed.



Coriolis effect is the deflection of moving objects on earth from a straight path, in relation to the differential speed of rotation at varying latitudes.

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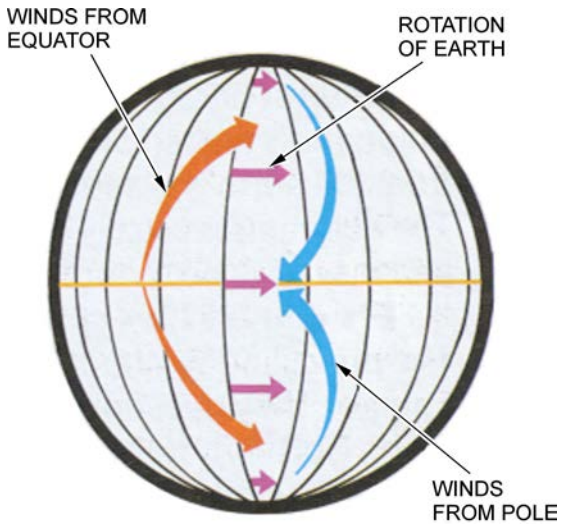

P. Tawrell, Camping and Wilderness Survival, Tawrell Books (p. 607)

Figure 7 Coriolis Effect

Wind will flow from a high air pressure area to a low air pressure area. Due to the rotation of the earth and friction, wind will flow around the outside of the high or low pressure areas. Wind strengths are directly related to the difference between high and low air pressure areas; the larger the difference, the stronger the winds.

WEATHER LORE

Meteorologists use lots of equipment and science to forecast weather. However, people whose livelihoods depend on weather – farmers and sailors – often use the things around them to predict the weather. Nature, animals and even humans may give clues to future weather patterns. Certain species of plants and animals are affected by the slightest change in their environment. Weather lore is often considered to be old wives tales and superstitions.

NATURE SIGNS

There are signs in nature that can show change in air pressure. Some are very obvious changes while others are of a more subtle nature.

Smoke. Smoke rising from a fire straight into the air means fair weather (high pressure) and smoke hanging low, (low pressure) means rain is on the way.

Red Sky. A red sky at either dusk or dawn is a beautiful natural sign one can use to predict weather. At dusk, a red sky indicates that the next day will be dry and clear day. This is due to the sun shining through dust particles being pushed ahead of a high pressure system bringing in dry air. A red sky at dawn often means that an approaching low pressure system is bringing in a lot of moisture. This is a fair indication that a storm is approaching. Do not confuse a red sky in the morning with a red sun in the morning. If the sun itself is red and the sky is a normal colour, the day will be fair.

Remember the old rhyme:

“Red sky at night, sailor’s delight. Red sky at morning, sailors take warning”

Sun Halo. When a halo rings the moon or sun, rain is approaching.

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PLANTS

Flowers. Flowers and plants will close before a storm.

Leaves. When the leaves of trees turn over, windy conditions and severe storms will not be far behind.

Pine Cones. Pine cones close up in moist weather to protect their seeds. If the weather is dry, the pine cone will open.

Seaweed. In coastal areas, kelp shrivels and feels dry in fine weather, and swells and becomes damp if rain is in the air.

ANIMALS

Lying Cows. When cows are lying down in a field, rain is on the way. The cows sense the moisture in the air and are making sure they have somewhere dry to lie down.

Squirrels Tails. If a squirrel's tail is very bushy, or they are collecting big stores of nuts in autumn, a severe winter may be expected (little scientific evidence supports this theory).

Birds and Bats. Birds and bats have a tendency to fly much lower to the ground right before rain due to the "thinning" of the air. They prefer to fly where the air is densest and where they get greater lift for their wings. With high pressure and dry air, the atmosphere becomes denser and birds can easily fly at higher altitudes. Some birds, like cockerels, sing when a thunderstorm approaches.

Crickets. When crickets are in cool grass, count the number of chirps they make. The number of chirps will indicate the temperature.

Household Pets. Cats and dogs in houses can sense storms and often seek a comfortable warm place to sleep.

HUMAN OBSERVATIONS

Senses. Mountains and other faraway objects will appear to be much closer and more sharply focused as wet weather approaches and the air pressure drops. The dust particles in the air begin to settle to the ground and the air clears allowing one to see more details of faraway objects. As high pressure approaches and the air becomes thicker, more dust particles become suspended in the air and landmarks take on their normal hazy appearance.

Sounds become sharper and more focused prior to stormy weather. Instead of travelling upward and outward into the atmosphere, sound waves are bent back to the earth and their range extended. Even birdcalls sound sharper. This is why some people think the air is clean and fresh and bird songs and calls sound sharper before a rain.

Aches and Pains. When cold is expected, many humans claim to experience aches and pains in joints and muscles.

Hair. When there is a lot of humidity, human hair often becomes frizzy. When air is moist (indicating rain), hair swells and straightens.

CONFIRMATION OF TEACHING POINT 1

QUESTIONS

Q1. What signs of cloud formation signal changes for bad weather?

Q2. What should you do in an open field when a thunderstorm is approaching?

Q3. What is weather lore?

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ANTICIPATED ANSWERS

A1. Signs of change for bad weather are:

- Clouds, regardless of their formation are thicker (darker), increase in numbers or join together to form layers, and/or lower in elevation.
- Clouds form banks in the west with winds from the south.
- Clouds move in all directions, or contrary to the wind on the ground.
- Altostratus clouds darken and lower.
- Altocumulus clouds move quickly across the sky or form towers in the morning.
- Cumulus clouds form in the morning and stack in the afternoon or move from the south or southwest.

A2. Make sure you are not the prominent high point in the area or that you are not next to a prominent high point.

A3. Weather lore is a way of predicting weather.

Teaching point 2 **Explain Weather Systems**

Time: 5 min Method: Interactive Lecture



The information in this TP is designed to give cadets background knowledge of weather systems which will aid them in predicting weather.

FRONTS

Weather Front. A boundary that separates two air masses that have different characteristics. As two air masses collide they will mix along their boundary, but will retain their distinct characteristics.

Cold Front. Cold (more dense) air mass moving into a warmer (less dense) air mass and is characterized by the following:

- abrupt uplift along the frontal boundary;
- cumulus (flat based or anvil-shaped) development;
- short duration heavy rain and thunderstorms; and
- shown as a line of blue triangles on surface weather maps.

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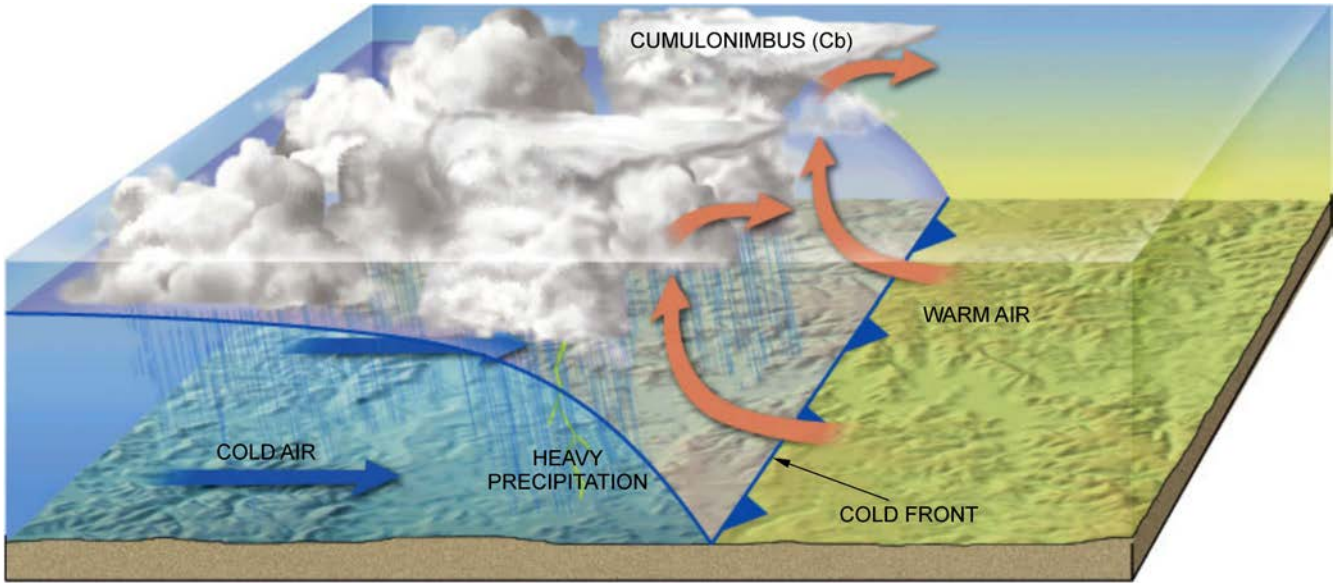
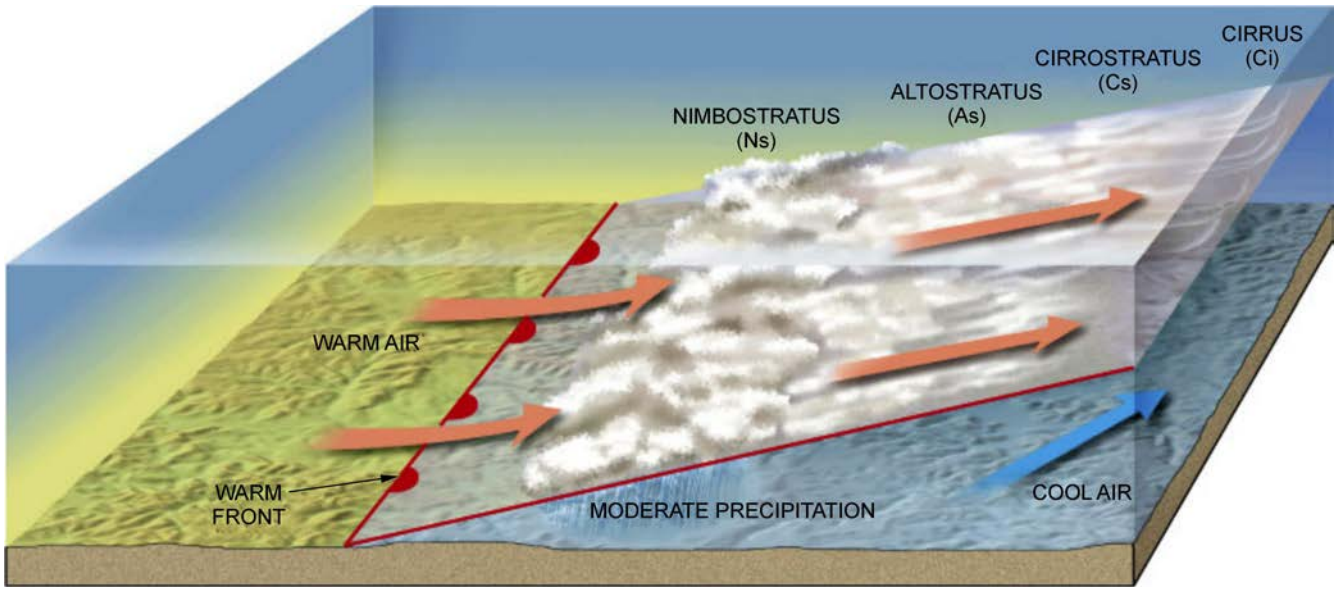


"Fronts", by The Atmosphere, Lutgens and Tarbuck, (8th ed). Copyright 2001 by John Stimac. Retrieved November 19, 2007, from http://www.ux1.eiu.edu/~jpstimac/1400/fronts.html

Figure 8 Cold Front

Warm Front. A warm (less dense) air mass moving into a cold air mass and is characterized by the following:

- gentle uplift;
- stratiform (stratus) cloud cover (the leading clouds, cirrus, are a good indicator of an impending change in the weather);
- long duration moderate rainfall; and
- shown as a line of red semicircles on surface weather maps.



"Fronts", by The Atmosphere, Lutgens and Tarbuck, (8th ed.) Copyright 2001 by John Stimac. Retrieved November 19, 2007, from http://www.ux1.eiu.edu/~jpstimac/1400/fronts.html

Figure 9 Warm Front

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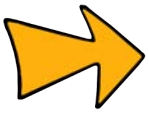
HIGHS AND LOWS

Air Pressure. The force of the air pushing down on the earth's surface. Air pressure is higher near sea level because there is more air at lower altitudes than on the top of a mountain. Changing weather is a result of changing air pressure. Understanding the effects of low and high air pressure is important in predicting weather.

Low Pressure Area. A low (an "L" on weather maps) is a region of air where the pressure is lowest in relation to the surrounding area. Lows are associated with stronger winds and rising air. This rising air expands and cools and cannot hold as much water, resulting in condensation and cloud formation.



Think about the air rising above a campfire. The air molecules, as they are heated, begin to expand and leave the earth's surface, putting less pressure on it. On a large scale, this hot air creates an area of low pressure.

High Pressure Area. A high ("H" on weather maps) is a region where the air pressure is highest with relation to the surrounding area.

An area of high pressure is a section of air that is sinking. As the air sinks, it warms, allowing it to hold more water. Highs are often associated with fair weather.



Ask the cadets if they were to open a window on a cold winter night and stand in the middle of the room what part of their bodies would be first to feel the cold?

Answer: Feet.

This is because cold air is dense and the molecules are sinking. On a large scale, cold air masses push down on the earths' surface creating an area of high pressure.

CONFIRMATION OF TEACHING POINT 2

QUESTIONS

Q1. What is a weather front?

Q2. What is a low pressure area?

Q3. What is high pressure?

ANTICIPATED ANSWERS

A1. A boundary that separates two air masses that have different characteristics. As two air masses collide, they mix along their boundary, but retain their distinct characteristics.

A2. A low pressure area (an "L" shown on weather maps) is a region of air where the pressure is lowest in relation to the surrounding area.

A3. An area of high pressure is a section of air that is sinking.

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Teaching point 3 **Have the Cadets Predict Weather for the Next 24-Hour Period**

Time: 10 min Method: Practical Activity

ACTIVITY

OBJECTIVE

The objective of this activity is to have the cadet predict weather conditions for the next 24 hours.

RESOURCES

- Pen or pencil, and
- Paper.

ACTIVITY LAYOUT

N/A.

ACTIVITY INSTRUCTIONS

1. Have the cadets observe the clouds, weather and natural features around them.

2. Have the cadets write down what they think might happen in the next 24 hours.

3. Divide the cadets into small groups, of no more than four and have them discuss weather predictions over the next 24 hours.

4. Follow up with the cadets' predictions in a few days time.

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 predicting weather will serve as the confirmation of this lesson.

CONCLUSION

HOMEWORK/READING/PRACTICE

N/A.

METHOD OF EVALUATION

This EO is assessed IAW A-CR-CCP-703/PG-001, Chapter 3, Annex B, Appendix 6 (324 EC-04).

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CLOSING STATEMENT

Being able to predict weather is a great tool when in a survival situation. Weather is an important aspect of planning in any survival situation with respect to the type of shelter selected and the best course of action to take.

INSTRUCTOR NOTES/REMARKS

Time shall be provided during a corps FTX to allow cadets to continue to practice the skill of predicting weather.

REFERENCES

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C2-157 The Old Farmer's Almanac. *Cricket Chirps to Temperature*. Retrieved February 1, 2008, from http://www.almanac.com/outdoors/crickets.php.

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