CHAPTER 6 - CANADIAN AIRPORT OPERATIONS

INTRODUCTION

Each time a pilot operates an airplane, the flight normally begins and ends at an airport. An airport may be a small sod field or a large complex utilized by air carriers. In this chapter we will discuss airport operations and identify features of an airport complex, as well as provide information on operating on or in the vicinity of an airport.

TYPES OF AIRPORTS

There are two types of airports.

- Controlled Airport
- Uncontrolled Airport

Controlled Airport

A controlled airport has an operating control tower. Air traffic control (ATC) is responsible for providing for the safe, orderly, and expeditious flow of air traffic at airports where the type of operations and/or volume of traffic requires such a service. Pilots operating from a controlled airport are required to maintain two-way radio communication with air traffic controllers, and to acknowledge and comply with their instructions.

Pilots must advise ATC if they cannot comply with the instructions issued and request amended instructions. A pilot may deviate from an air traffic instruction in an emergency, but must advise air traffic of the deviation as soon as possible.

Uncontrolled Airport

An uncontrolled airport does not have an operating control tower. Two-way radio communications are not required, although it is a good operating practice for pilots to transmit their intentions on the specified frequency for the benefit of other traffic in the area. Figure 6-1 lists recommended communication procedures. More information on radio communications will be discussed later in this chapter.

SOURCES FOR AIRPORT DATA

When a pilot flys into a different airport, it is important to review the current data for that airport. This data can provide the pilot with information such as communication frequencies, services available, closed runways, or airport construction, etc. Three common sources of information are:

- Aeronautical Charts
- Airport/Facility Directory (A/FD)
- Notices to Airmen (NOTAMs)

Aeronautical Charts

Aeronautical charts provide specific information on airports. Chapter 8 contains an excerpt from an aeronautical chart and an aeronautical chart legend which provides guidance on interpreting the information on the chart. Refer to Chapter 8, figures 8-1 and 8-22 for chart information.

Airport/Facility Directory (A/FD)

The Airport/Facility Directory provides the most comprehensive information on a given airport. It contains information on airports, heliports, and seaplane bases which are open to the public. The A/FD's are contained in seven books which are organized by regions. These A/FD's are revised every 8 weeks. Figure 6-2 contains an excerpt from a directory. For a complete listing of information provided in an A/FD and how the information may be decoded, a pilot should refer to the "Directory Legend Sample" located in the front of each A/FD.

FACILITY AT AIRPORT	FREQUENCY USE	COMMUNICATION/BROADCAST PROCEDURES	
		OUTBOUND	**INBOUND**
Tower only	Communicate with tower on frequency specified in CFS. If tower closed, broadcast on MF or ATF (see CFS for details)	Contact ground control or tower on frequency specified in CFS before taxiing ; follow instructions and clearances from ATC	Establish communications with ATC before entering control zone.
Mandatory Frequency (MF)	All traffic must communicate on MF published in CFS. If unable to contact FSS or ground station, use broadcast (self-announce) procedures on published frequency.	Before taxiing and before taxiing on the runway for departure.	5 minutes before entering area. Entering downwind, base, final. Leaving the runway
UNICOM or Aerodrome Traffic Frequency (ATF)	Recommended that all traffic monitor the ATF published in CFS and broadcast intentions to facilitate movement of traffic.		

Figure 6-1.—Recommended communication procedures.

In the front of each CFS, there is information such as special notices, services, and facility telephone numbers, etc. It would be helpful to review a CFS to become familiar with the information they contain.

FLIGHT SUPPLEMENT

OSHAWA ON CYOO

REF	N43 55 22 W78 53 42 11°W UTC -5(4) ELEV
OPR	MUNI 905-555-5555
SERVICES	FUEL 100LL OIL: ALL
COMM	TWR: 120.1 GND: 118.4 ATF: tfc 120.1 VDF: 120.1

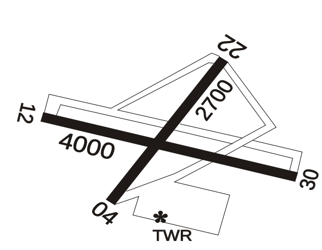

Figure 6-2.— The Canada Flight Supplement contains airports information.

Notices to Airmen (NOTAMs)

Notices to Airmen provide the most current information available. They provide information on airports and changes which affect the national airspace system that are time-critical and in particular are of concern to instrument flight rule (IFR) operations. NOTAMs advise pilots of closed airports and runways, out-of-service navaids, fuel shortages, forest fires, and other important matters that can directly affect flights. Prior to any flight, pilots should check for any NOTAMs which could affect their intended flight.

AIRPORT MARKINGS AND SIGNS

There are markings and signs used at airports which provide directions and assist the pilot in airport operations. We will discuss some of the most common markings and signs. Additional information may be found in the Aeronautical Information Manual (AIM).

Runway Markings

Runway markings vary depending on the type of operations conducted at the airport. Figure 6-3 shows a runway which is approved as a precision instrument approach runway and also shows some other common runway markings. A basic VFR runway may only have centerline markings and runway numbers.
Since aircraft are affected by the wind during takeoffs and landings, runways are laid out according to the local prevailing winds. Runway numbers are in reference to magnetic north. Certain airports have two or even three runways laid out in the same direction. These are referred to as parallel runways and are distinguished by a letter being added to the runway number. Examples are runway 36L (left), 36C (center), and 36R (right).

Another feature of some runways is a displaced threshold. A threshold may be displaced because of an obstruction or damaged pavement near the end of the runway. Although this portion of the runway is not to be used for landing, it may be available for taxiing, takeoff, or landing rollout.

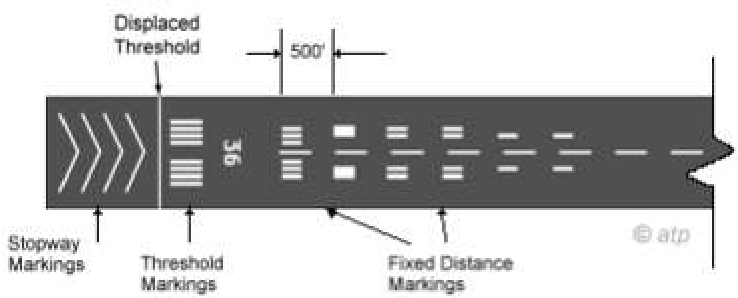

Figure 6-3.—Selected runway markings.

Some airports may have a blast pad, or a stopway area. The blast pad is an area where a propeller or jet blast can dissipate without creating a hazard. The stopway area is paved in order to provide space for an aircraft to decelerate and stop in the event of an aborted takeoff. Additional unpaved open space in the form of *clearways* may be provided beyond the end of runways. These areas cannot be used for takeoff or landing.

Taxiway Markings

Airplanes use taxiways to transition from parking areas to the runway. Taxiways are identified by a continuous yellow centerline stripe. A taxiway may include edge markings to define the edge of the taxiway. This is usually done when the taxiway edge does not correspond with the edge of the pavement. If an edge marking is a continuous line, the paved shoulder is not intended to be used by aircraft. If it is a dashed marking, an aircraft may use that portion of the pavement. Where a taxiway approaches a runway, there may be a holding position marker. These consist of four yellow lines (two solid and two dashed). The solid lines are where the aircraft is to hold. At some controlled airports, holding position markings may be found on a runway. They are used when there are intersecting runways, and air traffic control issues instructions such as “cleared to land — hold short of runway 30.”

Other Markings

Some of the other markings found on the airport include vehicle roadway markings, VOR receiver checkpoint markings, and non-movement area boundary markings.

Vehicle roadway markings are used when necessary to define a pathway for vehicle crossing areas that are also intended for aircraft. These markings usually consist of a solid white line to delineate each edge of the roadway and a dashed line to separate lanes within the edges of the roadway.

A VOR receiver checkpoint marking consists of a painted circle with an arrow in the middle. The arrow is aligned in the direction of the checkpoint azimuth, usually magnetic north in southern Canada. This allows a pilot to check aircraft instruments with navigational aid signals.

A non-movement area boundary marking delineates a movement area under air traffic control. These markings are yellow and located on the boundary between the movement and non-movement area. They normally consist of two yellow lines (one solid and one dashed).

Airport Signs

There are six types of signs that may be found at airports. The more complex the layout of an airport, the more important the signs become to pilots. Figure 6-4 shows examples of signs, their purpose, and appropriate pilot action.

Three importantl types of signs are:

- Mandatory Instruction Signs—have a red background with a white inscription. These signs denote an entrance to a runway, a critical area, or a prohibited area.
- Location Signs—are black with yellow inscription and a yellow border and do not have arrows. They are used to identify a taxiway or runway location, to identify the boundary of the runway, or identify an instrument landing system (ILS) critical area.
- Direction Signs—have a yellow background with black inscription. The inscription identifies the designation of the intersecting taxiway(s) leading out of an intersection.

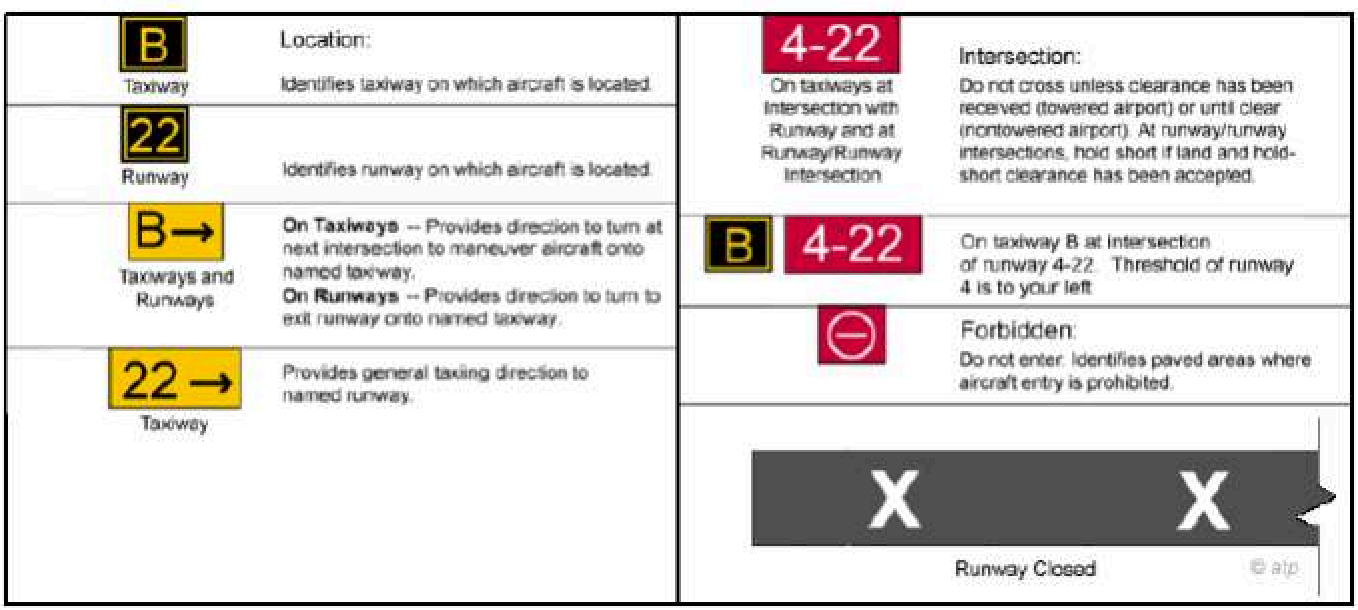

Fig 6-4 Important Airport Signs

AIRPORT LIGHTING

The majority of airports have some type of lighting for night operations. The variety and type of lighting systems depends on the volume and complexity of operations at a given airport. Airport lighting is standardized so that airports use the same light colors for runways, taxiways, etc.

Airport Beacon

Airport beacons help a pilot identify an airport at night. The beacons are operated from dusk till dawn and sometimes they are turned on if the ceiling is less than 1,000 feet and/or the ground visibility is less than 3 statute miles (SM) (visual flight rules minimums). However, there is no requirement for this so a pilot has the responsibility of determining if the weather is VFR. The beacon has a vertical light distribution to make it most effective from 1-10° above the horizon, although it can be seen well above or below this spread. The beacon may be an omnidirectional capacitor-discharge device or it may rotate at a constant speed which produces the visual effect of flashes a regular intervals.

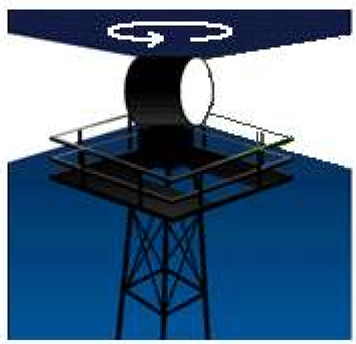

Figure 6-5.—Airport rotating beacons.

The most common beacons are flashing white beacons at suburban or rural civilian land airports. Large urban aports in Class C airspace usually don’t have beacons since these airports can be seen from a long distance in almost any weather.

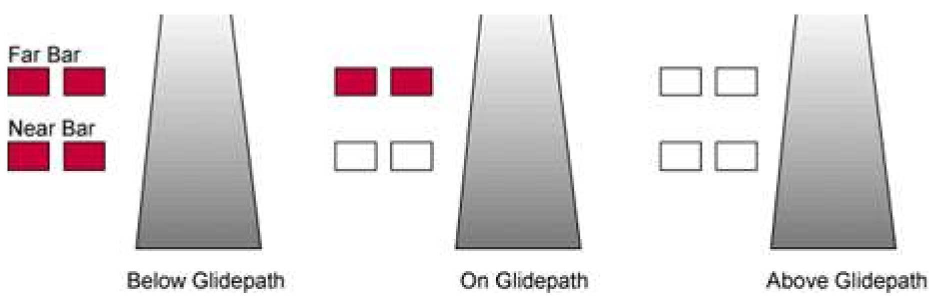

Figure 6-6.—2-Bar VASI system.

Approach Light Systems

Approach light systems are primarily intended to provide a means to transition from instrument flight to visual flight for landing. The system configuration depends on whether the runway is a precision or nonprecision instrument runway. Some systems include sequenced flashing lights which appear to the pilot as a ball of light traveling toward the runway at high speed. Approach lights can also aid pilots operating under visual flight rules at night.

Visual Glideslope Indicators

Visual glideslope indicators provide the pilot with glidepath information which can be used for day or night approaches. By maintaining the proper glidepath as provided by the system, a pilot should have adequate obstacle clearance and should touch down within a specified portion of the runway.

Visual Approach Slope Indicator (VASI)

Visual approach slope indicator installations are the most common visual glidepath systems in use. The VASI provides obstruction clearance within 10° of the runway extended runway centerline, and to 4 nautical miles (NM) from the runway threshold.

A VASI consists of light units arranged in bars. There are 2-bar and 3-bar VASIs. The 2-bar VASI has near and far light bars and the 3-bar VASI has near, middle, and far light bars. Two-bar VASI installations provide one visual glidepath which is normally set at 3°. The 3-bar system provides two glidepaths with the lower glidepath normally set at 3° and the upper glidepath one-fourth degree above the lower glidepath.

The basic principle of the VASI is that of color differentiation between red and white. Each light unit projects a beam of light having a white segment in the upper part of the beam and a red segment in the lower part of the beam. The lights are arranged so the pilot will see the combination of lights shown in figure 6-6 to indicate below, on, or above the glidepath.

Other Glidepath Systems

A precision approach path indicator (PAPI) uses lights similar to the VASI system except they are installed in a single row, normally on the left side of the runway.

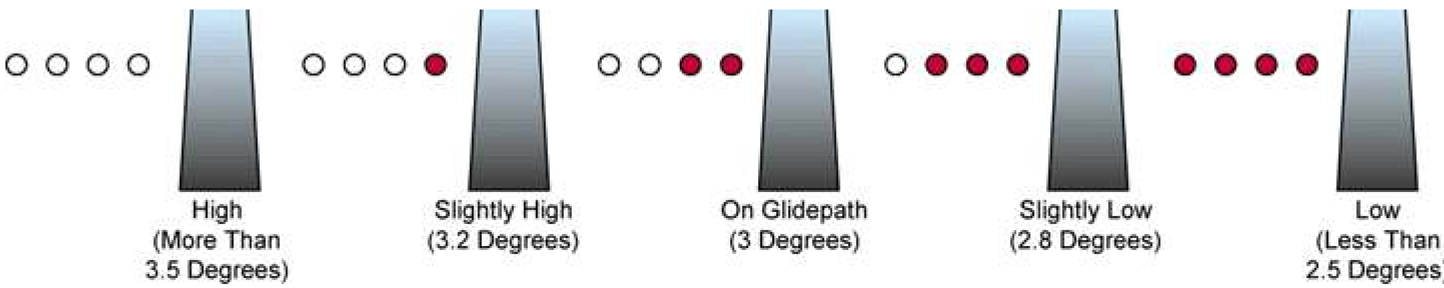

Figure 6-7.—Precision approach path indicator.

Runway Lighting

There are various lights that identify parts of the runway complex. These assist a pilot in safely making a takeoff or landing during night operations.

Runway End Identifier Lights (REIL)

Runway end identifier lights are installed at many airfields to provide rapid and positive identification of the approach end of a particular runway. The system consists of a pair of synchronized flashing lights located laterally on each side of the runway threshold. REILs may be either omnidirectional or unidirectional facing the approach area.

Runway Edge Lights

Runway edge lights are used to outline the edges of runways at night or during low visibility conditions. These lights are classified according to the intensity they are capable of producing. They are classified as high intensity runway lights (HIRL), medium intensity runway lights (MIRL), or low intensity runway lights (LIRL). The HIRL and MIRL have variable intensity settings. These lights are white except, on instrument runways where amber lights are used on the last 2,000 feet or half the length of the runway, whichever is less. The lights marking the end of the runway are red.

In-Runway Lighting

Touchdown zone lights (TDZL), runway centerline lights (RCLS), and taxiway turnoff lights are installed on some precision runways to facilitate landing under adverse visibility conditions. TZDLs are two rows of transverse light bars disposed symmetrically about the runway centerline in the runway touchdown zone. RCLS consists of flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold. Taxiway turnoff lights are flush lights which emit a steady green color.

Control of Airport Lighting

Airport lighting is controlled by air traffic controllers at controlled airports. At uncontrolled airports, the lights may be on a timer, or where an FSS is located at an airport, the FSS personnel may control the lighting. A pilot may request various light systems be turned on or off and also request a specified intensity, if available, from ATC or FSS personnel. At selected uncontrolled airports, the pilot may control the lighting by using the radio. This is done by selecting the airport frequency listed in the CFS and clicking the radio microphone. For information on pilot controlled lighting at various airports, the pilot should refer to the **Canada Flight Supplement.**

Key Mike	Function
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

Figure 6-10.—Radio control runway lighting.

Taxiway Lights

Taxiway lights outline the edges of the taxiway and are blue in color. At many airports, these edge lights may have variable intensity settings that may be adjusted by an air traffic controller when deemed necessary or when requested by the pilot. Some airports also have taxiway centerline lights which are green in color.

Obstruction Lights

Obstructions are marked or lighted to warn pilots of their presence during day and night conditions. Obstruction lighting can be found both on and off an airport to identify obstructions. They may be marked or lighted in any of the following conditions.

- **Red Obstruction Lights**—either flash or emit a steady red color during night operations, and the obstructions are painted orange and white for day operations.
- **High Intensity White Obstruction Light**—flash high intensity white lights during the day with the intensity reduced for night.
- **Dual Lighting**—is a combination of flashing red beacons and steady red lights for night operation, and high intensity white lights for day operations.

WIND DIRECTION INDICATORS

It is important for a pilot to know the direction of the wind. At facilities with an operating control tower, this information is provided by ATC. Information may also be provided by FSS personnel located at a particular airport or by requesting information on a common Air Traffic Frequency (ATF) at airports which have the capacity to receive and broadcast on this frequency.

When none of these services are available, it is possible to determine wind direction and runway in use by visual wind indicators. A pilot should check these wind indicators even when information is provided on the ATF at a given airport because there is no assurance that the information provided is accurate.

The most widely used wind direction indicator is the wind sock. These are usually located in a central location near the runway.

The wind sock is a good source of information since it not only indicates wind direction, but allows the pilot to estimate the wind velocity and gust. The wind sock extends out straighter in strong winds and will tend to move back and forth when the wind is gusty. When landing into the wind, an airplane will always be looking at the SMALL end of the windsock!

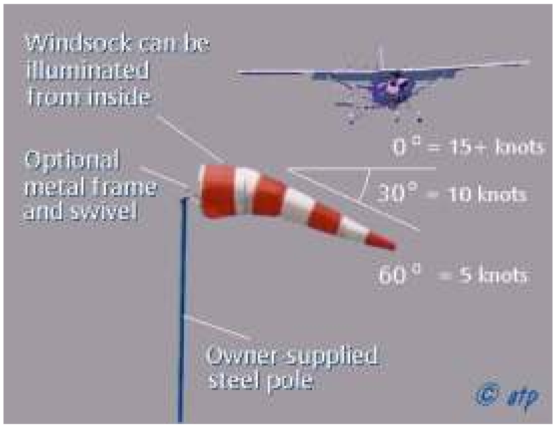

Fig 6-11 Airport Windsock

RADIO COMMUNICATIONS

Operating in and out of a controlled airport, as well as in a good portion of the airspace system, requires that an aircraft have two-way radio communication capability. For this reason, a pilot should be knowledgeable of radio station license requirements and radio communications equipment and procedures.

Radio Licence

There is no licence requirement for a pilot operating within Canada; however the minimum qualification is a Restricted RadioTelephone Operator's permit which can be endorsed onto the pilot's licence. A pilot who operates internationally is required to hold a Restricted Radiotelephone Licence issued by the Communications Canada.

An aircraft radio station license is required however for any aircraft with broadcast capability (simple receivers don't need to be licenced).

Radio Equipment

In general aviation, the most common types of aircraft radios are Very-High Frequency (VHF). A VHF radio operates on frequencies between 118.0 and 136.975 (just above the FM band) and the radio unit is classified as 720 or 760 depending on the number of channels it can accommodate. The 720 and 760 uses .025 spacing (118.025, 118.050, etc.) with the 720 having a frequency range up to 135.975 and the 760 going up to 136.975. VHF radios are limited to line of sight transmissions; therefore, aircraft at higher altitudes are able to transmit and receive at greater distances.

VHF navigation equipment operates in a slightly higher frequency range, and this type of VHF nav equipment is usually contained within the same radio unit in the aircraft.

For convenience, VHF communications radios will have an *active* frequency and a *standby* frequency. This simplifies channel switching when the pilot may be busy with many tasks at one time; using this feature, pilots can quiuckly switch back and forth between twofrequencies.

Phonetic Alphabet

Character	Morse Code	Telephony	Phonic (Pronunciation)
A	.-	Alfa	(AL-FAH)
B	-...	Bravo	(BRAH-VOH)
C	-.-.	Charlie	(SHAR-LEE)
D	-..	Delta	(DELL-TA)
E	.	Echo	(ECK-OH)
F	..-.	Foxtrot	(FOKS-TROT)
G	--.	Golf	(GOLF)
H	....	Hotel	(HOH-TEL)
I	..	India	(IN-DEE-AH)
J	.---	Juliett	(JEW-LEE-ETT)
K	-.-	Kilo	(KEY-LOW)
L	.-..	Lima	(LEE-MAH)
M	--	Mike	(MIKE)
N	-.	November	(NO-VEM-BER)
O	---	Oscar	(OSS-CAH)
P	.--.	Papa	(PAH-PAH)
Q	--.-	Quebec	(KAY-BECK)
R	.-.	Romeo	(ROW-ME-OH)
S	...	Sierra	(SEE-AIR-AH)
T	-	Tango	(TANG-GO)
U	..-	Uniform	(YOU-NEE-FORM) or (OO-NEE-FORM)
V	...-	Victor	(VIK-TAH)
W	.--	Whiskey	(WIS-KEY)
X	-..-	X-ray	(ECKS-RAY)
Y	-.--	Yankee	(YANG-KEY)
Z	--..	Zulu	(ZOO-LOO)
1	.----	One	(WUN)
2	..---	Two	(TOO)
3	...--	Three	(TREE)
4	....-	Four	(FOW-ER)
5	.....	Five	(FIFE)
6	-....	Six	(SIX)
7	--...	Seven	(SEV-EN)
8	---..	Eight	(AIT)
9	----.	Nine	(NINER)

Figure 6-13.—Phonetic alphabet.

All pilots must know the ICAO phonetic alphabet, and they will be examined on their ability to communicate using the phonetic method. Pilots are not expected to know the Morse Code equivalent.

Using proper radio phraseology and procedures will contribute to a pilot's ability to operate safely and efficiently in the airspace system. A review of the Pilot/Controller Glossary contained in the Aeronautical Information Publication (AIP) will assist a pilot in the use and understanding of standard terminology. The AIP also contains many examples of radio communications which should be helpful.

The International Civil Aviation Organization (ICAO) has adopted a phonetic alphabet which should be used in radio communications. When communicating with ATC, pilots should use this alphabet to identify their aircraft. A Cessna 172 aircraft with the registration C-FABC will identify itself as:

"Goose Bay Radio this is Cessna Charlie Foxtgrot Alpha Bravo Charlie"

Lost Communication Procedures

It is possible that a pilot might experience a malfunction of the radio. This might cause the transmitter, receiver, or both to become inoperative. If a receiver becomes inoperative and a pilot needs to land at a controlled airport, it is advisable to remain outside or above Class D airspace until the direction and flow of traffic is determined. A pilot should then advise the tower of the aircraft type, position, altitude, and intention to land. The pilot should then continue and enter the pattern, report his or her position as appropriate, and watch for light signals from the tower. Light signal colors and their meaning are contained in figure 6-14.

COLOR AND TYPE OF SIGNAL	AIRCRAFT IN FLIGHT	AIRCRAFT ON GROUND	OTHER VEHICLES, EQUIPMENT AND PERSONNEL
STEADY GREEN	Cleared to land	Cleared for takeoff	Cleared to cross, proceed or go
FLASHING GREEN	Return for landing (to be followed by steady green at the proper time)	Cleared for taxi	
STEADY RED	Give way to other aircraft and continue circling	STOP	STOP
FLASHING RED	Airport unsafe, do not land	Taxi clear of the runway in use	Clear the taxiway/runway
FLASHING WHITE		Return to starting point on airport	Return to starting point on airport

Figure 6-14.—Light gun signals.

If the transmitter becomes inoperative, a pilot should follow the previously stated procedures and also monitor the appropriate air traffic frequency. During daylight hours air traffic transmissions may be acknowledged by rocking the wings, and at night by blinking the landing light.

When both receiver and transmitter are inoperative, the pilot should remain outside of Class D airspace until the flow of traffic has been determined and then enter the pattern and watch for light signals.
If a radio malfunctions prior to departure, it is advisable to have it repaired if possible. If this is not possible, a call should be made to air traffic and the pilot should request authorization to depart without two-way radio communications. If authorization is given to depart, the pilot will be advised to monitor the appropriate frequency and/or watch for light signals as appropriate.
AIR TRAFFIC SERVICES

Besides the services provided by FSS as discussed in Chapter 5, there are numerous other services provided by air traffic. In many instances a pilot is required to have contact with air traffic, but even when not required a pilot will find it helpful to request their services.

Primary Radar

Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. Range is determined by measuring the time it takes (at the speed of light) for the radio wave to go out to the object and then return to the receiving antenna. The direction of a detected object from a radar site is determined by the position of the rotating antenna when the reflected portion of the radio wave is received.

Modern radar is very reliable and there are seldom outages. This is due to reliable maintenance and improved equipment. There are, however, some limitations which may affect air traffic services and prevent a controller from issuing advisories concerning aircraft which are not under their control and cannot be seen on radar.

The characteristics of radio waves are such that they normally travel in a continuous straight line unless they are “bent” by atmospheric phenomena such as temperature inversions, reflected or attenuated by dense objects such as heavy clouds, precipitation, etc., or screened by high terrain features.

TRANSPONDER PHRASEOLOGY	
SQUAWK (number)	Set designated code into transponder (Example: 1200, 4356)
SQUAWK IDENT	Press "IDENT" button
SQUAWK (number) and IDENT	Set designated code into transponder and press "IDENT" button
SQUAWK STANDBY	Switch transponder to standby position.
SQUAWK VFR	Set code 1200 into transponder

Figure 6-15.—Transponder phraseology.

Air Traffic Control Secondary Surveillance Radar System (SSR)

The air traffic control radar beacon system is often referred to as “secondary surveillance radar.” This system consists of three components and helps in alleviating some of the limitations associated with primary radar. The three components are an interrogator, transponder, and radarscope. The advantages of SSR are the reinforcement of radar targets, rapid target identification, and a unique display of selected codes.

Transponder

The transponder is the airborne portion of the secondary surveillance radar system and a system with which a pilot should be familiar. The ATCRBS cannot display the secondary information unless an aircraft is equipped with a transponder. A transponder is also required to operate in certain controlled airspace. Airspace is discussed in chapter 7.

A transponder code consists of four numbers from zero to seven (4,096 possible codes). There are some standard codes, or air traffic may issue a four-digit code to an aircraft. When a controller requests a code or function on the transponder, he or she may use the word “squawk.” Figure 6-15 lists some standard transponder phraseology.

Radar Traffic Information Service

Radar equipped air traffic facilities provide radar assistance to VFR aircraft provided the aircraft can communicate with the facility and are within radar coverage. This basic service includes safety alerts, traffic advisories, limited vectoring when requested, and sequencing at locations where this procedure has been established. In addition to basic radar service, terminal radar service area (TRSA) has been implemented at certain terminal locations. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the TRSA. Class C service provides approved separation between IFR and VFR aircraft, and sequencing of VFR aircraft to the primary airport. Class B service provides approved separation of aircraft based on IFR, VFR, and/or weight, and sequencing of VFR arrivals to the primary airport(s).

ATC issues traffic information based on observed radar targets. The traffic is referenced by azimuth from the aircraft in terms of the 12-hour clock. Also the distance in nautical miles, direction in which the target is moving, and the type and altitude of the aircraft, if know, are given. An example would be: “Traffic 10 o’clock 5 miles east bound, Cessna 152, 3,000 feet.” The pilot should note that traffic position is based on the aircraft track, and that wind correction can affect the clock position at which a pilot locates traffic.

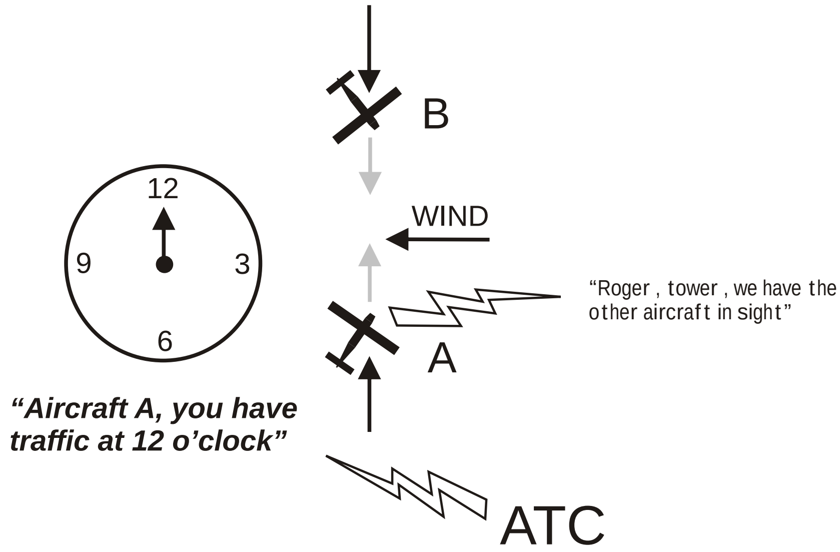

Figure 6-16.—Traffic advisories.

WAKE TURBULENCE

All aircraft generate a wake while in flight. This disturbance is caused by a pair of counter-rotating vortices trailing from the wingtips. The vortices from larger aircraft pose problems to encountering aircraft. The wake of these aircraft can impose rolling moments exceeding the roll-control authority of the encountering aircraft. Also, the turbulence generated within the vortices can damage aircraft components and equipment if encountered at close range. For this reason, a pilot must envision the location of the vortex wake and adjust the flightpath accordingly.
During ground operations and during takeoff, jet-engine blast (thrust stream turbulence) can cause damage and upsets at close range. For this reason, pilots of small aircraft should consider the effects of jet-engine blast and maintain adequate separation. Also, pilots of larger aircraft should consider the effects of their aircraft's jet-engine blast on other aircraft and equipment on the ground.

Wingtip Vortices

Lift is generated by the creation of a pressure differential over the wing surface. The lowest pressure occurs over the upper wing surface, and the highest pressure under the wing. This pressure differential triggers the rollup of the airflow aft of the wing resulting in swirling air masses trailing downstream of the wingtips. After the rollup is completed, the wake consists of two counter-rotating cylindrical vortices. Most of the energy is within a few feet of the center of each vortex, but pilots should avoid a region within about 100 feet of the vortex core.

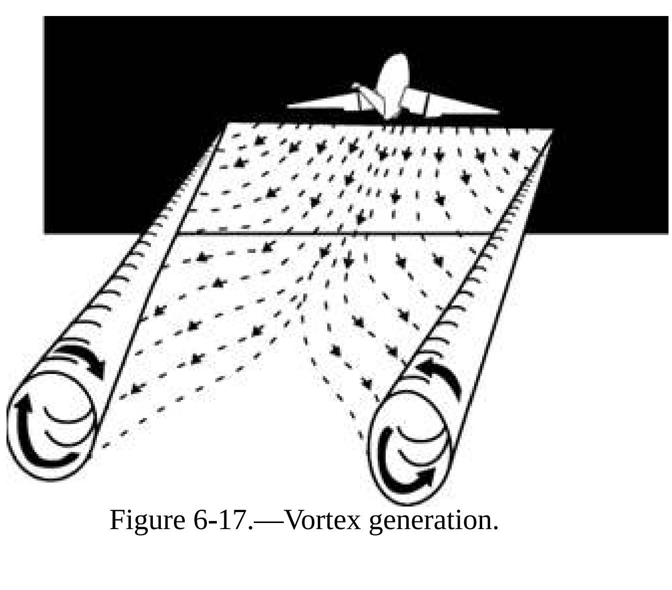

Figure 6-17.—Vortex generation.

Vortex Strength
The strength of the vortex is governed by the weight, speed, and shape of the wing of the generating aircraft. The vortex characteristics of any given aircraft can also be changed by the extension of flaps or other wing configuration devices as well as by a change in speed. The greatest vortex strength occurs when the generating aircraft is heavy, clean, and slow.

Vortex Behavior

Trailing vortices have certain behavioral characteristics that can help a pilot visualize the wake location and take avoidance precautions.

Vortices are generated from the moment an aircraft leaves the ground, since trailing vortices are the by-product of wing lift. The vortex circulation is outward, upward, and around the wingtips when viewed from either ahead or behind the aircraft. Tests have shown that vortices remain spaced a bit less than a wingspan apart, drifting with the wind, at altitudes greater than a wingspan from the ground. Tests have also shown that the vortices sink at a rate of several hundred feet per minute, slowing their descent and diminishing in strength with time and distance behind the generating aircraft.

When the vortices of larger aircraft sink close to the ground (within 100 to 200 feet), they tend to move laterally over the ground at a speed of 2 or 3 knots. A crosswind will decrease the lateral movement of the upwind vortex and increase the movement of the downwind vortex. A tailwind condition can move the vortices of the preceding aircraft forward into the touchdown zone.

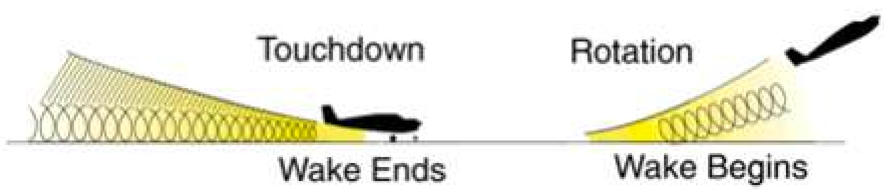

Figure 6-18.—Vortex behavior.

Vortex Avoidance Procedures

A brief summary of vortex avoidance techniques is as follows:

•**Landing behind a larger aircraft on the same runway**—stay at or above the larger aircraft's approach flightpath and land beyond its touchdown point.
•**Landing behind a departing aircraft on the same runway**—land prior to the departing aircraft's rotating point.
•**Departing behind a large aircraft --** rotate prior to the large aircraft's rotation point and climb above its climb path until turning clear of the wake.

COLLISION AVOIDANCE

The Canadian Aviation Regulations set out the established right-of-way rules to enhance flight safety. When two aircraft are approaching, the oneto the right has the right-of-way. If the aircraft are approaching from head-on each shall alter course to the right. Higher aircraft shall give way to lower aircraft. The pilot is also required to contribute to co llision avoidance by being alert and scanning for other aircraft. This is particularly important in the vicinity of an airport.

The Canadian Aviation Regulations also sets out VFR cruising altitudes in order to assist with enroute collision avoidance.

Scanning for Traffic

Effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed 10°, and each should be observed for at least 1 second to enable detection. Although back and forth eye movements seem preferred by most pilots, each pilot should develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning.

If you think another aircraft is too close to you, give way instead of waiting for the other pilot to respect the right-of-way to which you may be entitled.

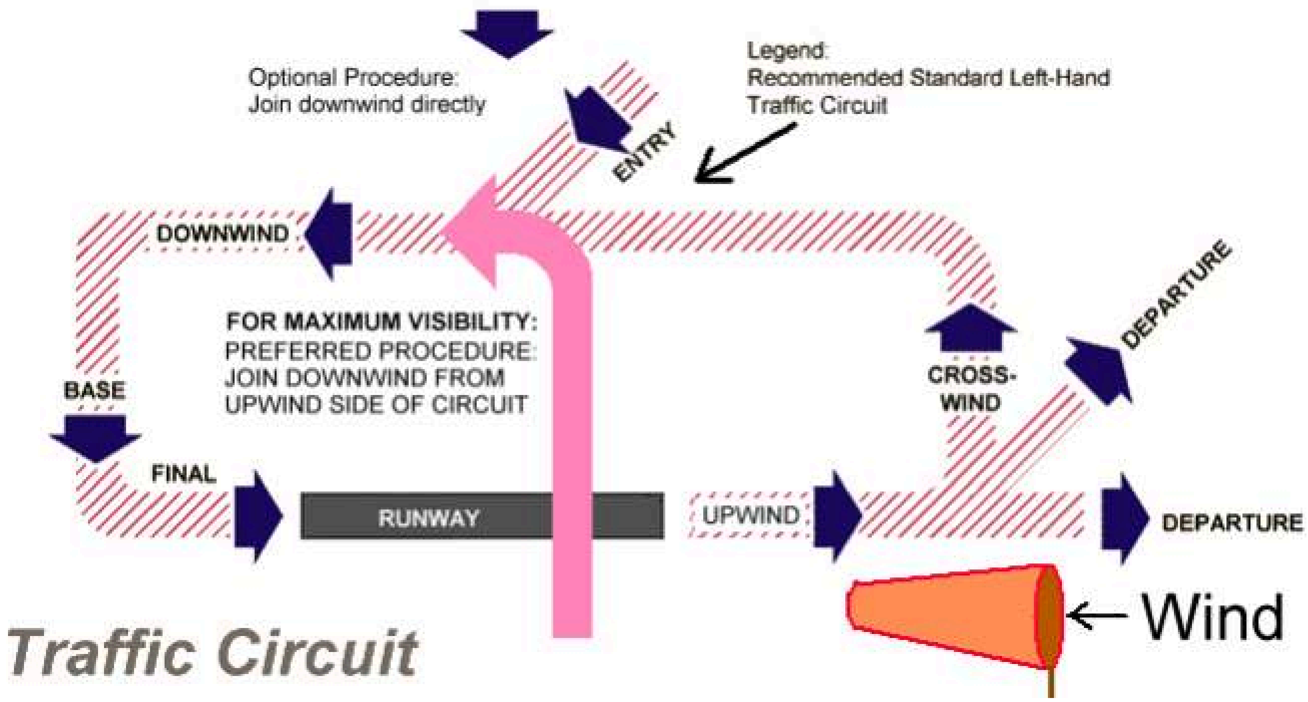

Fig 6-19 The Traffic Circuit

The Traffic Circuit

At uncontrolled aerodromes, traffic should adhere to the established *traffic circuit.* Aircraft should join the circuit from the **upwind** side, overflying the runway, and joining the other traffic on the **downwind leg**., at the same altitude as the other aircraft. If there is no possibility of conflict with other traffic, you may join the downwind leg at a 45 degree angle as shown in Fig 6-19. The circuit height (AAE) for each aerodrome is listed in the Canada Flight Supplement; the standard height is 1000'AAE, but this height may vary.

Clearing Procedures

The following procedures and considerations should assist a pilot in collision avoidance under various situations.

•**Before Takeoff** — Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach area for possible landing traffic, executing appropriate maneuvers to provide a clear view of the approach areas.

•**Climbs and Descents** — During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks left and right at a frequency which permits continuous visual scanning of the airspace.

•**Straight and Level** — During sustained periods of straight-and-level flight, a pilot should execute appropriate clearing procedures at periodic intervals.

• **Aerodrome Circuit** — Entries into the traffic circuit while descending should be avoided.

• **Traffic at VOR Sites** — Due to converging traffic, sustained vigilance should be maintained in the vicinity of VOR's and intersections. The same applies when using GPS units to fly the centre of airways (opposing aircraft coming toward you may be doing the same thing).

• **Training Operations**—Vigilance should be maintained and clearing turns should be made prior to a practice maneuver. During instruction, the pilot should be asked to verbalize the clearing procedures (call out clear "left, right, above, and below"). High-wing and low-wing aircraft have their respective blind spots. High-wing aircraft should momentarily raise their wing in the direction of the intended turn and look for traffic prior to commencing the turn. Low-wing aircraft should momentarily lower the wing.