Student Study Notes – Canadian PPL
Aviation Ground School: Beginner's Aviation

This version of my "Ground School: Beginner's Aviation" study notes is from January 1st, 2017. I'll update this document any time I find the need to make any changes, and as I continue to progress through additional training. This Beginner's Aviation information includes some basics relating to general aviation information that you'll start to learn as you progress through your first dozen or so training flights, and also touches on some of the basics from each of the various sections of ground school training, although I've gone into ground school in much more depth in other sets of study notes. It will be beneficial for a student pilot to learn all of this material immediately after your initial discovery flight, and while getting ready for the PSTAR and Radio License exams. This is all good information to know as you proceed through the first half of your pre-solo flight training.

I am sharing these study notes for anyone else who is taking their PPL in Canada. These aren't intended as a replacement for proper training; I am only sharing these as a supplement covering many of the key points that I decided that I really needed to memorize while going through my PPL studies. The info in these notes comes from a large number of different sources: The Transport Canada Flight Training Manual, various flight schools and instructors (in multiple provinces), and numerous other books and online sources. These notes are not always in any particular order, although I tried to keep similar topics together in many cases.

Please note that while I have made every effort to ensure that all of the information in these notes is accurate, based on the sources from which I learned, you should verify everything here against what you've learned in your own study programs. I (Jonathan Clark) shall not assume any liability for errors or omissions in these notes, and your official pilot training should always supersede any information presented here. As the Canadian PPL curriculum is updated occasionally, I recommend that if you want to be 100% certain that everything in this set of study notes is correct, you should print a copy and ask your instructor to review these notes with you.

If the aircraft type is not specified in the notes below, you should always assume that they refer specifically to characteristics of a Cessna 172M, which is a common training aircraft, and the type that I have used most frequently. Know the characteristics of your own specific training/examination aircraft by memory!

To download PDF or MP3 versions of these notes, visit: http://djbolivia.ca/aviation.html

Let's Get Started – Ground School: Beginner's Aviation

There are various agencies that are associated with aviation. Here are the important ones:

- Transport Canada is the government agency that is the main regulator with respect to aviation.
- Nav Canada is a private, not-for-profit agency that administers all air traffic control in Canada, and also provides maps, charts, and flight planning services.
- Industry Canada regulates radio licensing.
- Environment Canada provides weather forecasting and meteorology.

To check weather: http://flightplanning.navcanada.ca
Toll-free number: 1-866-WXBRIEF

METAR is a weather reporting standard. It stands for Meteorological Terminal Aviation Routine.

Learn your four-letter airport code, ie. Prince George is CYXS, Charlottetown is CYYG, Winnipeg is CYWG.

The Earth's magnetic north pole is approximately 500 miles away from the true north pole, in a southerly direction (inevitably!) towards northern Canada. We need to understand that sometimes we talk about compass directions based on **true north**, and more often (for PPL learners) based on **magnetic north**. Sometimes, to differentiate between the two, people will write a capital letter M after the number of degrees if it is a magnetic bearing, but this doesn't seem to happen frequently in aviation.

Know your **magnetic variation** or **declination** from true north. Prince George is +18^{o} (positive/east), Charlottetown is -19^{o} (negative/west), and Winnipeg is +3^{o} (positive/east).

To convert from True to Magnetic, you subtract the variation if it's easterly, and add the variation if it's westerly. Everything on the west side of Canada has an easterly variation. So for Prince George, which has an easterly variation of 18 degrees, you subtract that 18 degrees from your True bearing to get a Magnetic bearing.

Obviously, to convert magnetic to true, you do the opposite of the above instructions. Yes, it's a bit confusing at first.

Runway readings (in most of Canada, except the far north) are Magnetic.

Maximum visibility on a METAR will always be 9 statute miles. Other weather information tools may have different maximums for visibility.

Knot stands for nautical miles per hour. A nautical mile has been set by international agreement to be 1852 meters or about 6076.1 feet long. The reason for this is because it was set to be one minute in length of longitudinal arc along the equator. In contrast, the more familiar statute mile is 5280 feet or about 1609 meters long.

Fuel tank size in a Cessna 172M can vary. Know the size of the fuel tanks in the aircraft that you're using for your training flights and exam. For example, in C-GUAE (a Cessna 172M based in BC), the tank size is 38 US gallons usable (42 US gallons overall).

A Cessna 172M will burn about 8 gallons per hour. Know the burn rate in the aircraft that you train in. You must have a **thirty minute reserve** at all times unless calling an emergency.

When doing your **weight and balance calculations** in a Cessna 172M, your **Centre of Gravity** will probably be between 35 to 45 inches. You need to check the POH (Pilot's Operating Handbook) to make sure that your Centre of Gravity falls within acceptable limits.

Documents to have on the aircraft: **AROWJIL**
A = Airworthiness Certificate
R = Registration
O = Operating Handbook
W = Weight & Balance
J = Journey Log
I = Insurance
L = Licenses

The only way to really tell if someone exceeded the **maximum speed** for the aircraft is a visual inspection for obvious structural damage. Any time that an aircraft is known to have exceeded any maximum speed, it is no longer deemed to be airworthy and must be inspected by an AME before being flown again.

When flying, you should carry your pilot's license, your radio license, your medical certificate, your CFS, and your applicable charts.

Some Abbreviations:

PPL – Private Pilot's License
CFS – Canada Flight Supplement (re-published every 56 days)
VFR – Visual Flight Rules
VNC – VFR Navigational Chart
PGI – Preparatory Ground Instruction
WB – Weather Briefing
PFB – Pre Flight Briefing
TAF – Terminal Area Forecast
GFA – Graphical Area Forecast
Wx – Weather
NOTAM – Notice To Airmen
ASL – Above Sea Level
AMSL – Above Mean Sea Level
AGL – Above Ground Level
AAE – Above Aerodrome Elevation
CYA – Advisory Airspace
CYR – Restricted Airspace
CYD – Dangerous Airspace

There is a lot of confusion between altitude, elevation, height, and flight levels. Let's try to understand the nuances:

1. Altitude is used to refer to how high an aircraft is above sea level.
2. Elevation is used to indicate how high the surface of the ground is above sea level.
3. Height refers to how high an aircraft is above ground level, above an airport, above hills and other terrain, and so on.
4. Flight levels are defined as bands of altitude above mean sea level in a perfect standard atmosphere.

Some **Weather Briefing** Notes:

- 14003 KT means 140 degrees true, 3 knots.
- A3002 for altimeter means 30.02 inches Hg (mercury).
- Temperature drops about 1.98^{o} Celsius per rise of one thousand feet.
- TSRA stands for thunderstorms, rain.
- Ceiling means more than 50% of the sky covered.
- Sky clear means no cloud coverage. The abbreviation is SKC.
- Few means 1/8th or 2/8th covered. The abbreviation is FEW.
- Scattered means 3/8th or 4/8th covered. The abbreviation is SCT.
- Broken means 5/8th to 7/8th covered. The abbreviation is BKN.
- Overcast means 8/8th covered. The abbreviation is OVC.
- The closer the isobars, the stronger the winds.

Know your frequencies by looking them up in the CFS. For example, Prince George (CYXS) is 118.3 for Tower, 121.9 for Ground, and 128.725 for ATIS.

The **attitude** (don't confuse this with altitude!) refers to the apparent slope of the nose of the aircraft above or below the horizon, ie. the pitch of the aircraft.

Attitudes:

1. Cruise.
2. Nose Up.

3. Nose Down.
4. Banked.

Movements:

1. Rolling (longitudinal axis).
2. Pitching (lateral axis).
3. Yawing (normal or vertical axis).

Know the characteristics of the **Control Zone** for your local aerodrome. For instance, the Prince George airport is a Class D control zone, extending 7 nautical miles out from the airport to 3000 feet AGL.

Control zone types B, C, and D are civilian. Control zone E is one without an operating control tower. Some class B, C, and D control zones turn into Class E with a Mandatory Frequency when they close down temporary, such as overnight.

Know the elevation of your aerodrome. For instance, CYXS (Prince George) is 2260 feet ASL, CYYG (Charlottetown) is 160 feet ASL, and CYWG (Winnipeg) is 783 feet.

Class G airspace is uncontrolled. Understanding different classes of airspace is quite confusing, and requires a full understanding and a lot of memorization. Airspace classifications will be covered in detail in the Air Law section of ground school.

An orbit is a circular flight to delay movement.

Secondary radar requires a **transponder**. Primary radar does not. Primary radar is fairly rare now.

The **Hobbs reading** refers to the engine hours on the aircraft.

Carburetor Heat (on a Cessna 172M) – In is Cold, Out is Heat. Applying carb heat (less dense air) often causes a drop of maybe 75-100 rpm.

Throttle (on a Cessna 172M) – Push in for more throttle. Has a silver "set" knob (tighten clockwise) to fasten it in place. Less throttle (out) is referred to as "more lean." The throttle is also known as the "power."

Mixture Control (on a Cessna 172M) – Push in for rich, pull out for lean. Also known as the "mix."

Magneto checks are very important. When you do a mag check, you're checking to see if they remain "live" after the key has been turned off (which is not great), or during a pre-flight check, to make sure that they are both working.

Carbon Deposits – When you cycle a magneto off during a check you are anticipating a certain RPM drop associated with running the cylinder on half ignition. If you notice a significantly higher drop in RPM's, it could be a sign that you are experiencing some form of carbon deposit in that spark plug gap. To correct, try to lean out the mixture and increase power to try to "burn off" that excess carbon.

Electricity Generation – A dynamo has a commutator and produces direct current. A magneto produces alternating current and doesn't have a commutator. If you lose a magneto in flight, you'll lose some power.

For safety in flight, try to constantly be looking around for other aircraft (in VFR day or night flight).

Cruise Attitude – The attitude for level flight at a constant altitude and airspeed, using a recommended cruise power setting, with wings parallel to the horizon.

Normally, when turning, you should try not to exceed a bank attitude of thirty degrees.

Angle Of Attack (AoA) – The angle at which your aircraft moves forward through the air. It is normally one or two degrees (above relative airflow) in cruise.

For **standard cruise altitudes**, which start at 3000 feet AGL, remember these:
East is Least -> odd 1000's plus 500 feet.
West is Best -> even 1000's plus 500 feet.
Even though they start at 3000' AGL, the decisions are based on altitude above sea level.

L_h is balanced by inertia.
L_v or Lift is balanced by gravity.

Weight Arm – The distance from the firewall to the **Centre of Gravity**.

When lift equals weight, your altitude remains constant.

Rudders are very effective at slow speeds, but ailerons aren't.

There are four main forces acting upon an aircraft in flight, which are divided into two couples:
Lift vs Weight
Thrust vs Drag

For your **pre-climb** or pre-descent check, ensure the following:
1. Oil pressure and temperature both in the green.
2. Mixture set properly.
3. Carb heat set to cold for a climb, or hot/on for a descent.
4. Look out around aircraft.

Acronym for Climbs – **APT** – Attitude, Power, Trim.
Acronym for Descents – **PAT** – Power, Attitude, Trim.

Cruise in a Cessna 172M should be enough power to stay at 2200 rpm.

Standard climb in a Cessna 172M is 88 mph. Standard descent rate if landing is 80 mph. There will be more details on these later, as there are different climb airspeeds used depending on the goal for gaining altitude, and there are different descent airspeeds used (especially relating to flaps). These numbers can even vary slightly from individual aircraft to aircraft within a specific type/make of aircraft.

Whenever you are using full power, the mixture should be "pretty rich" or "full rich."

If you're constantly pulling back hard on the yoke (**control column**), you may want to turn the **trim wheel** down to counter balance this and make it easier on your arms. Trim up if constantly pushing forward.

UTC – Universal Time, Coordinated (also known as GMT, Greenwich Mean Time). This is also known as Zulu time.

Know your Zulu Offset for your local time zone compared to UTC. This can change depending on Daylight Savings Time. For instance, for part of the year (summer) Prince George has a -7 hour offset while Charlottetown has a -3 hour offset, but for part of the year (winter) the Prince George offset is -8 hours and Charlottetown is -4 hours. The "Daylight Savings" is the summer period.

SLP – Sea Level Pressure. The SLP reading in a METAR is really quite confusing. For 1015.3 hectopascals, you drop the first two digits and cut out the decimal, and you get SLP 153. For 978.5 hectopascals, you drop the first digit and cut out the decimal, and you get SLP 785. So no matter what, to convert back to hectopascals, add either a 9 or a 10 to the front of the SLP number, depending on which seems appropriate (range runs 950 to 1049 HPa), then put the decimal place back in.

TTSN – Total Time Since New. Used in readings of engine hours.

In Canada, the **general use frequencies** are as follows:
Emergency: 121.5
Gliders/balloons/ultralights: 123.4
En Route, Uncontrolled, general broadcast frequency: 126.7
Weather, FISE: 126.7
UNICOM1: 122.8
UNICOM2: 122.7
UNICOM3: 123.0
No Base Station: 123.2
Air-to-Air NDA: 123.45
Air-to-Air SDA: 122.75

Ancillary stands for auxiliary, or subordinate to. Ancillary Controls include:
- Carb heat.
- Mixture control.
- Environmental controls.
- Trim Knob.

Prime **icing** occurs between -5 and +15 degrees Celsius, but it can happen from about -13 to +38 degrees, especially with high humidity and/or rapid cooling and expansion.

MOGAS – Motor Gas, ie. consumer automobile gas.

Absolutely **no ethanol** is allowed in your fuel. Other than that, you can run on premium or high octane. Don't trust a gas station that says there is no ethanol in the fuel. Always test your fuel if using MOGAS. Water absorbs alcohol.

Effects of putting on Full **Carb Heat**:
- Richer mixture.
- Reduces maximum power output.
- Increases fuel consumption.

Features of the **Mixture Control**:
- Its purpose is to deal with changing density of air at higher altitudes.
- Push in or out. On some planes, rotating it will move it in or out quite slowly.
- Red knob to lock it in place, for increased safety.

Most of the time, you should set the mixture to full rich (for take-off, climb, descent, and landing). However, for taxi, pull it out by an inch or so. For cruise, you'll want to set it fairly lean. These settings are all affected by your altitude, so review this with your instructor.

Best Economy for mixture is at peak or slightly lean of peak.
Best Power for mixture is slightly rich of peak.

The Throttle controls the air flow, and the Mixture controls the fuel. Both are at "full" when in/forward.

A ratio of 15:1 air-to-fuel (by weight) is chemically correct. A mixture of 14:1 air-to-fuel (slightly richer) gives the best power.

Your **Airspeed is controlled by your attitude**. Nose up or nose down to change speed.
Your **Altitude/Height is controlled by your power**. Throttle in/full to increase altitude.

You should always try to stay at least 40 miles away from thunderstorms, for safety.

Tail Wheel aircraft – Conventional, uses a rear wheel.
Tricycle aircraft – Uses a front wheel, like a Cessna.

There are five types of **Adverse Yaw**:

1. Slipstream: Left yaw, use right rudder. Gets worse as prop speed increases.
2. Torque: Most noticeable on ground. Counteracts prop rotation. Apply right rudder.
3. Asymmetric Thrust (P Factor): Constant thrust when level. When climbing, add right rudder. When descending, add left rudder. This yaw occurs because the angle of attack of the propeller blades changes when the plane is not level.
4. Gyroscopic Precession: During takeoff, tail wheel aircraft will yaw to the left. Apply right rudder.
5. Aileron Drag: Rudder needs to be used in the same direction as the turn.

Compass Errors:

- The compass only works properly when you are in equilibrium.
- Does not work properly at start or top of climb.
- Does not work properly when accelerating, decelerating, or turning.
- Acceleration/deceleration errors are most obvious when travelling east or west, and the error is that when accelerating the compass reads northerly and when decelerating it reads southerly.
- Turn errors are noticeable when turning north or south. When turning south, the compass leads, and when turning north, the compass lags.

Phonetic Alphabet:

A – Alpha
B – Bravo
C – Charlie
D – Delta
E – Echo
F – Foxtrot
G – Golf
H – Hotel
I – India
J – Juliette
K – Kilo
L – Lima
M – Mike
N – November
O – Oscar
P – Poppa
Q – Quebec
R – Romeo
S – Sierra
T – Tango
U – Uniform
V – Victor

W – Whiskey
X – X Ray
Y – Yankee
Z – Zulu

Radio Calls should include the following information:
WHO1 – Who are you talking to?
WHO2 – Identify yourself.
WHERE – Give a 3D synopsis (direction, distance, height).
WHAT – What are your intentions?

Instructions (such as "hold short" or "line up and wait") must always be repeated back. **Clearances** do not get repeated but you must acknowledge.

Use "affirmative" to say yes, and "negative" to say no. "Wilco" means "will comply."

In your initial contact or **wake-up call**, you must include your aircraft type and the full four-letter identification. You also need to let them know which weather advisory you've heard, by saying, "with information XXX" (where XXX refers to a phonetic identifier). In subsequent calls, you can omit the aircraft type. If ATC shortens to just the last three letters of your identification, you may do the same.

Standard air pressure at sea level with temperature of 15 degrees Celsius and humidity of 0% would be equal to any of these three:
1013.25 HPa = SLP 132 = 29.92" Hg = 14.7 PSI

A few more **METAR** abbreviations (you'll learn many more in Ground School):
FG – Fog
CLR – Clear
BR – Mist
QS – Quasi Stationary
LCL – Localized
VLYS – Valleys
LYRS – Layers
PTCHY – Patchy

Lift increases directly proportionately to the forward speed of the aircraft. Once lift equals the weight of the aircraft, it takes off.

Pressure at 10,000 feet is about 10.2 PSI versus 14.7 PSI at sea level.

Centre of Pressure – For computational purposes, the total force of lift is considered to act through one point of the wing.

Longitudinal Axis – This is an imaginary line that runs through the aircraft, from the center of the propeller to the elevators.

Chord Line – This is an imaginary line that runs through the wing from the leading front to the very trailing edge.

Bernoulli's Theorem – As the velocity of air increases, its pressure decreases.

Stall – A stall is not the term used for an engine stopping! Hollywood often uses this term incorrectly. The correct term for an engine stopping is "engine stopping" or even better, "engine failure." Let's look at the

proper aviation definition of a stall. As the angle of attack of an aerofoil in flight is increased, the Centre of Pressure (CoP) moves gradually forward. At a point well beyond the angle of attack for ordinary flight, it begins to move back again. When it moves back far enough, the aircraft stalls.

Boundary Layer – A thin layer of air, sometimes only $1/100^{th}$ of an inch thick. There are two parts to look at. The Laminar layer is good. The Turbulent layer is bad.

Total **drag** is composed of induced drag and parasite drag.
Parasite drag is composed of interference drag and profile drag.
Profile drag is composed of skin friction and form drag.

Induced Drag – Evidence of induced drag includes wing tip vortices and downwash from the wings. This is that part of the drag of an aerofoil that arises from the development of lift.

Parasite Drag – All drag not caused by lift.

Aspect Ratio – Ratio of the span of the wing to the average chord.

Interference Drag – Caused by the interference of airflow between two sections of the aircraft.

Form Drag – A type of profile drag, caused by the form/shape of the plane.

Skin Friction – A type of profile drag, caused by the tendency of air to hold an aircraft back by clinging to its surfaces. A less polished plane or one with ice/dirt/insects will have more skin friction.

Minimum Drag – The airspeed where the total drag is the lowest.

Control Surfaces:
- Roll: ailerons (longitudinal axis).
- Pitch: elevators (lateral axis).
- Yaw: rudder (normal or vertical axis).

In most small single-engine aircraft, such as those used for flight training, only the elevators have controllable trim.

Gyroscopic Precession – When a force is applied to a spinning gyro wheel, it will react as though the force had been applied in the same direction at a point ninety degrees from where the force was actually applied.

Advantages of **Flaps**:
1. Stall speed is decreased, ie. you can fly more slowly before stalling.
2. A steeper landing approach is possible without an increase in airspeed.
3. Forward visibility is increased.
4. Take-off run may be shortened.

There are lots of different types of flap designs. Be careful near the ground.

Dihedral – A wing design feature in which the wing tips are higher than the center section of the wing. This causes a slip or skid to produce a roll.

Load Factor – Ratio of the load supported by the wings to the actual weight of the aircraft and its contents. Load factors increase at a tremendous rate after a bank of greater than 50 degrees.

Gust Loads – Caused by turbulence.

PIC – Pilot In Command.

Weight & Balances Report – Stay within specs! Can be really hard to recover from a stall outside the limits, especially on the aft side for the centre of gravity.

Important Weights:
- Licensed Empty Weight: aircraft/equipment/unusable oils.
- Basic Empty: add full oil/fuel.
- Maximum Permissible: listed in certificate of airworthiness.

The Cessna 172 enters the **Utility** category when the total weight is under two thousand pounds and the balance moment is under eighty thousand.

A typical GA aircraft engine is air cooled, with horizontally opposed cylinders, and not supercharged. The magneto is the ignition switch.

Pre-trip **Engine Checks**:
- Engine oil sufficient?
- Air filter not obstructed?
- Sample the fuel (for water/sediment).
- Look for leaks.
- Visual check (loose wires, etc.).
- Check the prop for nicks, etc.

Some engine oils have **detergents** in them. Only use detergent oil in a detergent engine. Only use non-detergent oil in a non-detergent engine.

Aircraft engine oil is fairly thick. Always keep monitoring oil pressure and temperature! After a cold start, once the engine has run for a short while, the RPM's will increase and the throttle can be dialed back.

The **Primer** draws filtered fuel from the fuel system and injects a fine spray directly into the engine intake ports. This is especially good for cold weather starts.

Always do run-ups facing into the wind. Change fuel tanks (if necessary) before the run-up, not between the run-up and take-off. If something suddenly goes wrong after switching to a different tank as a fuel source, you don't want to discover the problem as you're trying to become airborne.

The carb heat is normally set to cold while on the ground, except for performing an icing check.

Many pilots perform periodic carb heat checks for ice accumulation every ten to fifteen minutes, even on warm days. Under certain conditions, you will fly with carb heat on constantly.

Try to do a static full power check if possible, before the take-off roll, even if the checklist doesn't suggest it.

The Cessna has a fixed pitch propeller.

The normal climb speed in a Cessna is 88 mph. If you don't have enough airflow it can contribute to overheating of the engine. You'll also have potential problems if your engine RPM's exceed the limitations for sustained full throttle operation.

During a sustained descent, it is good to apply power periodically to retain engine operating temperatures.

Prior to shutdown (which you do on the ground by fully leaning out the mixture), do a **magneto check** to make sure you don't have a live magneto. By the way, always be careful when adjusting your mixture in the air. If you lean it out and kill the engine, you'll turn into a glider. This isn't necessarily the end of the world, but Transport Canada no longer considers it safe to kill the engine of an aircraft during practice for a PPL.

Air Time – This is the time elapsed when the aircraft is not touching the ground.

Flight Time – Length of time from when the aircraft first moves under its own power until it comes to rest at the end of the flight.

Aerodrome – Any surface used for taking off, landing, taxiing, etc.

Don't be scared to contact your destination for a field condition report. If in doubt, don't go. If the weather is bad and the destination may not be cleared, don't go. If there is a **NOTAM** advising unavailable operations at the destination, don't go. You don't want to arrive at the destination, discover that you can't land, and then discover that you don't have enough fuel to return to your origin.

FSS – Flight Service Station
RAAS – Remote Aerodrome Advisory Service
RCO – Remote Communications Outlet

When trying to understand wind reports, a written report such as METAR/TAF/FD reports winds as being "from" a direction, based on true north, in knots. A simple way to remember this is, "if it is written it is true."

Wind Sock (wind cone) Interpretation:
15 knots – Horizontal.
10 knots – 5 degrees below horizontal.
6 knots – 30 degrees below horizontal.

To converts knots to miles/hour and vice versa, use these conversions:
1 knot = 1.15 statute miles per hour
1 knot = 1.85 kilometers per hour

Runway markings are white. Taxiway markings (center line and hold points) are yellow. Taxi hold markings on an instrument runway are two dashed and two solid. On a non-instrument runway, the "hold short" line is one dashed and one solid. If no taxi hold position is obvious or marked, stay back 200 feet or 60 meters. Center line markings on a runway in Canada are 100 feet long and spaced 100 feet apart.

The **Button** is the point at the end of a runway where an aircraft is positioned for takeoff with the intention of full runway.

Runway Numbering:

- Numbers are based on degree bearing, rounded to tens, drop the zero.
- The bearing is usually magnetic, although in areas with high magnetic declination (the Arctic) the convention switches to true bearings.
- Each runway has two numbers, separated by 18 (180 degrees), and the proper number for the runway is one of these two, depending on which way you're facing.
- Example: If you're at one end of a runway ready to take off, and facing north-northwest at about 329 degrees, you're going to be on runway 33, but if you were at the other end facing south-southeast you'd be on runway 15.
- If you have parallel runways they will have separate designations of L or R to stand for Left or Right, or possibly even C for Center if there are three parallel runways at an extremely busy airport.

An ATC unit cannot suggest **Special VFR** to a pilot. The controller or FSS may often hint at it, by indicating that the weather is below VFR, but the onus still falls upon the pilot to actually request S-VFR. Controllers will often deny S-VFR, at least temporarily, if there is an IFR aircraft being controlled, because IFR craft have priority in IFR conditions. You may have to orbit and wait, and put in a Special VFR request a second time after the IFR craft has been dealt with.

ATC stands for Air Traffic Controller, and ATS stands for Air Traffic Services. All controllers provide certain types of air traffic services. However, not all ATS personnel and facilities provide air traffic control. Although some people use these terms almost interchangeably, there is a distinct difference, albeit with some overlapping roles.

There are four types of **Whiteouts**:

1. Overcast whiteout.
2. Water Fog whiteout.
3. Blowing Snow whiteout.
4. Precipitation whiteout.

The **Engine Cowling** is the covering of the engine. It is used for drag reduction, cooling, decorative purposes, and so on.

Instrument Panel Categories:

- Flight instruments.
- Engine instruments.
- Navigation instruments.

Some **Important Instruments**:

1. Airspeed Indicator – Airspeed through the air, not relative to the ground (you need to factor in the wind, bank, climb, and so on).
2. Altimeter – Height about sea level, not above ground.
3. Magnetic Compass – This has authority when stable, used to set heading indicator, but susceptible to errors on turns, turbulence, and more.
4. Heading Indicator – Uses a gyro, reliable, but must be set periodically by reference to the magnetic compass.
5. Turn & Bank Indicator – Needle shows the rate of turn and direction. Also useful as a guide to see how rudder should be applied.
6. Altimeter – Remember that the airport is not at zero. The altimeter, if set correctly, gives an estimate of altitude above mean sea level.
7. Vertical Speed Indicator (VSI) – Rate of climb/descent in hundreds of feet per minute.
8. Tachometer – Measures RPM's.

The VHF Omnidirectional Range (**VOR**) permits an aircraft to track to or from a VOR ground station on any track that the pilot selects.

The Automatic Direction Finder (**ADF**) points in the direction of any suitable ground radio station that is tuned in.

Master Switch – Connects the battery to the electrical system. Used for specific instruments and to start the engine. Once the engine is started, it runs independently from the electrical system, requiring only magnetos. Kill the master and you lose all electrically powered instruments, but the engines keep running.

Always carry flight charts, even when flying VFR in a localized area.

Try not to park on ice! Even when brakes are applied, wind may slide you around. Don't do an engine run-up on ice. Don't park on soft ground in case the aircraft settles. Even an extremely thin film of ice or frost on the aircraft can seriously reduce the lift qualities of an aerofoil. Contamination (ice or dirt) having the same grade as coarse sandpaper can reduce lift by as much as thirty percent and increase drag by forty percent. Ice can also jam the controls.

ELT – **Emergency Locator Transmitter**, broadcasts on 121.5 MHz, 243.0 MHz, and for all newer units since 2009, also on 406 MHz.

Indications of **Carb Icing**:

- Loss of RPM with fixed pitch propeller (Cessna).
- Loss of manifold pressure with constant speed propeller.
- Accompanying airspeed loss and rough idle.

A pilot is not damaging the engine (with an application of heat) at a cruise power of 75% or less. The engine loses an average of nine percent of its power when carb heat is applied. Carb heat also creates a richer mixture, so you might have to lean out the engine. At low power, such as in the traffic pattern, this may not be practical.

Carb Heat Guide:

- Start cold.
- Use heat before take-off. Not while taxiing though, because intake air bypasses the carb air filter.
- Don't apply heat during take-off, except maybe when really cold.
- When ice is suspected, immediately apply full heat. Power loss indicates the presence of heat, then there will be an increase in power as ice melts.
- Also smart to test for carb icing by applying heat approximately every ten to fifteen minutes.
- If ice persists after full heat, gradually increase power to obtain the greatest amount of carb heat.
- Icing can occur in temps of up to 38 degrees Celsius, and relative humidity of only fifty percent.
- During descents, apply carb heat (especially under 2000 rpm). Apply power periodically.
- Carb heat reduces power and increases fuel consumption.

Mixture Settings:

- Need less fuel (a mixture that is more "lean") as you ascend because the air also thins out and contains less oxygen.
- Take off with full rich unless maybe at an airport of really high elevation.
- Go full rich on descent, but you may want to ease into this as you descend.

When Fuel/Air is Too Rich:

1. May not develop rated power.
2. Engine runs unevenly.
3. Engine may be cooler than desirable.
4. Fuel is wasted.
5. Increased chance of spark plug fouling.
6. Range is reduced.

When Fuel/Air is Too Lean:

1. You lose power.
2. Rough running engine; vibration.
3. Engine may run too hot.
4. Engine damage is possible through detonation.

Run your engine slightly rich if you're uncertain.

Ram Air enters an air inlet as a result of forward motion of the aircraft.

If the **Tower** gives you directions to a runway and those directions force you to cross another runway, you do not have to ask permission unless you were told to hold short. Any instructions such as "hold short" must be read back. Taxiing at an unfamiliar airport can be very confusing. Don't hesitate to identify as being unfamiliar or a student, and ask for clarification.

Weathercocking is the tendency of the plane to head into the wind. Nose wheel (tricycle) aircraft such as the Cessna are less prone to this than tail-draggers.

It takes more power to start an aircraft taxiing than to keep it moving. Once you get started, ease off the power. Always use brakes sparingly when turning during a taxi. Slow down before a sharp turn. Only use your feet when taxiing. Brake and rudder only. The control column does nothing. The only exception to this rule is that when taxiing cross wind, deflection of ailerons will help maintain directional control.

Quartering Tail Winds:

- Put the elevators and ailerons that are on the side from which the wind is coming into a control position that pushes the plane down.
- Back Left needs down aileron left and down elevator (yoke forward).
- Back Right needs down aileron right and down elevator (yoke forward).
- Front Left needs up aileron left and neutral elevator.
- Front Right needs up aileron right and neutral elevator.
- These suggestions are for a Cessna. Many other planes will be similar, but some manufacturers may recommend a different approach.

Taxiing:

- It is often smart (in many adverse circumstances) to taxi with the control column well back to prevent flipping the plane.
- Taxiing downhill is hard.
- Try to never do a complete pivot on a stationary main wheel by braking.
- Marshalling is when an aircraft is receiving outside guidance.
- Never block a taxiway during warmup, run-up, etc.
- Always keep looking around for other aircraft.

You should always keep your heels on the floor during flights. Brakes are useless anyway.

Ailerons react consistently with airspeed changes. If you go faster (relative to airspeed), more air hits the ailerons. Rudder sensitivity is related to power at low airspeeds (as the prop throws air along the aircraft) but this sensitivity diminishes as cruise speed is reached.

Attitude plus Power equals Performance. Remember this. It is very important.

Trim – Changes in power and attitude affect control pressures on the elevator. Trimming, or changing the trim wheel, can eliminate these pressures to make flying more accurate and less fatiguing.

There are four main **types of climb**:

1. **Best Rate (V_Y)**: Greatest gain of elevation in a given period of time, although not in the shortest distance. 91 mph in Cessna 172 at sea level, slower as you gain altitude.
2. **Best Angle (V_X)**: Gets you above something in the shortest possible surface distance, although it is a slow rate of ascent. 68 mph in a Cessna 172 with flaps retracted, and 65 mph with 10^o flaps (you often don't climb with more than 10^o flaps, because drag can offset lift). Also, it is standard to raise flaps as soon as you're a couple hundred feet off the ground, once you have completed obstacle clearance.s

3. **Normal:** Fastest airspeed, but you are in no hurry to get to altitude. Better forward visibility, and better for cooling the engine.
4. **En Route:** Varies, depending on conditions. Convenience and comfort are usually the main factors. Maybe 80-90 mph.

Aircraft often yaw to the left during a climb. Apply right rudder and watch the ball in your Turn Coordinator.

The Turn & Bank Indicator and the Turn Coordinator are two similar instruments. In general, the Turn Coordinator is a more modern version of the Turn & Bank Indicator. Both instruments have an inclinometer along the bottom, although the earlier Turn & Bank Indicator used a needle deflection indicator in the top half of the gauge, whereas the modern Turn Coordinator uses the silhouette of an airplane. Although there are slight differences in the exact function of the two gauges, you should effectively treat them as being somewhat synonymous when you see a reference to either. If you want to know the exact difference, the modern turn coordinator can indicate the rate of roll, which the turn & bank indicator cannot.

The inclinometer is the vertical strip at the bottom of the Turn & Bank Indicator (or Turn Coordinator). It houses a ball which moves back and forth depending on the exact orientation of the plane.

Dense air gives better performance. Density decreases:
- As height increases.
- As temperature increases.
- As humidity increases.

Humidity in the air also has a secondary effect of reducing the amount of oxygen available for combustion in the engine.

A rule for climbing is to decrease the indicated sea level climb speed by 1.75% (use about two knots) for every one thousand feet of altitude starting after 1000 feet.

Density Altitude – The altitude corresponding to a given density in a standard atmosphere. It is a "condition," not a level of flight. In other words, it's the altitude that your aircraft thinks it's at. The elevation of an airstrip should be converted to density altitude to give a true picture of expected aircraft performance.

If using retractable landing gear, use caution while retracting the gear due to changes in attitude. Once retracted, the rate of climb increases.

Know your best **glide speed**! In a Cessna 172, it should be around 80 mph. This is the same as your standard landing speed without flaps extended.

Descents can be power-on or power-off. Power-on gives the pilot more control.

If another aircraft appears to occupy a stationary position on your windshield and to be growing larger, you'll eventually collide unless you take evasive action.

In a descent at constant attitude and airspeed, the position on the ground that remains stationary in relation to the fixed position on your windshield is the ground position that your aircraft should reach.

Power-off Descents:
1. Cockpit checks, altimeter reading.
2. Search sky for other aircraft.
3. Close throttle smoothly, but promptly.
4. The aircraft will probably yaw right, so you may need some left rudder.

5. Choose attitude for best glide.
6. Trim.
7. Pitch adjustments and re-trim if needed.
8. Check altimeter and vertical speed indicator.

Power-on Descents:

1. Reduce engine power to pre-selected RPM.
2. Decrease airspeed to desired rate.
3. Lower nose to correct attitude.
4. Trim to maintain attitude.
5. Check airspeed and rate of descent; adjust power and/or attitude if needed.
6. Re-trim.

It is common for a Cessna 172 to need a moderate amount of right rudder in a climb, and a lesser amount of left rudder in a power-off descent. This can vary in other types of aircraft. Pay attention to the ball in your inclinometer.

If flying into a headwind, you'll need to increase the airspeed slightly higher than usual to maintain an appropriate groundspeed for landing. With a tailwind, go with a slightly lower speed.

Centripetal Force – toward the center of a turn.
Centrifugal Force – not a true force; propensity to continue (inertia).

Some Notes about **Turns**:

- Gentle turns are those categorized as being up to fifteen degrees of bank.
- Medium turns are those between fifteen and thirty degrees.
- Steep turns are those of more than thirty degrees.
- Your stall speed increases eighteen percent at 45^{o} of bank, and forty percent at 60^{o} of bank.
- Adverse yaw in a turn means that you need to use a small amount of rudder in the direction of the turn. Adverse yaw has almost been eliminated in aircraft of recent manufacture, so rudder pressure required has been reduced very effectively.
- Always look around before and during turns.
- Don't try to sit vertical to Earth during a turn. Stay loose and ride with the turn.
- Learning how to do power-off descending turns properly is especially important.
- A steep descending turn can be used to come down through a hole in clouds. However, most situations requiring the use of a steep turn are the result of poor decision making.
- If the ball in the inclinometer is to the inside of a turn, you are slipping. If it is to the outside, you are skidding. If it is centered, you are turning properly.

Notes about **Flight for Range**:

- The objective is to fly the greatest distance possible per unit of fuel consumed.
- Fuel: Less fuel equals less range. This is basically a direct correlation.
- Angle of Attack: Maximum range is achieved when the aircraft is being operated at the angle of attack giving the greatest ratio of lift to drag. This is a constant, and not affected by changes in altitude or gross weight. Most light aircraft don't have an angle of attack indicator.
- Airspeed: You have to use the indicated airspeed. There is a specific speed for this, corresponding to the best angle of attack. Doesn't change with altitude. Increases slightly for heavy craft.
- Aircraft Weight: The angle of attack must remain constant so the only way to increase lift for a heavy aircraft is to increase airspeed. More power equals more fuel burned equals reduced range.
- Center of Gravity: If at the forward limit, more lift is required. There is an increase in drag, so a need to increase power to maintain airspeed, therefore range is reduced. If at the aft limit, less power will be required to maintain airspeed.

- Altitude: Based on many factors including wind, turbulence, ceiling, distance to fly, terrain, radio reception, map reading, aircraft performance, and more.
- Engine Efficiency: High altitude is better, mostly. Optimum altitude permits the throttle to be fully open while providing power required for correct airspeed or angle of attack.
- Climb: Even though higher altitudes may be best in the long term, trip variables may make lower altitudes more efficient in the end.
- Wind: May have a greater effect on the range of an aircraft than any other factor.

Notes about **Flight for Endurance**:
- The objective is trying to keep the aircraft in the air as long as possible.
- For reciprocating engines, maximum endurance is achieved at sea level.
- Turbulence: For level flight, we need to change power settings frequently, therefore, there is increased fuel consumption. It is better to use a slightly higher continuous power setting.
- Flaps: Generally not used due to drag being greater than lift.
- Mixture: Leaned properly. Double check the throttle afterwards, since leaning will increase RPM's.

Slow Flight – This is the range of airspeeds between maximum endurance speed for a plane, and the point just above its stalling speed, for the existing flight conditions. It is important to gain confidence in the handling of the aircraft at slow speeds, for safety reasons. In particular, you should practice takeoffs, landings, recovering from misjudged landings, and approach stalls.

Problems with Slow Flight:
- Fuel consumption is higher.
- Engine can overheat, especially while climbing.
- Lack of aileron response.
- When turning, you will definitely need to use rudder.
- Airplane will want to yaw left, and to a lesser extent, roll left.

P-Star – This stands for the Pre-Solo Test of Air Regulations, and is also known as the "Student Pilot Permit or Private Pilot License for Foreign and Military Applicants, Aviation Examination." This certificate is needed for both fixed and rotary wing pilots, before the first solo. P-Star tests include the CAR's, ATC clearances and instructions, VFR procedures in controlled and uncontrolled airspace, special VFR, AIC's, and NOTAM's.

AIC – Aeronautical Information Circular. It is published by Nav Canada.

A **stall** is a loss of lift and increase in drag that occurs when an aircraft is flown at an angle of attack greater than the angle for maximum lift. An aircraft may be stalled in practically any attitude and at practically any airspeed. Regardless of airspeed, an aircraft always stalls when the wings reach the same angle of attack. Remember that the airspeed indicator functions by the effect of air density. With respect to stalls, the indicated stalling speeds will remain the same at all altitudes.

Factors which affect **stalling speed**:
- Weight: heavier is bad.
- Balance: forward center of gravity is bad.
- Power: power off is bad.
- Flaps: extended flaps lower your stall speed
- Pitch: up is bad.
- Angle of Bank: steep is bad.
- Aircraft Condition: not well maintained is probably bad.
- Landing Gear: down is often good.

An **imminent stall** means that the aircraft is approaching close to a stall. A stall normally occurs "gradually." Stall symptoms often appear at 15-16 degrees. Most aerofoils stall at about 17 degrees angle of attack. Due

to the washout of the wings, the stall begins at the wing roots, and as the angle of attack is increased, moves progressively toward the wing tips. When the first symptoms of a stall appear, you should move the elevator control forward slowly and promptly.

Practicing **Stall Recovery**:

- Do it over an unpopulated area.
- Must be at an operationally safe altitude, ie. minimum 2000 feet AGL.
- The objective is to recognize an imminent stall, not to actually stall.
- Do a cockpit check first, for loose items.
- Check for carb ice.
- Do a look-around, especially below.
- Practice entering from straight and level, don't have nose up too much because this isn't realistic of real life.

Recovering from a stall:

1. Lower the nose immediately to reduce the level of attack. Get smooth airflow over the wing. Use rudder if necessary.
2. Apply full throttle promptly, but smoothly. The cruise power setting is probably OK, but don't be scared to use full power if the altitude is low.

Auto-Rotation – A rolling tendency during the stall, caused by a difference in lift between the two wings, causing one wing to drop.

Stalls, Power-On:

- Same principle as power-off stalls.
- Pitching of an aircraft from a full stall with power on is much more steep and rapid.
- More difficult to control due to auto-rotation.
- Elevators and rudder retain their effectiveness longer due to prop slipstream, but ailerons are less effective than during a power-off stall.
- Need to apply full power during recovery, always.

Acceleration Stall – Stalls can happen at higher airspeeds when manoeuvring loads are imposed by sudden turns, pull-ups, or abrupt changes in flight path.

Stalls:

- Be careful when using the elevator to recover from a stall. Don't overdo it too quickly and cause a secondary stall.
- Acceleration forces generated by turns or abrupt changes in upward pitch, regardless of airspeed, will always increase the stalling speed. This holds true for all types of turns.
- Turbulence can cause a significant increase in stalling speed.
- The lower the airspeed when a stall occurs, the lower the probability of structural damage (load factors are lower).
- During a climbing turn, the higher wing will stall first.
- During a level or descending turn, the inside wing normally stalls first.

The **Manoeuvring Speed** is the maximum speed at which the application of full aerodynamic control will not overstress the aircraft.

Be careful not to pull up too much on the yoke during takeoff. As soon as you're airborne, go to mostly level so you can gain more speed. You don't want to go as steep as possible.

An **overshoot** is like a departure stall, sort of. You might need to turn depending on traffic control. If dealing with an overshoot:

1. Apply full power.
2. The aircraft will go nose high. Anticipate it.
3. Retract flaps smoothly, in stages, if appropriate.

Spins – Your instructor will teach you about recovering from a spin. This manoeuvre will probably make you a bit nauseated at first, although with some practice, most people eventually come to be quite comfortable with spin recovery. There is no practical application for a spin in normal flight. Training is only for the purposes of recognition, avoidance, and recovery. Never do spins on purpose unless you're in an aircraft certified for intentional spinning. Many aircraft become uncontrollable in a spin.

Right Of Way:

- Aircraft in distress or emergency have the right of way.
- When converging at the same altitude, the PIC of the aircraft that has the other aircraft on the right must give way.
- If two aircraft are flying roughly at each other, at the same altitude, each of them must veer to the right.
- Aircraft that are less able to manoeuvre always have the right of way. Balloon >= glider >=blimp >= helicopter or airplane. The helicopter and airplane are equal.
- Pilot giving way must not pass over, under, or ahead of an aircraft with the right of way.
- An aircraft being overtaken has the right of way.
- Subsequent changes in position do not change the right of way.
- An aircraft that is landing has the right of way over any other aircraft on the ground or in the air. If both are landing, the one at the lower altitude has the right of way.
- Any aircraft with a slung/towed load (banner, glider, cargo net, water bucket) has the right of way over a powered craft.

An aircraft manoeuvring on water (**float plane**) is legally still an aircraft subject to air rules, but must also adhere to rules for watercraft while on water. You might want to get your boating license.

You can only **fly in formation** when you have the agreement of the other pilot and, if applicable because you're in a control zone, with the agreement of ATC.

Broadcast – A radio transmission that is not specifically directed at anyone in particular.

Some notes about **Light Signals**:

- Used when there is no working radio.
- Pilot should advise tower by telephone prior to departing or arriving.
- For communications failure at a controlled airport, circle the tower 500 feet above circuit altitude, watch for light signals from the tower.
- Steady green means either "cleared to land" or "cleared to take off."
- Flashing green means either "return to land" or "cleared for taxi."
- Steady red is either "continuing circling" or "stop" (on the ground).
- Flashing red is either "airport unsafe" or "taxi clear of landing area in use."
- Flashing white is "return to starting point at airport."
- Blinking runway lights, if you're on the ground, mean "vacate runway immediately."
- Red pyrotechnics (fireworks) is "do not land for the time being."
- Projectiles bursting into red and green stars means "you are in the vicinity of a restricted area, alter course."

To acknowledge **clearances** without a radio:

- At night on the ground or in the air, use a single flash of your landing light.
- During day on ground, by full movement of rudder or ailerons, whichever can be seen most easily, or by taxiing the aircraft to the authorized position.

- During day in the air, by distinct rocking of the wings.
- Transponder 7600 means lost communications.

Light signals can be found in:

1. CFS – Canada Flight Supplement.
2. AIP – Aeronautical Information Publication.
3. CARS – Canadian Air Regulations.

Aviation noise bothers some animals. Fly at least two thousand feet AGL over fur and poultry farms. Fur farms may be marked with chrome yellow and black stripes on pylons on the roof. A red flag may be present during whelping season. Avoid these areas, especially from February to May. Also, fly a minimum of 2000 feet AGL over herds of reindeer, caribou, and bison. You must fly at the same height above any national, provincial, or municipal parks, reserves, and refuges.

ICAO – International Civil Aviation Organization.

When doing an aircraft ident, you can drop the phonetic "C" prefix and just use the last four letters while in Canada, but you must use the full identifier in foreign countries.

Control areas and control zones are not the same. They are really confusing. We'll go into them in more depth later.

Line Up – Means to go onto a runway and wait for instructions to take off.

Unverified Altitude – When ATC notifies you about another plane but gives unverified altitude, it means that ATC is not in radio communications with the other plane, and is basing the altitude on that plane's transponder. If the altitude is not mentioned at all, this means that the altitude of the other craft is unknown.

Never do anything that compromises your safety. It is always safety first, controller request second.

Some abbreviations:

FSS – Flight Service Station
FIC – Flight Information Centre
UNICOM – Universal Communications (no tower, but there's a base station)
ATIS – Automatic Terminal Information Service
Wx – Weather
Rx – Receive
Tx – Transmit
Pax – Passenger
MF – Mandatory Frequency

The "WARN" Acronym:

W – Winds.
A – Altimeter.
R – Runway in Use.
N – Number or Identifier.

FIC's – A flight information centre provides toll free access to weather briefing and flight planning services from eight locations across Canada.

FSS – A flight service station provides services pertinent to the arrival and departure phases of flight at uncontrolled aerodromes and for transit through a mandatory frequency area.

On the initial radio call, the FSS or FIC is called "Radio," ie. "Campbell River Radio."

Class "E" airports with MF areas will have an associated FSS. These are often, but not always, manned. Class "E" aerodromes are MF and give advisories instead of clearances.

ATC Roles:

- Ground: Controls taxiways.
- Tower: Controls runways and the immediate airspace around the airport.
- Terminal/VFR Advisory: Directs VFR aircraft in the space surrounding large airports.
- Center: Controls IFR en route traffic and VFR flight following.

Some notes about **Control Zones**:

- Extend to a specified upper limit. Sometimes, but not always, this is 3000 feet AGL.
- When departing, remain on Tower frequency until clear of the control zone.
- With a Tower, advise ATC when you are on the downwind leg.
- ATC will give you the number in the approach sequence.

A pilot in a Class E or non-towered control zone needs to report:

- Before entering the zone.
- On downwind.
- On final.
- When clear of the runway.

Control Area:

- Describes a volume of controlled airspace that exists in the vicinity of an airport.
- Specified lower and upper levels.
- Usually situated on top of and around a control zone.
- Provides protection to aircraft climbing out from the airport by joining the low level control zone to the nearest airways.

ATF – Aerodrome Traffic Frequency. Busy and uncontrolled airports have an ATF. They may have a Unicom ground station. Otherwise, use 123.2 MHz. VFR en route in uncontrolled airspace should always monitor 126.7 MHz. If possible, also monitor 121.5 MHz for aircraft in distress.

Distress Calls:

- Use your normal air-ground frequency if possible. If not, go onto 121.5 MHz.
- Start with "Mayday, Mayday, Mayday."
- Include position, altitude, type of aircraft, nature of emergency, intended action.
- To cancel, call "Mayday, All Stations, All Stations, All Stations, Silence Finished, Out."

Urgency Calls:

- Use "Pan Pan, Pan Pan, Pan Pan."
- The station calling has an urgent message concerning the safety of someone or some craft, or is experiencing difficulties which do not require immediate help, ie. lost, low fuel, systems problems.

NOTAM Variations:

- APRX NOTAM: Good until a new or cancelling NOTAM is issued.
- NOTAM N: New NOTAM.
- NOTAM R: Replacement NOTAM.
- NOTAM C: Cancelling NOTAM.
- NOTAM J: Canadian Runway Friction Index.

Aerodrome – Any land or water designed for arrival, departure, movement, and servicing of aircraft (including buildings, installations, and equipment).

Airport – Any aerodrome with a certificate in force, which means that it meets certain certification standards.

Airport Types:

- Public Use Certificate (PUC): Open to all aircraft.
- Private (PVT): Private property, not open, permission needed except in emergency.
- Registered (REG): Registered for the purpose of publishing info in the CFS.
- Military (MIL): Emergencies only.

Movement Area – Includes manoeuvring areas and aprons.

Manoeuvring Area – Runways and taxiways, but not aprons.

Apron – Loading/unloading passengers and cargo, refueling, servicing, maintenance, parking, and associated areas.

Runways in the North and Arctic (the areas classified as NDA, or Northern Domestic Airspace) use true rather than magnetic runway headings.

Threshold – The end of the usable area of the runway.

Displaced Threshold – Used when obstacles at the end of the runway require additional clearance. Still usable for taxiing.

Relocated Threshold – Necessary if a section of the runway is closed, either temporarily or permanently.

Turnaround Bay – At the end of the runway, if there is no taxiway. It is big enough to turn around in, but not for holding while other planes use the runway.

Pre-Threshold – A part of the runway used for undershoot and overrun. Non load bearing, marked with yellow chevrons.

Stopway – Used in case of an abandoned takeoff. Marked with yellow chevrons.

It would be prudent to get a copy of "From The Ground Up" and memorize the section on "Guidance Signs and Aerodrome Markings," which was on pages 90-91 in my edition of the book. It would also be prudent to memorize "Traffic Circuits" (p. 91-93) and "Ground Control Signals" (p. 98).

Operational Guidance Signs – Provide directions or facilities information.

Location Sign – Used to identify a taxiway, never contains arrows.

Direction Sign – Used to identify intersecting runways, contains an arrow that indicates the direction of intercept.

Mandatory Instruction Signs – Used to indicate holding positions beyond which pilots must have ATC clearance to proceed. Red with reflective white letters.

A large white or yellow cross indicates that a runway/taxiway is unserviceable. May have red lights perpendicular to the center line.

Tetrahedron (Wind T) – The small end of the "T" points into the wind.

The **wind indicator** is situated beside the runway, adjacent to the centre (by length) of the runway if the runway length is less than four thousand feet. If the runway is four thousand feet or longer, wind indicators are placed at both ends. Runways get two parallel lines of white lights, plus a fixed white light or strobe at the end center. The runway threshold is marked by green lights (red from the back). The taxiway edges are marked by blue lights.

ARCAL – Aircraft Radio Control of Aerodrome Lighting. Turned on by VHF in the aircraft, keying the mike a certain number of times in a specified number of seconds. When you do this, it turns the lights on for maybe fifteen minutes. You should key the lights even if they are already on (to reset them to the start of their cycle, in case they're about to go off shortly).

VASIS – Visual Approach Slope Indicator System. An older system to help pilots maintain a correct glide path. Horizontal rows, red over white, means that you're on the correct approach. All white is too high, all red is too low.

PAPI – Precision Approach Path Indicator. Replacing VASIS. Four lights arranged horizontally, in a single row. Two white on left and two red on right means that you're at the correct approach level. All red is too low, and all white is too high.

Traffic **Circuit** – The defined pattern for traffic movement. Called the Traffic Pattern in the US.

Downwind Leg – Opposite direction of landing, parallel to and at a sufficient distance from the landing runway to permit a standard rate turn to the base leg.

Upwind Leg – Opposite of downwind leg. An approach made into this area must be at or above circuit height.

Circuit Joining Crosswind – A corridor within the airspace between the center of the landing runway and the end of the upwind. Links the upwind side and downwind leg (path across the middle).

Base Leg – Flight path at right angles to the direction of landing and sufficiently downwind of the approach end of the landing runway to permit at least a quarter mile final approach leg after completion of a standard rate turn to final approach.

Final Approach – The path in the direction of landing, commencing at least a quarter mile from the runway threshold. The aircraft should be in line with the runway and descending toward the threshold.

Some notes on **Circuits**:

- What is called an uncontrolled airport in Canada and a non-tower airport in the US are the same thing. In the US, there is only one recommended entry to the traffic pattern at a non-tower airport: forty-five degrees to the downwind leg at the midpoint of the runway at pattern altitude.
- The aircraft should ensure that it is at circuit height before entering the circuit.
- If you have to cross the circuit, be at least five hundred feet above the circuit.
- Circuit height is usually one thousand feet AGL, pending weather, etc.
- If you have to taxi back, always turn left. If you overtake another plane that has landed, always pass on the right.
- Most North American airports use Left Hand circuits. Obviously, you always turn left within such a circuit.
- "Cleared To The Circuit" means that you are allowed (by the Tower) to join the circuit on the downwind leg, at circuit height.

Sequential Operations have lots of rules for safety:

1. The preceding aircraft must have passed the intersection.
2. The arriving aircraft must have finished the landing roll and turned off.
3. The departing aircraft must be airborne.

SIRO – Simultaneous Intersecting Runway Operations. Can't happen if both aircraft are departing. Must have enough runway for the arriving aircraft to stop and hold short of the intersection. ATC will advise if SIRO is in effect.

LAHSO – Land And Hold Short Operation. Only permitted if you can stop before the Hold Short point.

SIRO and LAHSO are only permitted if:

1. Minimum 1000 foot ceiling, 3 NM visibility.
2. Braking good, runways bare.
3. Tailwind less than five knots, crosswind less than fifteen knots wet.
4. Pilot can accept the hold short request.

SDA – Southern Domestic Airspace (most of Canada's traffic).

You cannot **overfly** an aerodrome unless you're greater than 2000 feet AGL and greater than 1000 feet above the circuit (unless joining the circuit). You are not allowed to park a fixed wing aircraft on a helipad. A helipad would probably be marked with a big H.

Minimum VFR Equipment Requirements:

- Airspeed indicator.
- Altimeter.
- Magnetic compass.
- Timepiece.
- Tach, oil pressure, oil temperature gauges.
- Visual means for checking fuel.

For **night VFR**, you need (in addition to the above):

- Turn & Bank indicator or Turn coordinator.
- Gyroscopic heading indicator.
- A means of illuminating the instruments.

Minimum **night lighting**:

- Red on left wing.
- Green on right wing.
- White on tail.
- Anti-Collison lighting (flashing, red or white).

Night runways require two rows of lights, or two rows of reflectors with lights at both ends.

Survival Equipment – You need 72 hours of survival supplies for each person. This may be more complicated in the winter due to the need to remain warm. In addition to the basic supplies, your kit must also include methods for:

1. Signaling distress.
2. Providing shelter.
3. Purifying water.
4. Starting a fire.
5. Rendering first aid.

Oxygen requirements:

- Below 10,000 feet ASL: None needed.
- 10,000 to 13,000 feet ASL: Max 30min flying without O_2 permitted. For more than thirty minutes, enough oxygen is required for all crew and 10% of passengers (rounded up to nearest integer).
- Above 13,000 feet ASL: Oxygen always required, for all crew and passengers.

Infants are classified as being small humans of an age up to or equal to two years. Infants must either be strapped into a restraint system or "held in the arms of a seat-belted adult."

Flight Over Water:

- Float planes need life preservers for each person.
- All aircraft need life preservers if the flight over water is such that it is not possible to glide to shore.

Pilot Responsibilities Include:

- Safety & Security of self, passengers, and aircraft.
- Not violating any regulations.
- Don't do something that you think is unsafe, even if the controller tells you to.

Some notes about **VFR**:

- The recommended VFR minimum ceiling is one thousand feet. Lower than that means that you need to request Special VFR.
- For VFR in the Circuit, if the ceiling is exactly one thousand feet, you can remain VFR and join the circuit at five hundred feet below the cloud base.
- NORDO – No Radio.
- If you are on approach and don't hear "Clear To Land" then you should either request landing clearance OR go around if you aren't able to get a clearance.
- You may request an alternate runway/airport if the crosswind is too much.
- A pilot on VFR must remain VFR. If a controller vectors you toward clouds, alter your heading as required and advise ATC.
- VFR is defined as a minimum one thousand foot ceiling and visibility of greater than three statute miles.
- Avoiding wake turbulence is the sole responsibility of the pilot (although ATC might occasionally recognize the potential for wake turbulence and bring it to your attention).
- VFR must be five hundred feet below the cloud base.
- You must be able to spot or see the horizon as the main point of reference.

Some notes about **Transponders**:

- The Transponder is a radio that allows a controller to see the position and height of an aircraft. It is operated by secondary radar, and contains four selectable digits (in octal notation of 0-7) so the controller can identify each aircraft.
- 1200 is the basic VFR setting on a transponder, for flight below 12,500 feet ASL.
- 1400 is the code for VFR above 12,500 feet ASL.
- Squawk means to set a code.
- Squawk Ident: Only do this if requested by a controller. It makes your blip on ATC's radar screen light up and flash.
- While taxiing, put your transponder on standby.
- During takeoff, put your transponder on ALT.
- 7500 is the code for Unlawful Interference (Hijack).
- 7600 is the code for Communication Failure.
- 7700 is the code for Emergency.

The **Student Pilot Permit** allows a pilot in training to fly with the following restrictions:

- Can fly solo under instructor supervision.
- Can only fly in Canada.
- Can only fly under day VFR.
- Cannot carry passengers.
- Need a category 4, 3, or 1 medical.

VNC – VFR Navigation Chart.
VTA – VFR Terminal Area.

Wake Turbulence – Produced by air flowing over the wing or rotor of an aircraft, aka. induced drag. Vortices are not caused by jet blast. Aircraft encountering vortex will tend to roll with the vortex. Slow airspeed = higher angle of attack = more wake turbulence. Coming past the wing, air over the top flows inward toward the fuselage. Air under the wing flows outward. Wake turbulence can impose structural loads of up to 10 G's.

Seen from behind, the left wingtip vortex appears clockwise and moves downward, and the right wingtip vortex appears counterclockwise and moves downward. The **wingtip vortices** only develop when the airfoil is developing lift. They are more severe in heavier and slower aircraft. Vortices begin at rotation, only occur when actually off the ground, and are at their worst on takeoff and landing (when the aircraft is low and slow).

Size of Wake Turbulence:
- Two wing spans wide.
- One wing span in height.
- Settle below/behind at 400-500 feet per minute.
- Level off about a thousand feet down, ten to sixteen NM long.
- Constant for about two minutes then start to dissipate slowly.
- Can sit on the runway, based on weather.

Avoidance of **Wake Turbulence**:
- Avoid crossing behind and below the flight path of a large airplane or any helicopter.
- Don't taxi behind large planes.
- Don't cross behind someone doing their run-up.
- Take off upwind, and lift off before the rotation point of the previous plane.
- When landing, touch down before the rotation point of the aircraft taking off, and after the touchdown point of a landing aircraft preceding you.
- ATC gives a two minute separation between a heavy followed by a light. They only give an advisory when a light follows a medium.
- It is the pilot's responsibility to avoid wake turbulence.
- It is probably a good idea to allow two minutes of separation after a landing aircraft, or four minutes for an aircraft that is taking off, and perhaps even longer for larger planes.

CAME – Canadian Aviation Medical Examiner.

Aeromedical Exam:
- Valid to the end of the expiring month.
- Category 4 is all that is required for RPL (recreational): Can be done by family doctor.
- Category 3 is the minimum required for a PPL (private): Must be done only by a CAME.
- Category 1 is the minimum required for a CPL (commercial): Must be done by a CAME.

Hyperventilation – Breathing at a higher rate than the body requires. To counteract hyperventilation, breathe into a bag (which recycles CO_2), or force yourself to slow your breathing rate down to less than twelve breaths per minute.

Hypoxia – Lack of sufficient oxygen. Occurs at altitude. Slows reaction time, impairs night vision, possible fatigue.

As an aircraft climbs, air in body cavities expands. Ears may pop. It can be more of a problem if you have a head cold or throat infection. Descents are worse than ascents.

Valsalva Manoeuvre – Close the mouth, pinch the nose, and press out as if blowing up a balloon.

Scuba Diving – Decompression sickness doesn't usually occur below 20,000 feet ASL, but if you've been scuba diving recently, it can happen at as low as 8,000 feet ASL. Wait at least twelve hours after any dive. Wait at least twenty-four hours if the dive had decompression stops or if flying above 8,000 feet ASL.

Don't fly for forty-eight hours after donating blood.

If consuming **alcohol**, wait a minimum of eight hours from bottle to throttle (for a couple of social drinks). If you're worried about your legal BAC, then you should wait 24 to 48 hours, to be safe. Alcohol effects multiply as they are mixed with hypoxia.

Cabin Altitude (Equivalent Effective) – The equivalent altitude ASL having the same atmospheric pressure.

Commercial flights are usually pressurized so cabin altitude never goes above 8,000 feet equivalent effective.

Pilots flying at night are advised to use oxygen if possible, due to a decrease in the effectiveness of night vision.

Having either a flight plan or a flight itinerary is mandatory if you are travelling greater than twenty-five NM from your airport.

Minimum fuel requirements for fixed wing aircraft:

- Day VFR: Thirty minutes at normal cruise speed.
- Night VFR: Forty-five minutes at normal cruise speed.
- Rotary: Twenty minutes, both day/night VFR.

Some notes about **Flight Itineraries**:

- Filed with FSS or with a "responsible person."
- The Responsible Person agrees to report the plane to Search & Rescue if the flight is overdue.
- The pilot should report landing to the Responsible Person as soon as possible, no more than a maximum of 24 hours after ETA.

Some notes about **Flight Plans**:

- A flight plan is necessary when travelling to or from a military airport, or on an international flight.
- Filed with a FIC.
- Arrival report due to ATC within sixty minutes of arrival. This is an absolute worst-case scenario, and should be done as quickly as possible.

Elapsed Time – Needs to include time of intermediate stops, not just the flight legs.

Intermediate Stop – Indicated by repeating the name of the stop and duration in the "route" column, ie. "CKK7 CYWG (0130) CYWG CKK7."

Deviation from Flight Plan – Notify ATC or FSS/FIC as soon as possible if there is a deviation or an expected deviation (even if only a couple minutes late). This is very serious. Search & Rescue starts their active search

sixty minutes after the ETA on the flight plan, but an investigation actually starts only minutes after missing an ETA.

Notes about **Clearances**:

- Authorization to proceed with a certain action. You must acknowledge a clearance. Use your call sign.
- Once you accept a clearance, you must comply.
- If the clearance is uncertain or ambiguous, you must ask for clarification.
- If you accept the clearance and then something is not possible, advise and explain to ATC as soon as possible.
- If a clearance is unacceptable, refuse it and advise ATC. You may also want to suggest an alternative course of action, if you have a preference.

Notes about **Instructions**:

- A directive which the PIC must acknowledge and read back.
- Must comply unless safety is jeopardized.

ATC clearances and instructions are predicated on known traffic only. The pilot must still pay close attention, and give feedback to the controllers if something seems out of place.

Notes about **ELT's**:

- Emergency Locator Transmitter.
- Siren-like signal on 121.5 MHz and/or 243.0 MHz. The new global standard is 406 MHz, but that should augment rather than replace the lower frequencies (better detection capabilities for 406 MHz).
- Tune in to 121.5 at the end of each flight to make sure that your own and other ELT's have not been activated.
- If testing, do not test for more than 5 seconds, and you must do it during the first five minutes of UTC hours only.
- Aircraft must carry an ELT if travelling more than 25 NM from home base. Exemptions: gliders, balloons, airships, ultra-lights, gyroplanes, and large commercial jets.
- Usually activates at 4 G's or slightly higher, but you should manually switch the ELT "on" if possible after a crash in case it doesn't self-activate. Fly with it in the "armed" position. Don't turn it on unless it's an actual emergency.
- Never turn it off to save battery once you've turned it on following a crash. If possible, place it exposed to the sky with the antenna up (or pull/extend antenna) and, if really cold, store inside jacket to keep battery lasting longer.
- Accidental ELT activation should be reported to the nearest ATC immediately.

If an ELT becomes unserviceable, the aircraft can be operated for thirty days provided:

1. The ELT is removed at the first aerodrome where repairs or removal can be accomplished.
2. The ELT is promptly sent to a maintenance facility.
3. You place a placard in the cockpit stating that the ELT is absent, including the date of removal.

When starting an airplane, the pilot's seat must be occupied by someone who knows how to work the controls, or the aircraft must be locked in place.

Hazards associated with **thunderstorms**:

- Tornadoes.
- Turbulence.
- Squall lines.
- Microbursts.
- Precipitation static and heavy precipitation.

- Low ceiling and low visibility.
- Icing and hail.
- Lightning.
- Heavy updrafts/downdrafts.

In meteorology, a negative sign usually means “light” as in “light rain.” Use the letter M in front of the number to indicate negative, ie. -2 degrees is notated as M2.

Weather and meteorology are very complex topics, and will require a great deal of memorization once you tackle them in ground school.

Jet/Prop Blast chart:
- Jumbo: Idle blast is 600 feet, take-off thrust is 1600 feet.
- Medium: Idle blast is 450 feet, take-off thrust is 1200 feet.
- Small: Idle blast is 200 feet, take-off thrust is 500 feet.
- Expect to encounter a 45 knot blast area up to sixty feet behind a large turbo prop during taxi, and a lesser blast further away.

VHF Direction Finding System:
- Also known as a VDF Steer or a DF Steer.
- Requires only 2-way VHF.
- Aid to VHF, not a substitute.
- Established at selected FIC/FSS facilities & towers.
- Controller gets bearing with 2 degree accuracy.
- May be useful if compass is broken and no radar.

Notes about **General Airspace**:
- Airspace has seven classes, A to G.
- In controlled airspace, ATC services are provided. Some or all aircraft may be subject to ATC.
- Canada has four main types of airspace, which are based on geographic location and height. There is the Northern Domestic Area (NDA) and Southern Domestic Area (SDA) and each are broken into low level and high level airspace.
- NDA has the magnetic north pole near the center, and magnetic compass indications are erratic. Runway heading and cruising altitudes are based on true track, not magnetic.
- Low level airspace extends from the surface up to 17,999 feet ASL, everywhere.
- High level airspace is controlled from 18,000 feet ASL to FL 600 (sixty thousand feet) in the Southern Control Area.
- High level airspace is controlled from FL 230 to FL 600 in the Northern Control Area. However, the area between 18,000 feet ASL and FL 230 is not controlled in this area.
- High level airspace is controlled from FL 270 to FL 600 in the Arctic Control Area. However, the area between 18,000 feet ASL and FL 270 is not controlled in this area.

Altimeter Setting Region:
- All low level, also all of SDA.
- Set to current altimeter or to elevation of the aerodrome before taking off.
- In cruise, set to nearest station’s altimeter.
- When approaching an airport, set to that airport.

Standard Pressure Region (SPR):
- Includes all of NDA, and high level airspace in all control areas.
- Always set altimeters to 29.92, the international standard.
- Set to 29.92 *after* entering SPR.
- When exiting the SPR, set the altimeter to the nearest pressure setting *before* leaving the SPR.

- When climbing into the SPR at high levels, set altimeter *after* entering.
- When descending out of the SPR at high levels, set altimeter *before* leaving.

Essentially, if there's going to be a brief period of inaccuracy when transitioning between the SPR and ASR in either direction, the error needs to be while the aircraft is in the higher level airspace.

Air Defense Identification Zone (**ADIZ**):
- There is a combined ADIZ for Canada and the US, which forms a "border" around North America.
- Must have a flight plan filed if you enter the zone.
- Penetration must be within 20 NM of proposed route and +/- five minutes of ETA.

Cruising Altitudes:
- Mandatory at 3000 feet AGL and higher.
- Based on magnetic track in SDA, true track in NDA.
- Bearing/track 000 to 179 use odd 1000's plus 500 feet ASL for your flight level.
- Bearing/track 180 to 359 use even 1000's plus 500 feet ASL for your flight level.
- The above is all VFR. If you're flying IFR, you don't add the 500 feet.

Speed Limits:
- Maximum 250 knots below 10,000 ASL.
- Maximum 200 knots below 3,000 ASL if within 10 NM of an airport.
- These are indicated airspeeds, not true, calibrated, etc.

VFR Weather Minima Rules for Uncontrolled Class "G" at 1000 feet AGL and higher:
- Stay 500 feet below clouds.
- Stay 2000 feet horizontally from clouds.
- Maintain 1 mile visibility daytime.
- Maintain 3 miles visibility nighttime.

VFR Weather Minima Rules for Uncontrolled airspace below 1000 feet AGL:
- Stay clear of clouds.
- Maintain 2 miles visibility daytime.
- Maintain 3 miles visibility nighttime.
- If in a helicopter, you only need 1 mile visibility daytime.

VFR Weather Minima Rules for Controlled airspace (including Class "E" with no controller):
- Stay 500 feet below clouds.
- Stay 1 mile horizontally from clouds.
- Maintain 3 miles visibility.
- Maintain 500 feet above the ground in a control zone only.

VFR Weather Minima Rules for Special VFR:
- Must be requested by the pilot.
- Stay clear of clouds.
- Maintain 1 mile visibility.
- Maintain 500 feet above ground, but only if not taking off or landing.
- S-VFR is only allowed for landing, not for taking off.

VFR Weather Minima Rules for Aerobatics:
- Maintain 3 miles visibility.
- Not permitted in controlled airspace without prior permission.

Many people go to airshows and talk about wanting to watch aircraft doing acrobatics. However, only humans can do acrobatics. Airplanes do aerobatics. Unfortunately, the terms are misused so frequently that you almost have to treat them as synonymous.

Daytime in Canada is from ½ hour before sunrise to ½ hour after sunset. It is also considered to be when the sun's center is less than six degrees below the horizon during sunrise/sunset. **Nighttime** is all other times.

Notes on **Flight Restrictions**:

- You are not allowed to drop anything from a plane which could create a hazard to persons or property.
- You may not fly an aircraft at a distance of less than 500 feet from any person, vessel, vehicle, or structure (this applies only in non-populated areas, see next item).
- In built-up areas, you can't fly at less than 1000 feet over the highest obstacle, and within 2000 feet horizontally (of tall buildings) unless landing or taking off.
- Rotary wing aircraft have slightly less restrictive rules than the above: 1000 feet vertical still applies, but 500 feet horizontal separation is permitted.
- You are not allowed to land or take off from any surface within the built up area of a city or town unless that surface is an aerodrome or military aerodrome (except for balloons).
- Aerobatics have strict rules. They are not allowed over built-up areas or over an assembly of people, in controlled airspace without SFO certification, in visibility of less than 3 miles, or under 2000 feet AGL without SFO certification.

SFOC stands for Special Flight Operations Certification.

Class "F" Airspace (**Special Use**):

- If Restricted, the designation will end in "R" (ie. CYR 401) and you must stay out completely.
- If Advisory, the designation will end in "A" (ie. CYA 402) and IFR is not permitted. VFR may fly through, but be alert.

Notes on **Controlled Airspace**:

- Classes A through E are all controlled.
- ATC services are provided.
- It is recommended that you tour an ATC center sometime.
- Depending on class, and VFR vs IFR, some or all of the aircraft within it may be subject to control.
- Class E is tricky for VFR. Normally designated for IFR.
- Class E airspace follows the terrain.
- Class B starts at 12,500 ASL.
- Class A starts at 18,000 feet ASL.

Control Area Extensions – Used if airspace is insufficient for proper separation between IFR departures or arrivals. Control ring is dashed, extension solid. Extension starts at random height, not ground level. Extension lines on map may be jagged. Extensions of adjoining close airports can overlap.

Notes on **Low Level Airways**:

- These are Class E airspace, starting at 2200' AGL, and going up to 17,999' unless otherwise indicated.
- Always controlled, VFR does not have to contact controller unless you want flight following.
- Two types: VHF/UHF airways, and LF/MF.
- A VHF Airway is also known as a **Victor Airway**. The center line is dark blue on VNC maps, or black on LO charts. A Victor Airway uses two VOR's.
- When you have two NDB's, or when an NDB is paired with VOR, you need to use a wider (less accurate) angle. This is an LF/MF airway.
- LF/MF is light blue on VNC maps.

Control Zones:

- Very different from control areas.
- Designated around certain aerodromes to keep IFR aircraft within controlled airspace during approaches and to facilitate the control of VFR and IFR traffic.
- If they have a civil control tower, they usually have a 7 NM radius, although others can have a 3 NM or 5 NM radius.
- Military control zones are usually 10 NM.
- If a control zone touches the ground and if it is a Class C or Class D control zone, it will have a tower.
- In a Class E control zone, you *will* be controlled, even though it won't have a tower.
- Typically capped at 3000 feet AAE unless otherwise specified.

Aviation Occurrences Reporting:

- Includes both accidents and incidents.
- The purpose of reporting/investigating is to prevent recurrences, not to lay blame.
- Learn from the mistakes of others. You won't have time to make them all on your own.
- An occurrence is categorized as an accident if there is serious injury or a fatality, substantial damage, or if the aircraft is missing or inaccessible.
- The TSB must be notified in the event of a reportable accident/incident.
- An "incident" only applies to aircraft of 12,500 pounds (5700 kg) or heavier. Incidents include heavy turbulence, passenger injuries, electrical problems, or anything else of note.
- To report, call 911, or the FIC/FSS, or look for procedures in the AIM.
- Don't remove wreckage, unless for safety or rescue reasons.
- It would be wise to download and study a bunch of the "Aviation Safety Letters" published quarterly (free) by Transport Canada.

Priority of Radio Messages:

1. Distress (May Day).
2. Urgency (Pan Pan, declared emergency).
3. Radio direction finding.
4. Flight safety.
5. Meteorological.
6. Flight regulatory.
7. UN charter.
8. Government.
9. Telecommunications/priors.
10. All other.

UTC is based upon an atomic clock. UT1 is similar, but it's based upon the position of the sun from the Royal Observatory in Greenwich. GMT technically refers to UT1, although most people just say that it is equivalent to UTC. Because of minute fluctuations in the orbit of the earth around the sun, UT1 is not consistently accurate, which is why the atomic clocks of UTC provide better timekeeping for scientists.

Notes about **Radio Communications**:

- The Radio Operators License (Certificate) is administered by Industry Canada.
- Even though messages are broadcast publicly, they are considered private and operators are expected to preserve the secrecy of communications.
- Gossip, profanity, and false distress are not permitted (fines of up to $5000, prison up to one year).
- Speak plainly and clearly. Don't shout, accent syllables, or talk too rapidly.
- UTC means Universal Time, Coordinated. Abbreviated Z or Zulu.
- You normally use UTC, but when operations are conducted solely in one time zone, standard (local) is acceptable.
- Midnight can be 0000 or 2400.

- Do not use slang, or any of the following terms: Ok, repeat, ten four, over and out, breaker breaker, come in please. There are "proper" substitutes or protocols for all of those words and phrases.
- When broadcasting the civil registration, use the manufacturer and/or type of aircraft followed by the last four letters of the registration.
- If a Canadian air carrier, use the company name and either the flight/route or the last three characters of the registration. Use "heavy" if applicable, if it is a very large aircraft (exceeding 300,000 pounds).
- For a formal request for a radio check, use "signal check" rather than "how do you read?" Don't use a main working frequency, if possible.
- Distress/emergency messages can interrupt other transmissions.
- Learn what it means when ATC says "aim at the threshold."
- Learn what it means when ATC says "keep it in close."
- Learn what it means when ATC says "are you ready on immediate?"
- Use "say again" instead of "repeat."
- Use "affirmative" instead of "yes" or "ok."

Notes for **Radio Protocol about Numbers**:

- Usually use individual digits.
- 10 is pronounced "one zero"
- 75 is pronounced "seven five"
- 100 is pronounced "one zero zero"
- 5800 is pronounced "five eight zero zero"
- 11000 is pronounced "one one thousand"
- 121.5 is pronounced "one two one decimal five"
- $17.25 is pronounced "dollars one seven decimal two five"
- $0.75 is pronounced "seven five cents"

Examples of **Ground Stations**:

- Ottawa Tower (traffic control).
- Toronto Ground (ground control).
- Ottawa Radio (FSS).
- Edmonton Clearance Delivery (IFR).
- Vancouver Terminal (terminal control).
- Ottawa Arrival (arrival control).
- Winnipeg Departure Control (departure control).
- Montreal Precision (precision radar).
- Montreal Centre (area control).
- Hinton Airport Radio (community aerodrome).
- Carp Unicom (unicom).
- Private ground stations get assigned call sign or place name.

When a ground station gets a bunch of calls at once, it may respond first-come first-serve, geographic proximity, or priority system.

Always speak the identifier of the station being called first, followed by the words "this is" and your identifier.

Signal Check Responses:

1. Bad (unreadable).
2. Poor (readable now and then).
3. Fair (readable with difficulty).
4. Good.
5. Excellent.

Emergency Classifications:

- Distress: Grave and/or immediate danger.
- Urgency: Safety issue, does not require immediate assistance.
- Declared Emergency: Such as low fuel.
- Always use the frequency normally used for air-to-ground as your first option. If that fails, try 121.5, the standard aeronautical emergency frequency.
- Do your distress call, then the distress message.
- Distress call is May Day (3x), then "this is," then your call sign (3x).
- Distress message is May Day (1x), call sign, what happened, intentions of PIC.
- If possible, include particulars such as: airspeed, altitude, heading, persons on board and injuries, anything else relevant and useful.
- Not addressed to a particular station, receipt of transmission is not needed between the distress call and distress message.
- Distress relays: May Day Relay (3x), then "this is," then your relay station call sign (3x), then May Day (1x), then the particulars of the station in distress.
- Cancelling distress: May Day (1x), then "all stations" (3x), then "this is," then call sign (3x), filing time of message, call station of station that was in distress (1x), then either "distress traffic ended" or "silence finished," then "out."
- Urgency message: Similar procedures to distress message except use Pan Pan instead of May Day.
- 121.5 MHz is known as the International Air Distress (IAD) frequency or VHF Guard.
- 243.0 MHz is known as the Military Air Distress (MAD) frequency or UHF Guard.

The L/D ratio is the ratio of lift to drag.

Notes for **Maximum Endurance** (**Aerodynamic Efficiency**):

- Stay airborne the longest.
- Minimum power to maintain altitude.
- Fairly slow speed, just above slow flight.
- May be used in a holding pattern or waiting for weather to pass, or if you're lost.
- Lower altitudes are better (better aerodynamic efficiency).
- Turbulence is bad, so try to avoid it.
- Flaps at 10 degrees are best. Any more than that and the additional drag will outweigh the benefits of the extra lift.
- Mixture should be lean.

Notes for **Maximum Range** (**Engine Efficiency**):

- Go the furthest distance.
- L/D Ratio Max = best glide speed (80 mph in Cessna).
- In a headwind, increase slightly to 85 mph. In a tailwind, decrease slightly to 75 mph.
- Altitude: As high as possible is preferable, although it can be inefficient to go high if the fuel burned getting up there outweighs the efficiency benefits.

The center of gravity is slightly bad if it's too far back, but very bad if the aircraft becomes front heavy.

Preferred **glide speeds** in a Cessna 172:

- No flaps: 80 mph.
- 20 degrees flaps: 75 mph.
- 40 degrees flaps: 70 mph.

Always keep your right hand on the throttle until you get to at least a thousand feet AGL. Take off with only the left hand on the control column. Fly as often as possible with the left hand only, to get accustomed to

having your right hand available for the carb heat, throttle, and mixture controls. Also, you are less likely to try to move the ailerons in a stall/spin if you don't have both hands on the yoke.

Stall Speed < Slow Flight < Flight for Endurance

Maximum speed with flaps is 100 mph in the Cessna 172 that I did most of my initial training in. This works out to 87 knots. However, that varies in other aircraft. If you exceed that speed with the flaps even partially extended, the aircraft must be grounded until checked by an AME. Look at the white arc on your airspeed indicator.

Airspeed is controlled by your attitude (pitch).
Height/Altitude is controlled by your power (throttle).

Slow flight is a speed at which you need to add power to maintain altitude.

Symptoms of **slow flight**:
- Sluggish controls.
- Slow speed.
- Left yaw.
- High nose up (not always).
- Buffeting (minimal in Cessna).
- Stall warning (10 mph ahead of stall).

Before certain manoeuvres, you must do a **HASEL check**:
H – Height: Must be able to recover by 2000 feet AGL.
A – Area: Nothing civilized underneath the aircraft, and not over clouds/water/populated areas.
S – Security: Seat belts, doors, windows, no loose objects.
E – Engine: Mixture rich, carb heat on, oil temperature and pressure in the green.
L – Lookout: 180 degree turn, or two 90 degree turns.

Procedures for **Overshoot**:
- Power to Full.
- Carb heat Off.
- Control the attitude.
- Flaps to 20 degrees.
- Go into a climb attitude.
- No rush now, retract the flaps fully when ready, but don't ever exceed 100 mph if the flaps are still even partially extended. V_{fe} = 100 mph.

For Slow Flight, practice gentle turns, less than 15 degrees.

TAF – Terminal Area Forecast.
VV – Vertical Visibility in hundreds of feet. Example: VV002 means vertical visibility of 200 feet.

When checking the weather, check all of these sources:
- METAR.
- GFA.
- FD charts (upper winds).
- NOTAM's.
- Weather Radar.

Acceleration Stalls – An aircraft will stall at higher airspeeds when manoeuvring loads are imposed by sudden turns, pull ups, or abrupt changes in its flight path.

Turbulence can cause a significant increase in stalling speed. This is why an airspeed slightly higher than normal is usually recommended when approaching to land in turbulent conditions.

Manoeuvring Speed – The maximum speed at which the application of full aerodynamic control will not overstress the aircraft.

The **Stall speed (V_s)** in the Cessna 172M that I did a lot of my training in was 49 mph. This is based on the flaps being retracted.

Stalls During Turns:
- Level: Inside wing stalls first.
- Descending: Inside wing stalls first.
- Ascending: Outside wing stalls first.

Departure Stall – Happens when you are in slow flight, from lift-off until you are approaching the point of appropriate climb speed. This stall is very dangerous. Don't lift the nose too high. Even if you don't stall again, if the nose is too high the aircraft will never build up enough speed to clear obstacles.

Learn how to establish the correct nose-up attitude for a climbing turn after take-off.

To counteract a departure stall:
1. Apply full power (smoothly but quickly).
2. Hold the correct attitude (compensate for nose-up).
3. Retract flaps smoothly, in stages.

When you are lost, remember the 3 C's:
- Climb: Get higher so you can see better.
- Confess: Talk to ATC.
- Comply: Follow ATC instructions.

What pilots of powered aircraft call "turbulence" and avoid, pilots of gliders call "lift" and seek out.

Notes about **Stalls**:
- A heavier plane is already closer to the critical angle of attack in cruise speed.
- A nose heavy aircraft (center of gravity is forward) is the same.
- When flaps are extended, the chord changes.
- In a stall, do not add power until you're at the bottom of the curve and about to start rising again, so you don't initiate acceleration towards the ground.
- Three stalls that won't be on your exam, but which you should be aware of, include accelerated stalls, turning stalls, and secondary stalls.
- If you're given clearance for a tailwind takeoff, don't be scared to decline the clearance and request a takeoff into the wind.
- Any time you have flaps on at more than 20 degrees during a stall, you immediately put throttle to full, carb heat on, and get the flaps up to 20 degrees. You then have a tiny bit of breathing room before you continue to raise them up to 0 degrees. Generally, you start raising them from 20 degrees once you first have two positives on your VSI and altimeter (same as for an overshoot).
- The big mistake that people make on an approach stall is that they see that they are below the glide path, so they pull the nose up, which causes a stall. Even if power is added, you're on the wrong side of the power curve, so the power just brings the nose up and makes things worse. Just add power in this scenario, and at most, control your attitude to keep the pitch level until you build up speed.

Stalls that may be on your exam:

- Power-off stalls at 0, 20, or 40 degrees flap.
- Power-on stalls (1700-1800 rpm) at 0, 20, or 40 degrees flap.
- Departure stalls.

Important Velocities and Critical Approach Speeds:

- V_{ne} – Never Exceed.
- V_a – Highest speed at which you are able to make sudden control movements without causing problems for the aircraft (also known as manoeuvring speed).
- V_{fe} – Highest speed with flaps extended.
- V_x – Speed at which the aircraft gains the most height for the least forward motion. Good if you need to clear a line of trees at the end of a runway.
- V_y – The speed at which the aircraft gains height as quickly as possible, even though it may take a lot of forward motion. This is good if you don't have to worry about a line of trees at the end of the runway.
- V_s – Stall speed, no flaps. Indicated by the bottom of the green arc on the airspeed indicator. This is usually synonymous with V_{s1}.
- V_{so} – Stall speed, full flaps. Indicated by the bottom of the white arc on the airspeed indicator.

Never use the ailerons during a stall recovery, ever. Use 100% rudder only. This also applies to spin recovery.

Mush – A stall where the nose hasn't dropped. Perhaps the aircraft is starting to "pancake" and fall out of the sky, even though it feels like it is at an appropriate attitude and still moving forward. You'll know this if your VSI and altimeter show that the aircraft is rapidly losing height.

Your **passenger briefing** should include the following:

1. Comments about what happens for an emergency on the ground.
2. What you'll do if there is an emergency below the Minimum Safe Altitude (MSA).
3. What you'll do if there is an emergency above the MSA.
4. Your "Go" or "No Go" decision.

Autorotation is an automatic rolling tendency that develops following a stall that has been aggravated by yaw. If allowed to continue, it develops into a spin.

Spiral Dive – A steep, descending turn in which the airspeed, rate of descent, and wing loading increase rapidly. Can be very hazardous (possible structural damage).

Spin vs Spiral – The main difference between these two is the airspeed. In a spin, the airspeed is constant and low, at or about the stalling speed. In a spiral, the speed will be well above the stalling speed and increasing rapidly. Don't ever practice spins or spirals when solo! Your instructor will demonstrate. There is a danger of pilot blackout, structural damage, etc.

A spiral may result from attempting to force an aircraft into a spin too soon before a stall occurs, or from relaxing the elevator controls once a spin has started.

Slips – The aircraft is placed in a banked attitude, but its tendency to turn is either reduced or prevented by the use of rudder. You'll learn three types of slips:

1. **Side Slip**: To counteract the effect of drift when landing in a cross wind (different from crabbing).
2. **Forward Slip**: Increases the rate of descent without increasing airspeed. Used to control the angle of approach. Used in aircraft without flaps, and can even be used in some aircraft with flaps extended. Engine should be idling. More effective if made into a cross wind.

3. **Slipping Turn**: Has the same aim as a forward slip but in a turn. The turn is slowed but not prevented by the use of opposite rudder. Can be useful during the turn to final approach, especially in the case of a forced landing in which excess altitude must be lost.

To enter a slip:

1. Lower the wing on the side toward which the slip is to be made.
2. Use rudder to move the nose in the opposite direction.
3. Due to the location of the pitot tube and static port, slipping can cause airspeed errors.
4. There will be a tendency for the nose to pitch up. Counteract this with elevator.
5. To recover from the slip, just reverse all three control inputs simultaneously (release rudder, level wings, adjust pitch).

Reasons to take off into the wind:

1. Shorter run, lower ground speed.
2. Eliminates drift, less strain on the landing gear.
3. Best directional control, especially at the start.
4. Better obstacle clearance (steeper climb).
5. Establishes circuit pattern direction.

People have a tendency to over-control on takeoff. Exercise self-restraint.

Notes about **takeoffs**:

- Line up properly.
- Go to full power quickly but smoothly.
- Ailerons and rudder in neutral position (steer with rudder though).
- The elevator should be back slightly to reduce the weight on the nose wheel, but not too far back.
- Wait until the plane wants to become airborne before you pull back more strongly.
- Once you lift off, level out almost immediately to gain speed. This helps take advantage of "ground effect." Once you reach the optimal climb velocity (88 mph in a Cessna 172), *then* you lift the nose.
- The only exception is if there are obstacles to clear, in which case you use the best "rate of climb" speed. Keep full power on.
- For takeoffs from a soft or rough surface, keep a nose-high attitude.
- Be aware that short field takeoff techniques and soft field techniques are not necessarily the same. These will be discussed by your instructor during training.
- In some aircraft, the use of partial flaps increases climb performance, but in other cases reduces climb performance.
- Even if the surface is calm, you might encounter a tail wind once airborne. It helps if you study all available weather reports and also pay attention to the ATIS, but unexpected winds can occur. Be prepared for surprises.

Notes for tail wheel aircraft:

- Keep the tail wheel on the ground to steer.
- When the speed is sufficient that rudder and elevators become effective, lower the nose to the takeoff attitude.
- There may be a tendency for the aircraft to yaw left.

Aircraft reactions to a **crosswind**:

1. Nose turns into the wind, known as weather-cocking (because there is more surface area behind the wheels).
2. Entire aircraft gets pushed sideways, which exerts a strain on the landing gear.
3. The into-wind wing gets more wind, therefore more lift.
4. The angle of attack of the into-wind wing is greater due to a positive dihedral, so again, there is more lift.

During a **crosswind takeoff**, maintain directional control with rudder. Deflect ailerons as though turning into the wind. Full deflection at the start, but lessening appropriately as the aircraft picks up speed. Once you have lifted off, try not to let the aircraft bump the runway again as this puts considerable strain on the landing gear. Once the aircraft is airborne, with no chance of touching the ground again, make a coordinated turn into the wind to compensate for drift (crabbing).

It is a certification requirement that an aircraft be capable of safe operation in a 90 degree crosswind, provided that the speed of the wind does not exceed twenty percent of the aircraft's stalling speed.

Hydroplaning – Might be indicated by raindrops bouncing off the runway. Assume that the brakes may not work on takeoff once you get to perhaps thirty knots.

Ground Effect – Caused by the effect of the ground on the airflow patterns about a wing in flight. Decreases the induced drag, which makes it possible to become airborne at less than normal airspeed. Valid usually at a height of up to about one wing span above the surface.

Problems with Ground Effect:

1. An attempt to climb out too early may result in settling back onto the runway.
2. It is possible to lift off with too much load or insufficient power to climb out of ground effect.

The **best conditions** for flight occur with:

- Low elevation airports.
- Cooler morning temperatures.
- Low humidity.
- Higher atmospheric pressures.

Koch Chart – Calculates the effects of altitude and temperature, to give you a percentage increase in normal takeoff distance, and a percentage decrease in the rate of climb. This is not as good as your aircraft manual's takeoff distance chart. Note that the Koch chart uses pressure altitude, not real elevation. Make sure to reset your altimeter properly after checking this.

Wheelbarrowing – Only happens on nose wheel aircraft, when the nose wheel is bearing a lot of weight and the rear wheels are light during takeoff or landing.

Components of **The Circuit**:

1. Takeoff.
2. Crosswind leg.
3. Downwind leg.
4. Base leg.
5. Final approach.

Notes about **Circuits**:

- Always omit the word "leg" on the radio when referring to circuit components.
- Do not confuse the crosswind leg with joining the circuit crosswind.
- Try to make the downwind call when abeam the control tower.
- Unless special conditions exist and there is authorized advice to the contrary, all circuits are left hand, therefore, all turns within the circuit are left turns. Exceptions are listed in the CFS, and are usually because of conflicts with other nearby airports or hazardous terrain.
- Normal circuit height is 1000 feet AAE.
- On crosswind and base legs, you want to be flying at right angles (based on the ground) so you may need the aircraft to be facing into or slightly out of the wind.
- Always judge your circuit visually in relation to the runway, not to other points on the ground.

- Circuit spacing is very important and very challenging. Learn to widen or narrow your circuit, and/or increase or decrease your airspeed.

Here are some notes about joining or leaving the circuit at a controlled facility:

Joining the circuit (when controlled):
- Call the tower before entering the control zone.
- Provide ID, location or estimated distance & direction, and altitude.
- When cleared "to the circuit" you are expected to join the circuit on the downwind leg at circuit height. Descend to this height outside of the circuit, before joining.
- "Cleared to the circuit" authorizes you to make a right turn, if required, to join cross wind, or to join the downwind leg provided that the right hand turn is only a partial turn that can be carried out safely.
- You may be authorized to join on base leg or straight in to final approach.

Leaving the circuit (when controlled):
- Follow tower instructions and stay in contact with the tower, if remaining within the control zone.
- If the circuit is left hand, you can only take a right hand turn after takeoff with permission from the tower. If that's not possible, follow the tower's instructions.
- If you have to fly through the control zone of a second airport, you must be in contact with that second tower.
- Always monitor ATIS if it exists.

Uncontrolled aerodromes have no operational control tower. There may not be air-to-ground comms, but there is often a **mandatory frequency** where you can talk to a Flight Service Station. Make use of any radio or unicoms, and broadcast your intentions.

Here are some notes about joining or leaving the circuit at an uncontrolled facility:

Joining the circuit (when uncontrolled):
- Observational crossovers must be at least 500 feet above circuit altitude.
- Descend to circuit height on the upwind side.
- If there is no mandatory frequency, join on the upwind side unless there's no traffic.
- If MF exists, you can join from any side.

Leaving the circuit (when uncontrolled):
- Climb to circuit altitude, straight out, after takeoff.
- Don't turn back toward the circuit or airport until at least 500 feet above the circuit.

Always get off a runway as quickly as possible. However, until the runway is cleared of aircraft, no other aircraft has landing priority.

The mixture is pretty much always rich except when you lean it out during cruise, and when you're on the ground taxiing.

Carb heat basically goes on any time you're descending, any time you're below 2000 rpm, and occasionally for icing checks.

Minimum Essentials for Takeoff (**METO Check**):
- Oil temperature and pressure in the green.
- Mixture rich.
- Carb heat off (cold for takeoff, for maximum power).
- Circuit breakers checked.

- Magnetos set to both.
- Master and Alt switches on.
- Test for brake pressure.
- Fuel selector switch set to both.
- Seatbelt checks.

Four **classes of landings**:

1. Normal.
2. Crosswind.
3. Short field.
4. Soft field (unprepared field).

Flare – The transition from the normal glide attitude to the landing attitude. Also known as the round-out.

Always keep one hand on the throttle while landing! You never know when you might suddenly need to overshoot, and if that happens, you'll need full power immediately. Learn to fly with just your left hand on the control column.

When landing, nose wheel aircraft should touch down on the main wheels only, but tricycles should land with all three wheels touching simultaneously.

When you are landing, if you flare too hand, never push the control column forward to compensate. Just ease off the pressure or else you may find yourself hitting hard, or the nose wheel hitting before the main wheels.

Once you land:

- Tail wheel aircraft: Hold the control column all the way back to keep the tail from skipping.
- Nose wheel aircraft: Lower the nose wheel gently and slowly.

The last 500 feet of a normal approach should be straight, with no slipping or turning.

Crosswind Landings:

- Can be harder on landing gear.
- Harder than crosswind takeoffs.
- Two methods: Side slip (wing down) which is easy, or crab followed by last minute rudder kick, which is hard.
- Will be covered in much more detail in subsequent training.

Notes about **Side Slip**:

- Continuity in flight control positioning.
- Try not to initiate the slip until close to landing.
- The longitudinal axis of the aircraft is kept in line with the center line of the runway by use of the rudder.
- Hold the aileron toward the upwind wing after touchdown to prevent it from rising.
- Will be covered in much more detail in subsequent training.

Notes about **Crabbing**:

- Not usually taught in elementary training.
- Can be hard on landing gear if you mess up.
- Higher risk of ground looping.
- Must apply rudder to line the aircraft up straight exactly at the moment of contact.
- Will be covered in much more detail in subsequent training.

Notes about **Short Field Landings**:

- The aircraft will float for some distance after the flare, consider this when aiming for a specific touchdown point.
- Use power to control the descent more accurately. Leave power on until the landing flare is completed.
- Touch down as slowly as possible.
- Retract the flaps after touchdown. They produce aerodynamic drag, but that is offset by increased lift that decreases the effectiveness of the wheel brakes.
- Will be covered in much more detail in subsequent training.

For gusting wind on any landing, add half the maximum differential in the gusts up to a maximum of 10 knots added. For example, for winds gusting to sixteen knots, add eight knots to your normal intended landing speed (depending on your aircraft & configuration).

A strong cross wind can essentially mean almost no headwind. Keep this in mind.

A strong tail wind can effectively double the length of your landing requirement.

Remember that runways are not always flat, and remote airstrips are even more likely to have runway gradients up or down. Sometimes, landing uphill with a tailwind may be more effective than landing downhill into a headwind.

Never neglect to consider the weight of a passenger or full fuel tank in increasing the distances required for takeoff or landing.

Grass surfaces are one of the best landing options for light aircraft:

- Soft, cushion.
- Shorter landing roll.
- Main drawback is that they can be really slippery if the grass is wet, and up to 30% more distance is required for braking than on wet pavement.

Hydroplaning on runways is a huge problem. At worst, it can increase the stopping distance by as much as seven times. Also, a 10 knot crosswind can blow a hydroplaning aircraft right off the side of a runway.

Some aircraft have steerable nose wheels, controlled by rudder.

Swing – An undesirable turn during ground operations. Some causes:

1. Touching down while crabbing into the wind.
2. Touching down when drifting sideways.
3. Cross wind causing the aircraft to weathercock.
4. Allowing upwind wing to rise.
5. Incorrect recovery for drift after a bounce.

Ground Loop – A violent, uncontrollable turn resulting from failure to correct a swing on landing. Usually happens in tail wheel aircraft.

If a landing is doubtful and you're starting to get into trouble, and you think you have enough runway, just open the throttle and go around again. An overshoot is almost always the safest option.

Air Density (and Density Altitude) effects on **landing requirements**:

- Warmer air requires a longer landing run.
- Higher elevation requires a long landing run.
- No comments were found regarding the effect of moisture/humidity in the air.

Going Around – Aborting a rough landing. Apply power, control yaw, put the carb heat to cold, raise flaps. Act like you're doing a takeoff: Level out, gain speed, then nose up at 88 mph. If you have been forced to go around for some reason while on approach, try to ease over to the right, fly parallel to the runway, and watch out for other traffic.

Notes on **Visual Illusions**:

- Even a relatively small upslope can give you the illusion that you're too high, causing you to touch down before the threshold.
- Approaches over featureless terrain (snow, water) or dark areas tend to be too low.
- Steep surrounding terrain can make you think that you're too low.
- If flying near the ground in reduced visibility, it is usually advisable to reduce speed. You might want to partially extend the flaps.
- Flying low and downwind gives the illusion of increased speed. Be careful not to reduce airspeed to the point of risking a stall.

It's always smart to overfly an unfamiliar field before landing, then fly a normal circuit.

Touch & Go actions pre-takeoff:

1. Flaps up (or set for takeoff).
2. Trim set for takeoff.
3. Carb heat cold.
4. Power to full.

Notes on **Runways**:

- For clearing the runway, continue in the landing direction to the nearest suitable taxiway and exit the runway ASAP.
- You will normally be given instructions to backtrack after landing on a dead-end runway.
- You are not considered clear of the runway until all parts of the aircraft are past the taxi holding position line or past the 200-foot mark.

Notes on **First Solo**:

- Your flight instructor will have to be satisfied that you are competent in many areas.
- The instructor will ensure that suitable conditions exist and precautions are taken.
- Fasten the belt in the empty seat.
- Your takeoff and climb will be faster than you expect due to lighter weight (no instructor).
- You will need less power to maintain a specific rate of descent.
- The float after your landing flare will last longer.

Benefits of **Partial Flaps**:

- Lower operational speed.
- Smaller turn radius (to avoid obstacles).
- Better view (lower position of nose).

The altimeter gives heights ASL, not AGL. Don't hit the ground! Ground heights can be more easily judged by looking well ahead than by looking down.

Map reading is harder when you're closer to the ground.

Don't practice low level flight without an instructor on board.

If you're going to have to do a precautionary landing, it's best to do it sooner rather than later, to help avoid additional limitations being imposed by worsening aircraft conditions, deteriorating weather, or other factors.

Normal precautionary landing:

1. First do a normal circuit at low approach over intended landing area, to inspect.
2. Follow up with another normal circuit ending in a safe landing.

Notes on **Precautionary Landings**:

- You may have to guess wind velocity from a number of clues (movement in leaves, water, dust grass). General forecast?
- Surface must be long, smooth, and firm, as level as possible, free of obstacles, and into the wind if possible.
- Think of the amount of room needed for takeoff later, which is more than is needed for landing!
- Watch out for hard-to-see obstacles like wires and trees. Look for utility poles.
- When inspecting an area, don't use slow flight as the aircraft is harder to control. Partial flaps may give a better view and lower the stall speed.
- Don't fly too low when doing your inspection, due to safety risks.
- Fly to one side, not directly over.
- An aircraft travelling at 60 knots (70 mph) covers about 100 feet per second.

Notes on **Night Flying**:

- Lower temperatures mean that the air is more dense, better flying.
- Usually fewer clouds and less turbulence.
- Less traffic in the sky, and that which is there is easier to see.
- Reference points (horizon, geographical features, ground) are unfortunately often invisible.
- Need to be comfortable/proficient with flying using instruments.
- Flashlight is mandatory.
- Memorize positions of all controls!
- Pay attention to generator/alternator charge rate.
- Review tower light signals (manual).
- Will be covered in much more detail in subsequent training.

Types of **lighting**:

- Runway (white).
- Runway threshold (green).
- Runway approach.
- Taxiway (blue).
- Taxiway entrance.
- Obstruction (red).
- Airport Rotating Beacon (white).

Retro Reflective Lighting – Positioned such that when the aircraft is lined up on final, the lights provide the pilot with the same visual presentation as normal runway lighting.

Notes on **Forced Landings**:

- Don't be nervous, glider pilots do these every time they land.
- Establish a glide, carb heat on, trim.
- Know your glide speed.
- If the engine is fuel injected instead of having a carburetor, open an alternative fuel source.
- An aerodrome would be your first choice, fields second, roads or highways third.
- Pay attention to wind direction and slope.
- Watch out for signs, power lines, and traffic if landing on a road.

If you have an **engine failure** on the runway:

- Close the throttle.
- Apply brakes.
- Turn the battery master switch off and fuel valve switch off, if it looks like you might leave the runway inadvertently.

If you have an **engine failure** after takeoff:

- Close the throttle.
- Get to a recommended glide speed.
- Pick a landing path, and land.

If you have an **engine failure** below circuit altitude:

- Select a field ahead.
- Close the throttle.
- Lower the nose to maintain glide speed.
- Land straight ahead (avoid obstacles).
- Do a Cause Check and May Day if time permits.
- Secure the engine.
- Forced landing.

Warning! Numerous fatal accidents have resulted from attempting to turn back to the aerodrome following an engine failure after takeoff. Pilots try to turn and maintain altitude, and then go into a low level spin from which you're not high enough to recover.

If you have to do a **forced landing** from the Circuit:

- Usually successful.
- Know key positions and plan your glide.
- Base leg may be flown closer to the field than normal in a strong wind.

Engine failure or near failure **Cause Check** list (in no particular order):

- Fuel on, amount sufficient?
- Fuel pumps on (backup)?
- Primer locked?
- Mixture rich?
- Magnetos good (check L/R/B)?

It helps to do the May Day call before you're too low, due to radio range and line-of-sight considerations. If unsure of the best frequency, and nobody is active on your frequency currently in use, broadcast on 121.5 MHz. Set the transponder to 7700.

Passenger Safety for a potentially dangerous landing:

- Remove glasses.
- Stow loose objects.
- Seatbelts and shoulder harnesses on.
- Make sure seat is all the way back (to minimize head injury).
- Unlatch doors (jam open if possible) on final so they can't jam closed.

Engine Shutdown procedures:

- Shut it off (key/mags).
- Fuel tanks off.
- Mixture to idle cutoff.
- Alt/Gen switch to off.

- Master off (after flaps are set).
- Try closing the throttle.
- Approach height should be slightly high.

Simulated Engine Failure procedures:
- Don't allow engine to get cold.
- Apply cruise power periodically for a few seconds during descent.

Pilot Navigation is probably the hardest part of learning to fly, for most people, at least in terms of the theory involved. The following sections will cover an overview of some general navigation theory, although all aspects of navigation will be covered in much more detail by your instructor.

Selecting the Chart:
- Standard chart is 1:500,000 VNC (VFR Navigation Chart).
- Also useful for airports with high traffic are the 1:250,000 VTA charts (VFR Terminal Area).

Choosing your Route:
- A straight line is not always best.
- Think about alternate airports and good landmarks.
- Be wary of hills, peaks, elevations, obstacles, and large bodies of water.
- Think about airspace you go through.
- Weather and safety issues are important.

Preparing the Chart:
- Useful tools include pen, pencil, marker, protractor, dividers, chart rule, straight edge.
- Track (intended track) is the first line. Dark and neat.
- Drift lines are at 10 degrees to each side from both ends, 2/3's of the track length. You might want to make them dashed.
- Ten Mile Marks: Small strokes across the track line at 10 mile increments.
- Fractional Distance: Dividing the overall track into quarter, half, and three-quarter, helps with easy and rapid revision of ETA.
- Checkpoints: Occasional Random Markings.

NOTAMS:
- Notice To Airmen.
- Last minute notes about changes to facilities or navigation.
- If the airport doesn't have a NOTAM, call the number in the CFS.

Weather:
- Check it. You might want to set more conservative personal restrictions than the regulatory minimums.
- You can get an online report or personal briefing from a FIC or Atmospheric Environmental Service weather office.
- Brief the briefer, which will help the weather specialist give you useful and pertinent info.

Altitude:
- Minimums are affected by terrain and obstacles, maximums are affected by the cloud base in VFR.
- Don't climb too high if going a short distance, or if oxygen is an issue.
- Over water, make sure you're high enough to glide out.
- Visual detail is better when low, but visual range is better when high.

Flight Planning Form:
- No set/standard format or layout.

- Keep track of trip info and in-flight record keeping.

Departure Type (three types):
- Overhead: Climb in vicinity of the airport to cruise altitude, set heading, starts over airport. Can conflict with other traffic, takes time and fuel. Good when airport is surrounded by featureless terrain.
- Geographic Point Procedure: Start at a distinct landmark, preferably a short distance away (within several minutes of the aerodrome).
- En Route Climb: Quick and direct, turn to intercept track, climb en route.

Level Off Procedure:
- Level attitude, power, trim.
- Make sure outside airspeed is correct, as it affects the true airspeed.
- Lean the mixture out, set the heading indicator.
- Check the engine/system instruments, fuel.

Setting Heading:
- Record time then check the heading indicator, compass, and visual angle of departure.
- Calculate an estimate for the first check-point, and ETA for the end of the first leg.

Map Reading:
- Orientation: Hold the map so the track parallels the ground track.
- Anticipation: Having a watch is very important. Remember the slogan, "watch to map to ground."
- Confirmation: Make a positive ID for landmarks.
- Pin Pointing: Identify position relative to place and time, note this on a map.

Ground Speed Check – Be established at cruise attitude, heading, and airspeed for the entire distance of the check. Try to do it early, in case you encounter something you didn't expect.

Cockpit Checks – Do them regularly. Same with VFR position reports.

PIREP – Stands for Pilot Weather Report. You can report unexpected turbulence, icing, strong winds, heavy precipitation, reduced ceiling/visibility, etc. Pass them on to any Air Traffic Control facility.

Notes on **Instrument Flying:**
- This is a required part of PPL training.
- When vision is taken away, we become prone to believing other senses that can cause confusion.
- You must have faith in instrument indications.
- Never react to an unconfirmed physical sensation, no matter how strong it is.
- Learn to relax when flying by instruments, hold controls lightly.
- Will be covered in much more detail in subsequent training.

There are three main **groups of instruments** (don't confuse with three types of controls):
- Control.
- Performance.
- Navigation.

The two **key control instruments** are the Attitude Indicator and the Tachometer. The attitude indicator gives direct and immediate pitch and bank info. The tachometer (or manifold pressure gauge) gives direct power information.

The two **key performance instruments** are the Altimeter and the Heading Indicator. The altimeter gives your estimated height above sea level (the VSI is also useful), and the heading indicator (related to the compass) gives your estimated heading.

When performance instruments show bad results, pay attention to control instruments to fix the problem, then return to the performance instruments to verify.

The Turn & Bank Indicator is good for Yaw and Coordination.
The Turn Coordinator is good for Yaw, Roll, and Coordination.

Indirect Information sources:
- Pitch attitude can be indirectly inferred from airspeed, altimeter, and the VSI.
- Bank attitude can be indirectly inferred from the heading indicator, the turn & bank indicator, the turn coordinator, and the magnetic compass.

Fundamental Skills:
- Instrument Scan.
- Instrument Interpretation.
- Aircraft Control.

Selective Radial Scan – Use the attitude indicator as the central instrument, keep returning to it after checking other instruments.

Instruments to Focus On:
- Straight & Level: Attitude indicator plus heading and altimeter.
- Straight Climb: Attitude indicator plus airspeed and heading.
- Approaching Desired Altitude: Attitude indicator plus altimeter and heading.
- Level, Approaching Airspeed: Attitude indicator plus airspeed, heading, and altimeter.

Adverse Yaw – Any yaw, regardless of origin, having an effect contrary to the interests of the pilot.

Coordinated Manoeuvre – The ball in the inclinometer is centered, so the aircraft is not slipping or skidding.

When correcting for an altitude error, make an attitude change that will result in a vertical speed that is approximately double the error in altitude.

In straight and level flight, any change in power results in a change in airspeed or altitude (we usually think altitude but this depends on pitch adjustments).

A general rule of thumb (not perfect) for airspeed control is that 100 rpm or one inch of manifold pressure produces a change in airspeed of approximately 5 knots.

Always scan the heading indicator during changes in power and pitch attitude. Correct for all heading deviations by using small bank angles.

Pay attention to the attitude indicator while control inputs are being applied for pitch corrections.

For levelling off during instrument flight, an effective practice is to lead the altitude by 10 percent of the vertical speed, ie. for a descent of 800 feet/minute, lead the altitude by approximately 80 feet.

Instrument Turns:
- The typical instrument rate of turn is three degrees per second, or two minutes for a complete circle.
- Three degrees/second is referred to as a “rate-one” or “standard rate” turn.

- Don't exceed a 30° angle of bank during an instrument turn.

To produce a **rate-one turn**, start by using the estimated angle of bank from the standard formula, then cross reference to ensure that the turn coordinator or the T&B indicator confirm a rate-one turn. A small amount of nose-up pitch is usually required to maintain altitude.

For a steep turn, in addition to pitching up slightly, you will very likely need to increase power slightly to maintain altitude and selected airspeed.

If the VSI and the altimeter indicate a descent, and the airspeed is increasing despite backward pressure on the control column, reduce the bank angle and restore the aircraft to level flight, then try again.

Changing airspeed in turns is an effective manoeuvre for increasing proficiency in all basic instrument skills.

The angle of bank necessary for a given rate of turn is proportional to the true airspeed. The angle of bank must be varied in direct proportion to the airspeed if a constant rate of turn is to be maintained.

The approximate **angle of bank required** to make a rate-one turn may be calculated by using this formula:

(Knots Indicated Airspeed / 10) + 7 = Bank Angle in Degrees

If using statute miles/hour, add five at the end of that formula instead of seven.

Use small angles of bank to make small heading changes. Usually a bank angle equal to half the number of degrees of the intended turn is good. Don't exceed the rate for a standard turn. For a twenty degree heading sweep to the left, don't exceed a bank angle of 10°, according to our rule of thumb. However, let's assume that we're travelling at 90 knots, so the bank angle in degrees for a standard rate-one turn at that speed is 16°. It looks like we're good. But if we wanted to make a heading change of ninety degrees, our rule of thumb would say to use a bank angle of half that or 45°. Unfortunately, that exceeds the bank angle for a rate one turn (16° of bank) so we just stick with the 16° when banking, and it'll have to take a bit longer to swing around through the whole ninety degrees of compass heading.

To roll out of a turn on a selected heading, lead the heading by half the angle of bank, ie. for a 30° bank angle, begin the roll-out at fifteen degrees compass heading before reaching the desired heading.

Partial Panel – Refers to instrument flying while the altitude indicator and heading indicator are either missing or unserviceable.

Line of sight for a VOR is about 39 miles at 1000 feet AGL, and about 77 miles at 4000 feet AGL. These constraints are in reference to the curvature of the Earth (without complications from terrain), and assume that your transmitting and receiving equipment is adequate to communicate over such distances.

For VOR's, all radials are named as bearing *from* the station.

CDI – Course Deviation Indicator
OBS – Omni Bearing Selector

The CDI does not have to be flying in or out along the radial to have the needle centered. An aircraft on the radial but crossing it will have the needle centered, regardless of the bearing of the plane. VOR is sensitive to position but not to heading.

Homing to a VOR Station:

1. Tune the receiver to the correct frequency, identify the station.

2. Rotate OBS until To/From shows “To.”
3. Keep rotating until the CDI is centered.
4. The reading under the OBS index is the magnetic track to the station.
5. You may have to keep adjusting over time in a cross wind.

Intercept **VOR “To” a Station**:

1. Select the frequency, identify the VOR.
2. Determine the reciprocal of the radial, set on OBS.
3. Check To/From. If set at From, you can’t readily intercept the radial.
4. Assuming set as “To” then if the CDI is left, subtract 90 degrees, or if right, add 90 degrees. This gives your intercept heading.

Intercept **VOR “From” a Station**:

1. Select the frequency, identify the VOR.
2. Set the radial (not reciprocal) on the OBS.
3. Check To/From. If set at To, you can’t readily intercept the radial.
4. Assuming set at “From,” use the same approach as above, ie. subtract 90 degrees if left, or add 90 degrees if right. This is your intercept heading.

LO Chart – En route Low Altitude chart.

Air routes joining two VOR stations do not always show the radials as exact reciprocal numbers because of chart convergence and magnetic variation.

Fix – Intersection of lines of position on a navigational chart. The position of an aircraft can be determined by taking bearings from two or more VOR stations.

When you’re about to fly over a VOR station, expect wide CDI needle fluctuations, and the To/From flag to flip.

ADF – A low frequency radio receiver that can be used for reception of NDB signals and commercial broadcast stations. Can provide continuous relative bearings and/or magnetic bearings to any radio facility within the frequency range of 190 KHz to 1750 KHz.

NDB – Non Directional Radio Beacon.

When using a radio broadcast station for an ADF beacon, be careful in case a backup antenna site is being used and you’re homing into the wrong beacon!

ADF is not restricted to line-of-sight like VOR, but is more subject to static from lightning, etc.

Fixed Card Display – Assumes that the longitudinal axis of the aircraft is parallel to a line passing through the zero index and 180 degrees.

Relative Bearing – The angle formed by a line drawn through the center line of the aircraft and a line drawn from aircraft to beacon, measured clockwise from the nose of the aircraft.

Magnetic Bearing – The angle formed by the intersection of a line drawn from the aircraft to the beacon and a line drawn from the aircraft to magnetic north.

Reciprocal Bearing – The aircraft’s bearing plus or minus 180 degrees.

Intercepting an ADF Track to a Station:

1. Turn on the same heading as the desired track.
2. Turn 90 degrees from this parallel track in the direction of the ADF needle.
3. As you approach the desired track, your ADF needle will approach either 90 or 270 degrees. At this point, turn inbound on the desired track.
4. If, after turning to parallel the required track, the needle indicates a bearing of between 90 and 270, you're going the wrong way. Make a 180 degree turn.
5. To intercept an ADF from a station, use the same approach as above but turn outbound!

If **adjusting for drift** with ADF, you'll know you have the correct adjustment if the number of degrees that the needle is placed off the 0^o or 180^o index remains constant, with a constant heading being shown on the heading indicator.

A 90^o intercept angle is the shortest route to a desired radial or track, but it isn't the shortest route to the station. You'll eventually learn to use shallower intercept angles that will take you more directly to your destination. Make sure you intercept the radial before reaching the station.

Most **engine fires** on the ground are the result of over-priming in cold weather, or priming unnecessarily in summer. Do not fly the plane after an engine fire until it has been inspected by an AME.

Different types of **in-flight fires** (such as cabin, engine, or wing) are often treated separately. If you can't extinguish an in-flight fire, land immediately.

Electrical Fire:

1. Turn off the Master or Battery switch, and also the Alternator or Generator switch.
2. If turning equipment on to isolate the source of a fire, do each item one at a time with a significant waiting period between each item. It may take time for the malfunctioning electrical component to heat up and start smouldering again.
3. If you're turning equipment on and notice a burning smell, remember that the last unit activated may not be the one causing the fire.

Icing – VFR pilots should never be flying in conditions that can lead to icing! Icing does not occur only in cloud. If you start to encounter icing, note your heading and immediately start a 180^o turn. Remember that icing can significantly reduce lift, so avoid steep banks. Make sure that the pitot heat is on, and get as much heat as possible to the windshield.

Insufficient Battery Charge – If the warning light comes on, shut down all unnecessary electrics to conserve battery charge. A battery that is not being recharged can die in as little as twenty minutes or less. Warn ATC that you may lose radio.

Low Oil Pressure – If the oil temperature is constant, your oil pressure gauge may be faulty. If the oil temp is rising, you have a problem and should try to land immediately.

If you have to **ditch the aircraft** (ie. land in water):

1. Land into wind/waves, unless the waves are very heavy. For heavy waves, you may consider landing perpendicular to the waves, so you don't slam into a large wave.
2. Use full flaps on high wing aircraft, or retracted flaps on low wing craft.
3. Crack the door or wedge it open before landing, to prevent jamming.
4. Fasten your seat belts, store loose objects, have floatation devices handy.
5. Water always looks calmer from the air than it really is.
6. When ditching in a river, try to land facing downstream.
7. Be prepared for a double impact. The second one is worse, when the nose hits.
8. The aircraft will not sink for a while unless it is badly damaged. Don't panic.

9. You may need to wait a bit before opening closed doors, until the cabin fills with some water and the pressure equalizes.

Automatic Terminal Information Service (**ATIS**) – Continuous broadcasting of recorded information for arriving and departing aircraft at major airports.

Clearance Delivery – A frequency at major airports which ATC uses to reduce radio congestion on other channels. Primarily used to issue IFR clearances to aircraft on the ground. You may need to contact ATC on Clearance Delivery after checking ATIS, then the Clearance Delivery controller will pass you on to the appropriate ground controller.

Ground Control – Usually coordinates taxi clearance to/from the active runway. For a normal taxi clearance, you may taxi to the holding position for the active runway, but *never* taxi onto an active runway unless specifically cleared to do so. Any instructions that include the words "hold," "hold on," "hold XXX of," or "hold short" must be read back to the controller. It is not a bad idea to even read back instructions such as enter, cross, backtrack, or line up.

Tower Control:
- Do not request takeoff clearance until all pre-takeoff checks have been completed.
- If you're told to taxi and hold short, do not go onto the runway to line up.
- If you're told to taxi and line up, you can taxi onto the runway and line up, but do not take off until cleared.
- If cleared for takeoff, you should acknowledge, taxi onto the runway, and take off immediately. You should never stop/pause on the runway unless told to.
- Be aware that the Tower may have to give you different departure instructions (altitude/heading) than expected/requested, so pay attention.
- IFR aircraft may be on different frequencies that you cannot hear, so always keep a sharp lookout for conflicting aircraft.
- You must remain on the Tower frequency until clear of the control zone.

Arrival:
- Check ATIS before contacting Tower.
- Do a wakeup call before entering the control zone.
- You must obtain clearance before entering a Class B or Class C control zone.
- You may be told to hold over (circle) a VFR hold point in a left hand orbit within visual contact of that point.
- Know and understand the procedures for circuits.
- If "cleared for the option" you may make a low approach, a touch-and-go, a stop-and-go, or a full stop landing, at your choice.
- If Tower doesn't volunteer clearance to land, you must request it. Without clearance, you must overshoot and do another circuit unless it is an emergency.
- If told to pull up and go around, you must do another circuit.
- Once landed, get off the runway as quickly as possible, at least 200 feet off or past the hold line.
- Once off or past the hold line, switch to ground control for further taxi instructions.

Control Zones:
- If intending to transit through a control zone, call and state your intentions.
- You may be refused entry due to heavy traffic and/or bad weather.
- Be prepared to hold, divert, or perhaps request special VFR.
- A "vector" is the same as a heading.

Sometimes, doors/windows/panels will pop open during flight, often during takeoff. Don't panic. This may degrade your aircraft's flight capabilities, but keep flying the plane. Deal with the problem when you feel

ready. Never slow down to deal with an open door/window once you've started your takeoff roll. Wait until you're in the air and climbing comfortably, and there's no risk of coming back down onto the runway, before you fix the issue. Your plane will fly with the door or window unlatched.

Conclusion

The topics included in a study of beginner's aviation have a greater scope than I've covered here. It would also be wise to spend quite a bit of time studying the various publications that I've linked to on this page: http://www.djbolivia.ca/aviation.html

I have links there to several additional aviation-related publications.

Thanks for reading, I hope this was helpful to pilots in training. If you find any errors in the above information, feel free to contact me at jonathan.scooter.clark@gmail.com

- Jonathan Clark