Georgian College

Flight Lab - Module Two

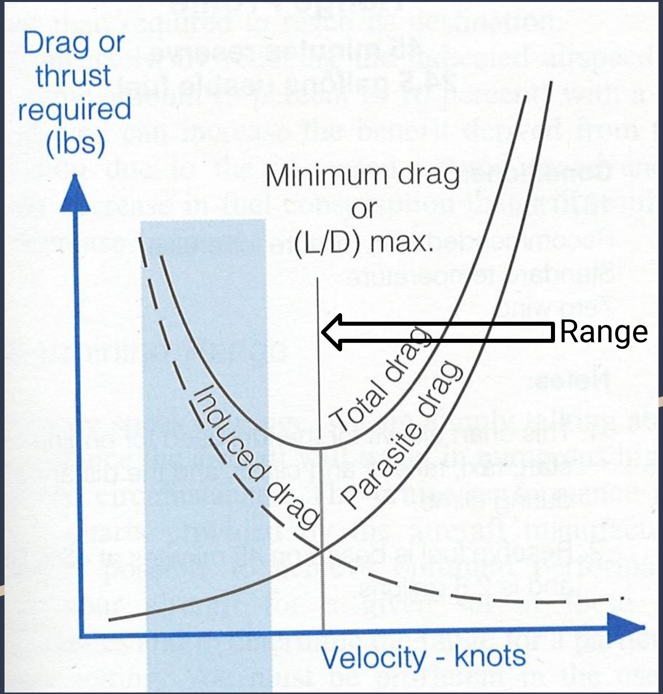
Lesson Objectives

Lesson One - The Basics

By the end of this lesson, you will have a firm understanding of:

- Flight for Range
- Flight for Endurance
- Slow Flight
- Slipping
- Circuit procedures

Flight for Range



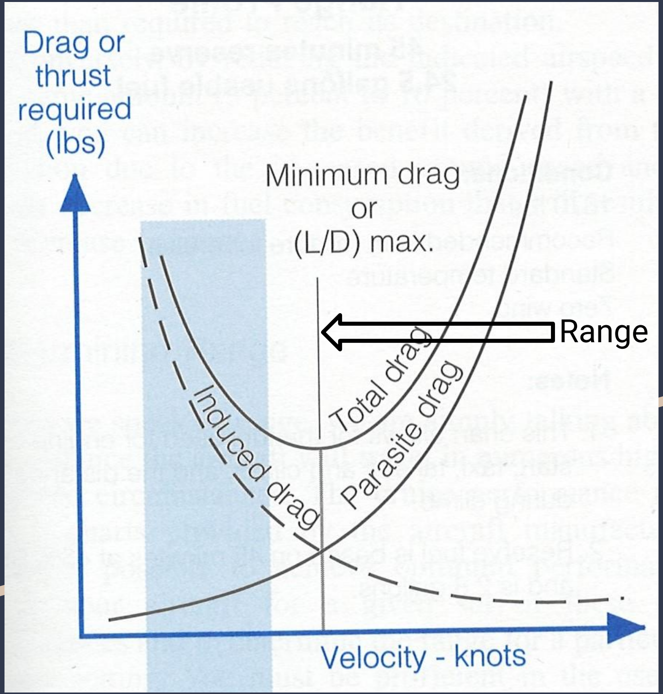
When the aircraft is set up to fly for maximum range, the objective is to fly the greatest distance possible per unit of fuel consumed.

This is affected by a number of factors:

Fuel Available - Obviously, the more fuel there is in the tanks, the greater the range. To determiner range with full fuel, we simply refer to the aircraft POH. This gets more difficult when we don’t have full fuel. In this case we must divide the amount of fuel onboard by the rate of fuel consumption for your given power setting.

Angle of Attack - In order to fly at max range, the aircraft must be flown at the angle of attack which provides the best lift/drag ratio. This angle of attack is always the same and is not affected by weight or altitude.

Flight for Range

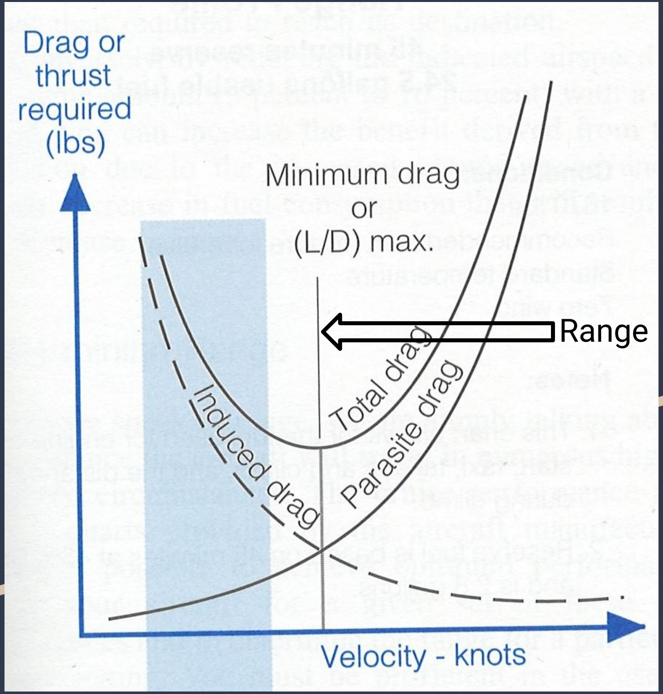


Airspeed - We stated previously that an optimal angle of attack must be achieved in order to reach the lift/drag max. We can use airspeed to correspond to this optimal angle of attack.

Weight - As we increase our weight, we must increase the amount of lift we produce. There are only 2 ways to do this. One, increase out angle of attack but we know that there is only one angle of attack that gives us the best lift/drag max so the only other option it to increase power. When we increase power, we increase or fuel burn and decrease or range.

Centre of Gravity - if the aircraft centre of gravity is more forward, the tail will be required to produce more lift to keep the aircraft level. Increasing the lift also increases the drag, requiring more power and reducing range.if the aircraft centre of gravity is more aft, there will be less drag created by the tail. Less drag means less power required which increases our range.

Flight for Range

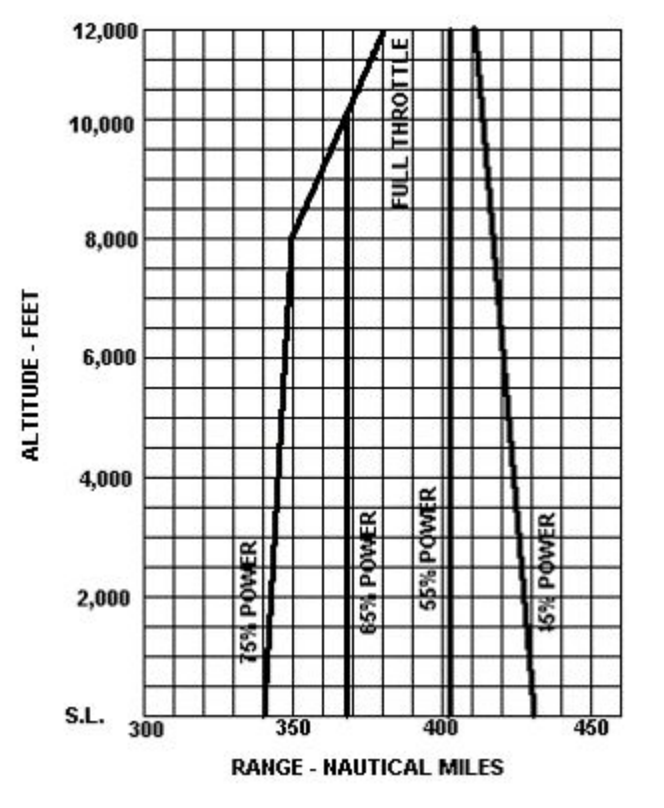


Engine Efficiency - The maximum range is achieved when the engine is operating at peak efficiency. This occurs at an altitude which would allow the engine to run at full throttle while still maintaining the correct airspeed and angle of attack. This can only be achieved at a high altitude.

Climb - Climbs are generally performed at a high power setting, if not full power. This increases the rate of fuel burn and decreases range.

Wind - Headwinds will decrease range while tailwinds will increase range.

Flight for Range



Cessna provides a chart like this one in the Pilot Operating Handbook. It can be used to determine the aircraft range at various altitudes and power settings.

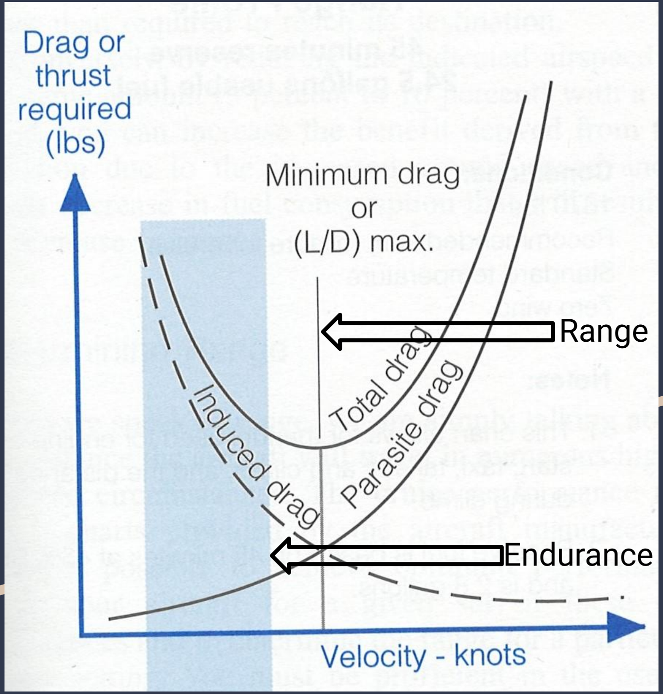
Note: This chart is based on full fuel at take off.

Example:

An aircraft travelling at 3000’ with 65% power will have a range of 369 nautical miles.

An aircraft travelling at 12,000’ and 75% power will have a range of 380 nautical miles. This is because the engine is operating at maximum efficiency with full throttle.

Flight for Endurance



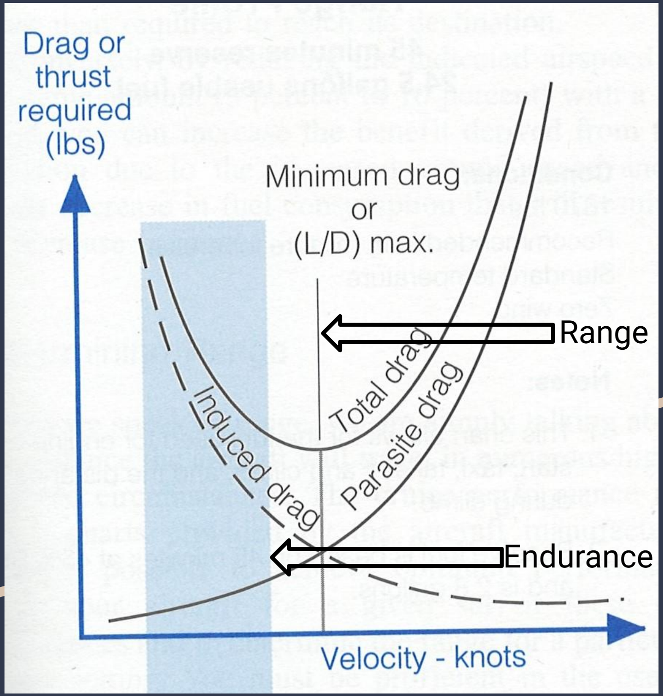
Flight for Endurance refers to the amount of time an aircraft can remain in the air.

It is the maximum flight time available for the amount of fuel on board.

It makes sense that the higher the power setting, the greater the fuel burn and the shorter the endurance. For this reason, flight for endurance is also referred to as the lowest power setting that allows an aircraft to maintain altitude and airspeed.

Most pilots will seldom set the aircraft up to fly for endurance, however, there are situations where this may become necessary. For example, an aircraft that has just completed a long cross country only to discover that the runway is temporarily closed due to a disabled aircraft. The pilot must now hold clear of the runway until the aircraft can be removed. Setting the aircraft up for endurance will safe fuel and increase the amount of time the aircraft can hold.

Flight for Endurance



There are a number of factors that affect endurance

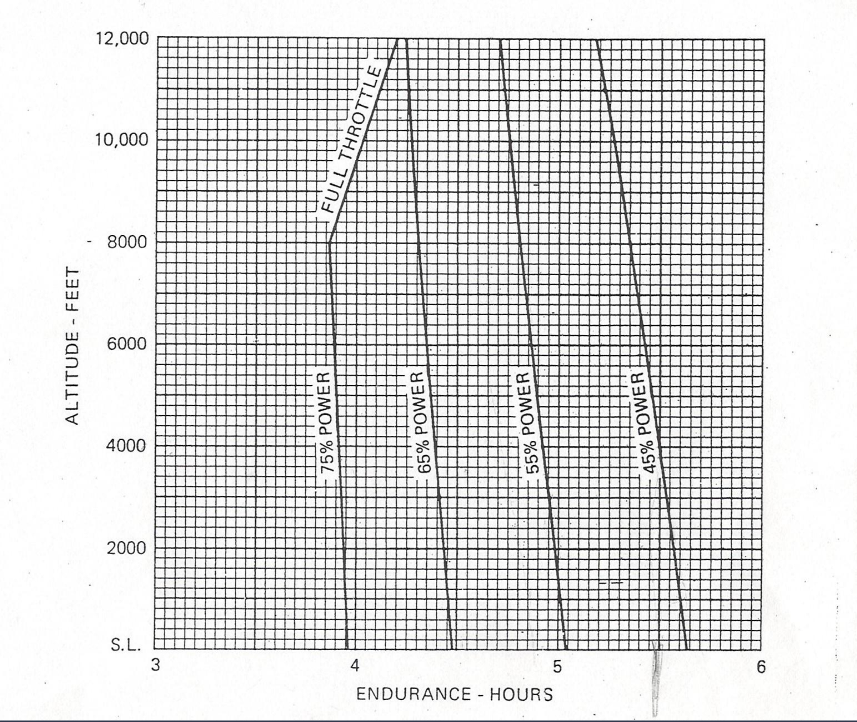
Altitude - Maximum endurance is achieved at sea level. This is rarely possible or advised but the lowest altitude commensurate with safety will give you the greatest endurance.

Turbulence - Turbulence causes the pilot to constant adjust the power to maintain level flight. This decreases endurance.

Flaps - Flaps increase the amount of drag that is being produced. In order to overcome this drag, more power is required, decreasing endurance.

Mixture - Flight for maximum endurance can only be achieved by properly leaning the mixture. Properly leaning the mixture can give the pilot a slight increase in RPM. Allowing the pilot to further reduce the throttle and burn less fuel.

Flight for Endurance



Cessna provides a chart like this one in the Pilot Operating Handbook. It can be used to determine the aircraft endurance at various altitudes and power settings.

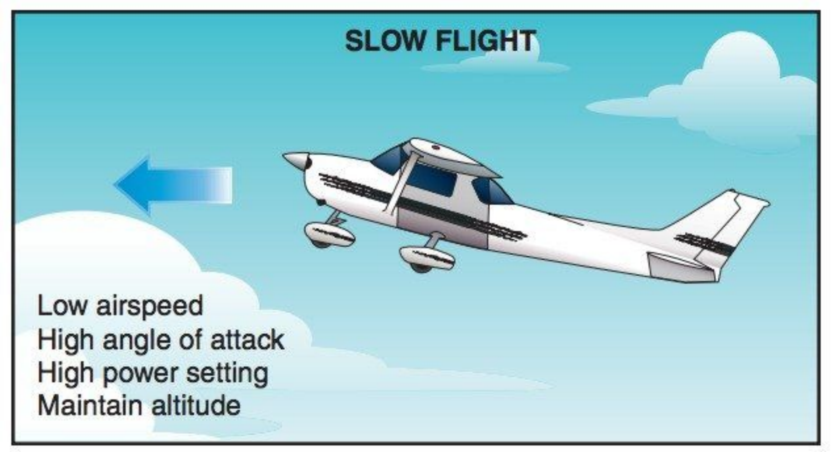
Note: This chart is based on full fuel at take off.

Example:

An aircraft travelling at 3000’ with 65% power will have a endurance of 4.8 hours.

An aircraft travelling at 12,000’ and 75% power will have a endurance of 4.5 hours. This is because the engine is operating at maximum efficiency with full throttle.

Slow Flight



Slow flight is defined as the speed range between Endurance and just above the stall speed.

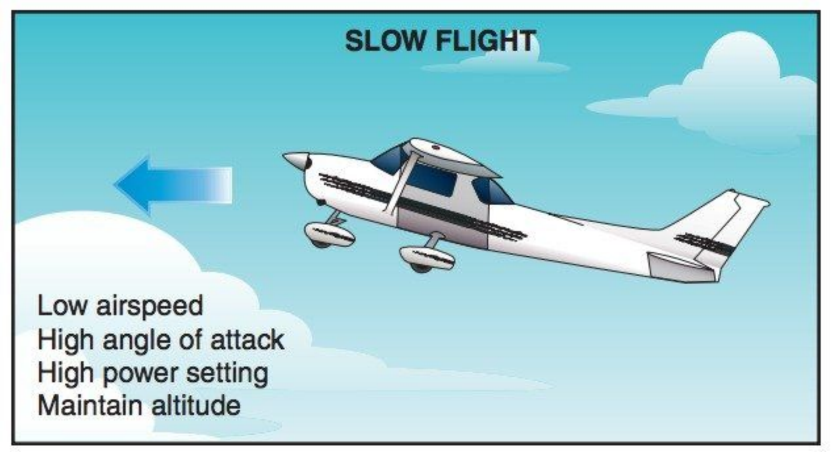
Slow flight is more than just flying slow. We transition through slow flight everytime we take off and land.

Pilots spend many hours properly learning this exercise in order for them to recognize the symptoms of slow flight and how to control the aircraft safely while operating in this speed range.

Pilots must also learn and understand the consequences of not taking prompt corrective action and lastly, how to recover from a slow flight situation.

In fact, it is so important that pilots must demonstrate proficiency in this exercise on their flight test.

Slow Flight



Symptoms of Slow Flight

There are a few signs that should tell a pilot that they are approaching or in the slow flight speed range, they are:

- High nose up attitude
- Low airspeed
- Yaw
- Sluggish controls

Dangers of slow flight

- Poor forward visibility
- Reduced engine cooling
- Stall (if left uncorrected)

Slipping

Slipping is a manoeuvre in which the aircraft is bank but the turn is prevented or reduced by using the rudder.

There are 2 main reasons for slipping:

1. Losing altitude
2. Maintaining directional control over the runway during landing.

There are 2 types of slipping used to lose altitude, the forward slip and the slipping turn.

With the forward slip, the pilot applies full rudder in the desired direction while applying opposite aileron to maintain a straight path over the ground.

With a slipping turn, the pilot applies aileron in the direction of turn but applies opposite rudder to reduce the rate and create drag.

Slipping

The side slip is used during landing to prevent drift caused by a crosswind.

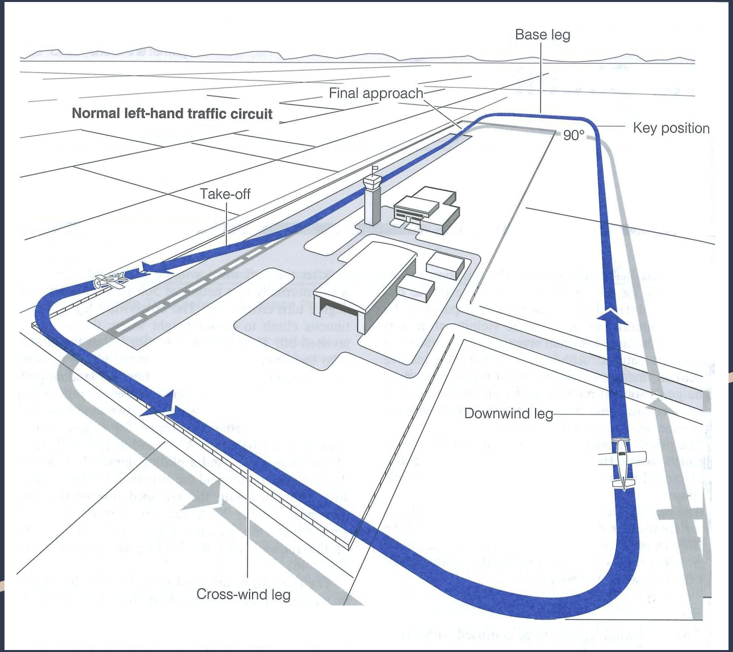
The pilot banks the aircraft into the wind and applies enough opposite rudder to keep the longitudinal axis aligned with the runway centreline.

The amount of rudder and aileron inputs are constantly adjusted to correct for the changing wind conditions.

The pilot must apply the inputs until after the landing is complete. If the controls are relaxed or returned to normal prior to landing, the wind will cause the airplane to drift sideways.

In the picture to the left, you can see the right tire will touch down first, followed by the right and then the nose tire. As the aircraft slows down after landing, the pilot gradually applies full aileron deflection into the wind

The Circuit



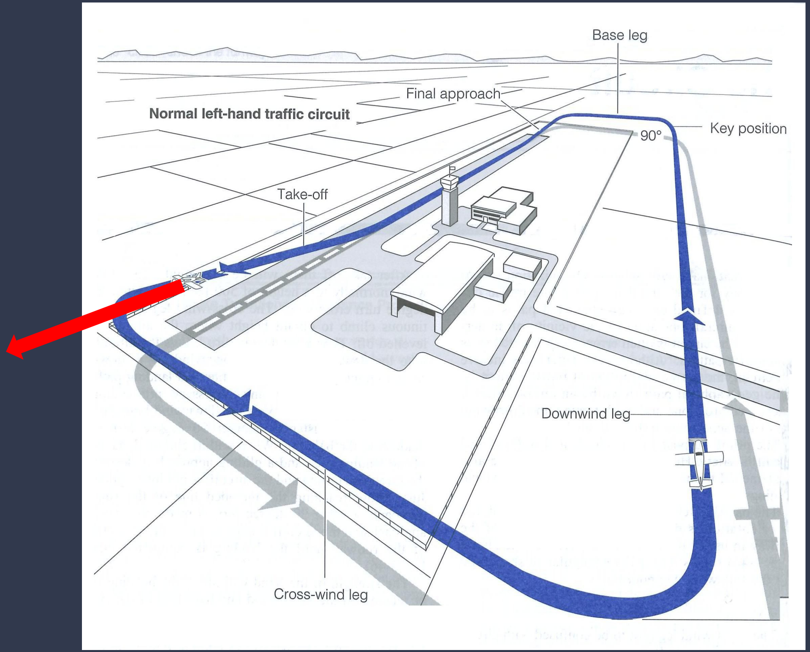
A standard circuit pattern is always to the left. Meaning that an aircraft flying in the circuit will be making left hand turns. This is done because the pilot sits on the left side of the aircraft and would therefore have the best visibility while turning.

There are 4 legs to a standard circuit. Once the aircraft becomes airborne, it will be on the departure leg. The first left hand turn will put the aircraft on the crosswind Leg, another left hand turn will put it on the downwind leg. A third turn will put the aircraft on the base leg. This is normally where an aircraft starts its approach for landing. A last left hand turn will put the aircraft on the final leg. This should align the aircraft with the runway and the aircraft will begin the landing phase of the flight.

A non-standard circuit is essentially the same but all turns are made to the right.

The Circuit

Departure



Departure from the circuit at an uncontrolled aerodrome can only be done one way.

First, the aircraft must maintain runway heading after it becomes airborne.

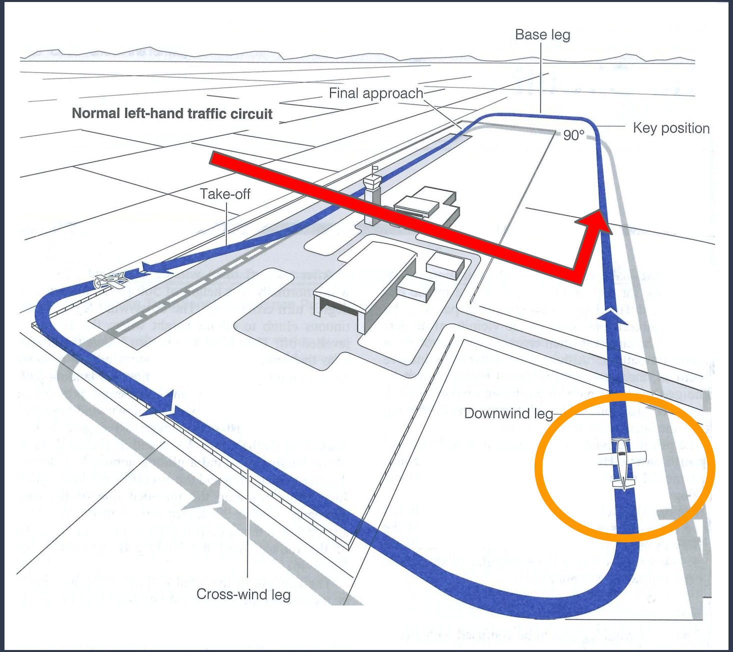
The aircraft is to maintain runway heading until it reaches 1000 feet AGL. At that point it is considered 'clear of the circuit' and may now turn in the desired direction for the flight.

Note: Aircraft requiring to turn left towards the circuit are advised to continue to climb on runway heading until they reach 1500 feet AGL. This will prevent them from turning into the circuit and possibly creating a hazard with other aircraft joining a straight in downwind.

Aircraft departing the circuit at a controlled airport can start their turns at 500 feet AGL

The Circuit

Entry



Entry in to the circuit at an uncontrolled aerodrome can be done only one of two ways.

First, the aircraft can enter a ‘straight in downwind’. This would be indicated by the aircraft in the orange circle.

The second way would be to cross overhead the airport and join a mid-downwind, as shown by the red arrow.

At a controlled airport, or an airport with a air traffic controller, the pilot could be instructed to join the circuit at any point, including a ‘straight in final’.

Circuit entry altitude is normally 1000 feet above Ground Level (AGL)

Short Field Takeoff and Landing

For cases where takeoffs or landings must be completed on a short runway, the manufacturer has specified the procedure to use.

For Cessna:

Takeoff

- Position at the end of the runway with full brakes
- Apply full throttle, confirm with RPM
- Release brakes
- Elevator control slightly tail low
- Rotate at 55 kts

Landing

- Full flaps
- Touchdown at slowest safe speed
- Apply heavy braking without skidding
- Full back on the controls
- Flaps up

Soft Field Takeoff and Landing

For cases where takeoffs or landings must be completed on a grass or gravel runway, the manufacturer has specified the procedure to use.

For Cessna:

Takeoff

- Control column full aft
- Position aircraft on runway and without stopping apply full power
- Reduce back pressure slightly to avoid tail strike
- Maintain directional control
- Once airborne, lower nose to stay in ground effect

Landing

- Full flaps
- Apply a small amount of power prior to touchdown
- Ease aircraft on to runway with nose high attitude
- Reduce power and slowly apply full back pressure

Conclusion

That concludes the ground portion for Flight Lab module 3.

If after reviewing this you have any questions, we suggest you write them down and bring them with you to your lesson. Your instructor will be happy to go over them with you.

Remember to check the schedule often at:

https://ontarioflightcentre.ca/georgian-college/

Due to a number of factors, your flight may get changed.

If you are not feeling well on the day you are scheduled for flight lab or if you suspect you may have come in contact with Covid-19, please notify us as soon as possible and try to switch with another student.

We look forward to seeing you soon.

Ontario Flight Centre