



# Low Flying Introduction

Commonly, low flying refers to any flight at or below 500 feet agl that may be practiced only in designated low flying zones.

By maintaining good situational awareness, it should be possible to avoid the unplanned operational need for low flying, for example, as a result of weather, however, pilots need to be familiar with flying low. This exercise allows them to observe the effects of inertia, to experience the visual illusions caused by drift and a false horizon, and to recognise that the stress of low flying is a situation to avoid.

It is important for the student to be exposed to operating close to the ground, not only when forced to fly low, but also when mountain flying. It improves the student's awareness of terrain and the effect of wind. Good aviation practice dictates that a pilot should never fly lower than they

must, however, each takeoff and landing involves low flying operations, where the recognition of potential visual illusions is critical.

Whether the designated low flying zone is over water or not, limited value will be found in this lesson if winds are less than 10 knots.

These lessons will not make anyone an expert at low flying. Setting personal limits well above the legal minimum, always leaving a way out, and turning back or landing at the nearest suitable aerodrome long before the situation simulated in this exercise is reached – cannot be stressed enough.

Better to be on the ground wishing you were flying, than airborne wishing you were on the ground!

## Objective

To compensate for the effects of visual illusions, inertia, and stress when operating the aeroplane close to the ground.

## Considerations

### Inertia

The effects of inertia and the sensation of speed become most apparent at low level. At normal cruise speeds the degree of anticipation and the amount of horizontal airspace required to turn the aeroplane is substantial.

### Visual Effects

The effect of wind is very apparent at low level and this can lead to quite powerful visual illusions.

When flying into wind at a constant airspeed the groundspeed is low and this can lead the student into either lowering the nose or increasing power.

Downwind the groundspeed is high and this may result in the nose attitude being raised or power reduced.

When flying across the wind the effect of drift is most noticeable. A suitable reference point on track must be chosen. In order to track towards this reference point, the appropriate amount of drift must be offset and balanced flight maintained. Avoid any tendency to fly with crossed controls.

When turning from into-wind to downwind an illusion of slipping into the turn will occur and likewise, when turning from downwind into the wind, an illusion of skidding out of the turn will occur. The strength of this illusion increases in proportion to the wind strength. Never attempt to correct an apparent skid or slip with rudder. Cross-reference to the balance indicator during low-level flight is vital.

Many designated low flying zones are over water, and flight over calm water, with its lack of texture, produces depth perception problems (empty field myopia). For this reason, low-level flight over water in less than 10 knots of wind is not recommended.

### The Poor Visibility Configuration

The poor visibility configuration for your aeroplane should be stated and its benefits explained.

In the poor visibility configuration, the airspeed is reduced, flap is extended (generally 15 to 20 degrees depending on aeroplane type (refer CFI)).

The benefits are as follows.

#### *Reduced Airspeed*

This means less inertia and a lower groundspeed, allowing more time to think and react to obstacles as well as reducing the radius of turns.

#### *Flap*

Flap increases the lift and drag and adversely affects the L/D ratio. The increased lift results in a decreased stall speed, allowing safe flight at the lower airspeed. The adversely affected L/D ratio means a relatively high power setting must be used to maintain straight and level flight.

#### *Power*

Maintaining the rpm in the normal range means that the continuous use of carburettor heat is not required, and operating temperatures and pressures should remain within their normal ranges. However, prolonged use of this configuration may lead to increasing oil temperature.

Power also reduces the stall speed and provides slipstream. Slipstream not only provides additional effectiveness to the rudder and elevator (for most aeroplanes) but also helps to clear the windscreen in drizzle.

Remember from the turning lessons, power must always be increased in turns. The level of power required increases as the angle of bank increases.

### Low Flying Zone

Management of the exercise requires a careful inspection of the low flying zone and preparation of the aeroplane before entering the area.

Low flying must take place within the boundaries of a designated low flying zone. The boundaries of the area should be described with reference to a map or terminal chart and the minimum descent height stated. Flight below 200 feet agl is not recommended (refer CFI).

If low-level flight is to be conducted over water, lifejackets should be worn, not just carried in the aeroplane.

A broadcast or report, including the estimated elapsed time (EET) to be spent in the zone must be made on entering – and a vacating report when leaving.

## Airmanship

When flying close to the ground, if the aeroplane's high speed and inertia are combined with conditions of poor visibility, there is little time to react to obstacles or plan a course of action. Therefore, to better manage the flight, the use of the poor visibility configuration is recommended.

It should be noted that most low flight will be in the normal cruise configuration. The need for training in the operational application of the poor visibility configuration is relevant but raises the questions; "Have I gone too far?" "Should I turn back?" "Should I take an alternative route?" "Should I consider a precautionary landing?"

The use of the term poor visibility rather than bad weather configuration is recommended, because bad weather is not necessarily perceived by the student as poor visibility; for example, turbulence. If the weather is otherwise fine but the aeroplane is experiencing severe turbulence (where the aeroplane's structural load limits may be exceeded), the student may consider this to be bad weather! However, in such situations, if the poor visibility configuration is selected, extending flap usually reduces the aeroplane's maximum structural load limits (refer Flight Manual).

For this purpose, many organisations adapt the **HASELL** checklist, adding an extra L for lights (refer CFI).

#### *H Height (not altitude)*

Not below 200 feet above ground level (refer CFI).

#### *A Airframe*

State the configuration.

#### *S Security*

No loose articles, harnesses secure (life jackets).

#### *E Engine*

Fuel on fullest tank, fuel pump ON, mixture RICH and a full SADIE check is completed. Check for carburettor ice.

#### *L Location*

The boundaries of the low flying zone are positively identified.

#### *L Lookout*

Look into the area for indications of wind direction and strength, possible causes of turbulence (tall trees or cliffs) and downdraughts, other aircraft, birds, obstructions (especially wires) and suitable forced landing sites – as little time for field selection will be available from low level.

#### *L Lights*

Turn on all external lights, especially the landing light.

Since ordinarily there would only be one aircraft in the low flying zone at a time, the student may be wondering, why turn on the landing light? The reason is that birds have been shown to be more sensitive to bright lights than moving objects. This is one reason why landing lights are commonly used below 1000 feet during takeoff and approach.

## Aeroplane Management

Carburettor heat is cycled more often throughout low flying.

Fuel management needs to be considered if additional power is required to control speed or overcome the drag associated with the use of flap.

## Human Factors

Discuss the difficulty of detecting obstructions at low level (wires, birds) against a cluttered background.

Discuss the need to be aware of low flying sensations and potential illusions. Challenge any mindsets to help avoid the need for reactive actions because visual cues have been misleading.

Flying the aeroplane close to the ground in poor visibility can be a very stressful situation. The poor visibility configuration increases the time available for processing. High stress levels result in a decrease in performance and may cause a narrowing of attention by fixating on one instrument or aspect, and/or hyperventilation.

Avoiding bad weather will eliminate one reason for low flying altogether.

## Air Exercise

### Low Flying Zone Boundaries

Complete the **HASELL** checks and at 1000 feet agl fly around the edge of the LFZ.

Using a powered descent, enter the LFZ at 500 feet agl.

### Visual Illusions

At 500 feet agl it can be hard to identify the horizon, unless you are over water, so the horizon will need to be superimposed over the terrain. This will be covered in more detail in the *Mountain Flying* lesson(s).

The most common illusions are those caused by wind. Look specifically at the effect wind has on turning, and how to track over the ground with a crosswind. In addition you should note the effects of flying upwind and downwind on the groundspeed.

### The Effects of Inertia

Maintain straight and level at 500 feet agl and note the reaction time needed to initiate a manoeuvre.

Complete medium level turns and note the reaction times required and the radius of turn.

### 3-D Effect

At lower levels the three-dimensional effect of terrain and obstacles is more apparent. In this light, such things as wires, sun strike, shadows, and mechanical turbulence need to be discussed.

### Poor Visibility Configuration

Reduce the power to \_\_\_\_\_ rpm (refer CFI) while maintaining straight and level flight and when the airspeed has reduced to inside the white arc, lower the flap to \_\_\_\_\_ degrees (refer CFI). As the airspeed approaches the nominated configuration speed, power is increased, as required, to maintain straight and level flight at the nominated speed. Trim.

The level to which the power will need to be increased varies depending on the aeroplane weight and other factors. At typical training weight and configuration this setting will be about \_\_\_\_\_ rpm.

Note the reduced speed and how this gives the pilot more reaction time, lessens the effect of wind and inertia, and with a lower nose attitude improves the visibility over the nose.

## Airborne Sequence

### On the Ground

Make sure there are no loose objects.

### The Exercise

The low flying zone should be identified by the student flying around the outside of the boundary, at a minimum of 1000 feet agl, keeping it on the left or student's side so that the student can look into the area.

The student should complete the **HASELL** checks and enter the low flying zone using a powered descent.

The effects of inertia, resulting in a large turning radius and requiring anticipation, are experienced by the student in the normal cruise configuration. This is best achieved by having the student follow a winding road or river. If these features are not available within your low flying zone, flying around the boundaries at 500 feet agl may substitute. Note that the visual impression of greater speed becomes more noticeable as height is reduced.

Level medium turns through 360 degrees may also be practiced (refer CFI).

Describe the sensations and potential illusions the student may encounter.

The student should then be taught the poor visibility configuration as discussed in the briefing.

This will usually be the first time the student has ever flown the aeroplane level in this configuration. Therefore, allow adequate time for student practice (refer CFI). Remind the student of the need to use power in the turn, especially with the flap lowered.

In this configuration, the effect of visual illusions created by flying across the wind, downwind and upwind can be experienced by the student and compared with the previous cruise configuration. In addition, the visual effects of slipping into the turn when turning downwind and skidding out of the turn when turning into wind are seen.

The visual illusions caused by drift on the track made good are first demonstrated by flying along a line feature at right angles to the wind. Crossing the aeroplane's controls is avoided by choosing a reference point on which to maintain level balanced flight, and regular cross-reference to instruments – especially balance.

The effects of groundspeed changes and apparent slip or skid are commonly demonstrated by establishing a race track or circuit type pattern at less than 500 feet agl.

Medium level turns are practiced in this configuration as part of the race track or circuit pattern. Medium level turns through 360 degrees may also be practiced (refer CFI).

On completion of the exercise you may gain some insight into whether or not transfer of learning has occurred by simply asking the student to “take me home.”

The student has been previously taught that, before raising flap, there are three criteria that must always be met: safe height, safe airspeed (above a minimum and accelerating) and a positive rate of climb. These will be achieved only by using full power!

Returning the aeroplane to the clean configuration, in anticipation of a climb out of the low flying zone should be treated as a go around.

#### After Flight

The next lesson will look at some further considerations of low flying and additional types of turns, and why they might be needed.