Basic Mountain Flying

This training introduces students to the principles of basic mountain flying and further develops their experience and understanding of operating near terrain with its associated weather. This is a CPL level exercise.

The exercises do not require high mountains to establish the basic principles.

Opportunities for scenario based decision making should be maximised.

As with the previous lesson *Terrain and Weather Awareness* the training should focus, whenever the opportunity presents itself, on recognising the significance of weather, especially wind relative to the terrain and its impact on flight conditions and flight path.

Objectives

To consistently identify a useable horizon and to superimpose it on to a variable background.

To appropriately position an aircraft in a valley and to conduct level, climbing and descending turns.

To safely approach, cross, and position after crossing ridges, saddles, passes or spurs.

Experience real or simulated circumstances of disorientation and the strategies for reorienting in place and time.

To practice emergencies where options may be limited.

Considerations

The student should experience these exercises to increase their awareness of mountain flying and their associated weather;

1. In clean configuration and poor visibility configuration
2. In both calm and windy conditions (greater than 15 knots, at instructor discretion)
3. In clear conditions and in conditions of some precipitation
4. Completing turns through 180 degrees and 360 degrees both clockwise and anticlockwise.

Wind below 15 knots is generally predictable. It is important that instructor discretion is applied in wind conditions above 15 knots, when ability to accurately predict conditions is more challenging and affected by the terrain shape, size and presentation of airflow.

Importantly, basic mountain flying requires completion of a ground course, please refer to the Mountain Flying Training Standards Guide for the content of this course.

Superimposed Horizon

Revise the definition of the horizon.

Identify the real and imaginary horizon.

Review the illusions associated with inaccurate horizon definition, most commonly an insidiously climbing terrain gradient which tricks the pilot into raising the nose. Potential hazards associated with illusions and poor horizon definition include inadvertently reaching the stall speed with high power and no room, or performance, available to escape.

Operating in a Valley

Review and expand on;

- use of check turns,
- positioning in a valley,
- turning using minimum angle of bank to use all available space,
- poor visibility configuration use and considerations, and

Discuss the considerations of climbing and descending turns when entering and vacating a valley. This will help the student to experience the changing horizon perspective and consequent importance of attitude/speed control.

Discuss valley gradients – the student should experience flying at a constant height above the valley floor while descending down a valley to observe the VSI indications and predict the climb performance necessary for flight in the opposite direction. The gradient in most valleys far exceeds the climb performance of the average light training aeroplane.

Discuss the effects of sun and shade – if possible, in a controlled dual environment, expose the student to the sun suddenly appearing/ disappearing behind a ridge.

Crossing Ridges, Saddles, Passes or Spurs

Review and expand on the considerations from the *Terrain and Weather Awareness* lesson;

- consider all aspects of crossing,
- configuration and attitude of aeroplane,
- effect of wind and terrain,
- escape options,
- use of parallax, and
- types of saddles.

In increased wind conditions the student will need to assess the areas of lift and sink, and areas of potential turbulence for all phases of a crossing.

The student must consider the approach path/angle from well before the crossing. They must assess the approach angle (left to right or right to left) for wind, cloud and turbulence conditions and provide for the best escape option at all times.

Escape options should be available through a shallow angle (45 degrees or less) to minimise the angle of bank and consequent V_S. The best escape option should provide for a downstream, downhill escape on both sides of the crossing to anticipate the effects of potential turbulence or sink.

The student should experience as many options as possible, including those that may not be the best, provided that the experience stays within the instructor's limitations.

Route Finding

Discuss the importance of good planning and map preparation. The time spent on the ground significantly reduces workload in the air, especially in the mountains where a good lookout is more critical because of the proximity to terrain.

Being able to identify the direction of water flow/ gradient will help greatly when it is critical to be assured of the aeroplane's position. The student should develop the skill of recognising flow direction and by assessing the amount of white water present, gain a clear indication of valley gradient.

Being aware of the alignment of the valley being flown in, and of those nearby, will help maintain situational awareness.

Discuss using the position of the sun to improve situational awareness and knowledge of orientation. For example if the sun was in front of the right shoulder entering the valley, and if insignificant time elapses, it should be behind the left shoulder exiting the valley.

Emergencies

Emergency landings, whether forced or precautionary, are more of a challenge when flying below the ridgeline.

The lack of a real horizon is the primary problem.

There are many variables to consider; height available, distance to viable landing sites, existence of viable sites within reach, wind/ turbulence/precipitation conditions, and light conditions, to name just a few.

Confined spaces will affect the plan.

The wind will also affect the glide range – avoid the sink and use the lift if possible. It may be possible to take a calculated gamble on the presence of an anabatic or katabatic wind.

The valley being flown over will probably have a gradient – how steep it is? What will be the elevation of the landing site? Are there any wires?

Be aware of the illusions and mindsets that can be experienced.

Make an early MAYDAY call, possibly on 121.5, set 7700 and activate the ELT.

Look for habitation and head for it.

Before takeoff, there should be an appropriate survival kit on board and the pilot should have knowledge of its contents and use. See the *Survival* Gap for more information.

Airmanship

In this lesson the student must be doing more than just thinking ahead, they must anticipate the environment they cannot yet see, in order to ensure they are not left in a situation where reacting quickly is the only option left open to them.

It is important that they learn to recognise threats and develop appropriate strategies to mitigate those threats.

It is much better to have sound decision making than rely on inadequate aeroplane performance to provide escape options.

The student must remain aware of their situation at all times, in particular remaining aware of the changing weather, nearby terrain, other traffic in the area, and the student's own performance.

It is helpful to make position reports both before and after crossing to assist with traffic awareness.

As with all low flying, more frequent use of **SADIE** checks is advised.

The minimum descent altitude for this exercise is restated (refer CFI).

Aeroplane Management

Revise the poor visibility configuration – considering when it is necessary to adopt and the effect it has on performance.

Review V_A, V_S, and operating speed range considerations. Review the use of power as necessary to remain safely above stall speed, but in anticipation of potential turbulence, below the maximum manoeuvring speed.

Carburettor heat as required.

Review leaning the mixture for engine considerations, performance and economy.

Revise control coordination to ensure smooth, balanced handling to reduce unnecessary stress on the aeroplane, passengers and pilot.

Consider the positioning of the aeroplane in relation to the terrain while taking into account wind direction and speed, so as to mitigate the effects of turbulence.

Human Factors

The illusions experienced when flying without a horizon have been discussed earlier, but expand on the other illusions the student may experience, for example, whiteout and disappearing ridgelines.

Workload, stress, fatigue and effect on performance – employ sound planning techniques, good training and currency to reduce any degrading effect on performance

Hypoxia and dehydration factors – be knowledgeable and aware of effects on performance

Direct the student towards more reading on this subject, there are a number of GAP booklets that deal with flying in mountains, *Mountain Flying*, *Survival*, the *In, Out and Around* series, as well as the *Mountain Flying* DVD.

Air Exercise

Review the previous lesson and the skills developed there.

This lesson should start approaching any terrain. Discuss horizon, wind, gradient and potential lift/sink well in advance of the arrival in any valley.

Superimposed Horizon

Fly a constant altitude while maintaining a constant wingtip distance from terrain.

By using outside reference as the primary source, and only confirming performance with instruments, this exercise will help to develop the skill of accurately superimposing the horizon onto varied backgrounds.

This exercise should be flown smoothly and with coordinated control movements. While flying smoothly and maintaining a constant altitude and distance from terrain, encourage the student to develop an awareness of the area around them and their position in it. They should also be gaining an appreciation of inertia when they make turns, be consistently aware of their escape options, be applying the right of way rules, and using an appropriate lookout technique.

Next, fly a constant height above a descending valley floor to give the student an appreciation of gradient and shifting horizon perspective.

Turn around and fly a constant height above a rising valley floor to appreciate the same things.

Operating in a Valley

This is ideally carried out in a valley that provides a variety of slopes, valley sides, background terrain, and weather conditions. This may not be practical so a variety of valleys and conditions should be used.

Turns should be made while level, climbing, and descending.

When either unsure of the radius required, approaching the entrance to a valley, in a narrowing valley, or part of the valley, make check turns to evaluate the turn radius of the aeroplane, exit options and the space available for an escape.

Start with complete 360 degree level turns both left and right, in the cruise configuration, using the full width of the valley. Then the same level turns in the poor visibility configuration.

Note the difference in appropriate aeroplane position when in a narrow valley compared to a large one.

Make steep descending turns into a valley, the student should correctly anticipate the location the aeroplane should roll out, and notice the changing horizon perspective and reduced space available.

The student should be able to make efficient climbing turns, to enable the aeroplane to either climb out of a valley or to position for a saddle crossing using the available lift to assist, and avoiding sudden sun strikes.

If the valley has a vertical face, experience the turning radius through 180 degrees in both the cruise and poor visibility configurations to appreciate the effects of illusions.

Crossing Ridges, Saddles, Passes or Spurs

Apply a CPL standard to the previously established principles of assessing the appropriate flight path for approach, crossing and after crossing, that applies the safest compromise of the options and principles involved.

This exercise will be carried out in wind conditions that may exceed 15 knots.

The student should be able to demonstrate a saddle crossing, while taking into account, the approach, the effect of wind, the turbulence, their height, their speed, an efficient crossing, and be able to show you where they would escape to at any point. A safe airspeed must be maintained at all times and the aeroplane flown smoothly. Where compromise may be required, assessment of the best option should be made.

The student should apply sound decision making to all of their decision-making processes, and be able to discuss these. Their consideration of suitable escape options in conditions of unexpected sink or turbulence should be of primary concern.

Route Finding

While conducting mountain flying training, or during dual cross country training and operating below the ridge line, allow the student to experience their own real disorientation and guide them through strategies for reorientation. If this is not possible you may need to simulate the exercise.

Emergencies

Take opportunities to simulate forced or precautionary landings whenever the aeroplane is below a ridge line. Emphasise the need to recognise and mitigate any threats.

The student may have difficulty adjusting to a situation where the standard pattern cannot be flown, including a forced landing without power where the only option is straight ahead.

Airborne Sequence

Develop local simulated scenarios so you can assess a student's entry into and exit from a valley system, climb into and out of a valley system or crossing from one valley system into another.

When conducting cross country training consider routes and altitudes that facilitate practical application of principles learned.