VFR Above Cloud

If you encounter a lowering cloud base while on a cross country flight, it can be tempting to climb up through a hole and fly VFR above cloud or 'on top', particularly if the weather at your destination is clear. This is a risky decision, however, given the changeable nature of New Zealand's weather.

Not a Good Idea

Pilots create at least three major problems for themselves by flying VFR on top. First, you compromise your ability to navigate accurately. Second, you lose situational awareness of where terrain is below you, and third, if you have an engine failure, you will be forced to descend through the cloud layer – a terrifying situation to be in.

Given the changeable nature of New Zealand's weather, there is no guarantee that a hole will exist to enable you to get below a cloud layer again if you opt to go over the top. Even if you establish that a hole exists at your destination before deciding to fly on top, by the time you get there it could very easily have closed in.

"The best piece of advice is – don't do it. If you do, it could be the longest flight you can remember – if you live."

Descending through a cloud layer is not an option without appropriate equipment and a current instrument rating. This is incredibly dangerous due to the risk of spatial disorientation, and because you will have no way of maintaining terrain clearance. Not to mention that it is also against the rules.

Civil Aviation Rules set the minimum safety standard. Aircraft on air operations are not permitted to fly VFR on top. Rule 135.155(e) states that an air operation may not be performed under VFR above more than scattered cloud unless the aircraft is authorised and equipped for IFR flight, the pilot holds a current instrument rating, and sufficient fuel and fuel reserves are carried to proceed by IFR to an aerodrome where an instrument approach procedure can be carried out. Single engine aircraft are not permitted to fly VFR on top on an air operation under any circumstances (rule 135.155(f)).

The rules for private operations are less prescriptive. The VFR meteorological minima in Part 91 do not preclude private flights above cloud – however good airmanship does. If you get into a situation where you cannot find a hole or have an engine failure, and descend through cloud, then you will be breaking the rules.

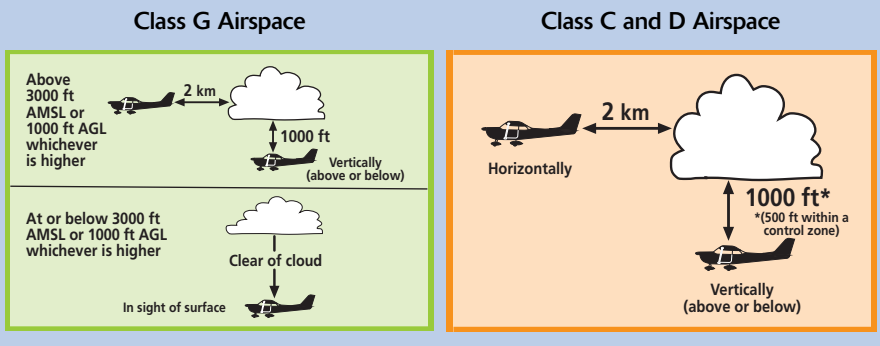
How to Avoid Getting Stuck on Top

Careful pre-flight planning is essential. Think about the weather and the suitability of your route given the conditions on the day. If you are unsure about whether you can make it through a mountain pass given the cloud base, pre-plan alternative routes before you depart. Changing to an alternative route is always preferable to climbing up through a hole and going over the top. Even if this means doubling back and taking the long way around. With this in mind, plan to have enough fuel on board to go the long way if necessary, without using your reserves.

Helicopter pilot Keith McKenzie is based in Taumarunui and has 36 years flying experience.

"The best piece of advice is – don't do it. If you do, it could be the longest flight you can remember – if you live. Holes seem to close extremely quickly

VFR Meteorological Minima (rule 91.301, Table 4).



and open very slowly. The weather can change so much, so quickly, that it can lead to an emergency situation almost instantly.

"The fastest way to lose weight is to fly VFR on top – you will be amazed how much you can sweat in a matter of minutes. Do not fly on top unless you have the knowledge and experience of a current instrument rating and an aircraft equipped with all the goodies.

"Always keep one eye in front for the next big hole and one eye behind on the last. If you lose sight of the hole behind without seeing another one in front – go back. It may take a while to go back to the last hole – but at least you know it exists, unlike continuing on, as there may not be another one," says Keith.

In order to make the best possible decisions en route, always obtain up to date weather information from an ATS unit and other aircraft.

What to Do if Stuck on Top

Most importantly, don't panic. Establish a plan for inadvertent VFR on top well before the situation arises. Fly the aircraft, and establish communications early with those who can help. Do some quick fuel and daylight calculations to establish how much time you have available to make a sound decision on how to proceed.

Seek help – make a mayday or pan call and squawk 7700. If you are inside radar coverage, ask your nearest ATS unit to confirm your position. Talk to other aircraft in the area, find out the position of those in VMC, or ask IFR aircraft higher than you if they can see areas of VMC. They may be able to direct you to a hole.

Use any and all navigation equipment at your disposal (if you know how). To help orient yourself, you could tune up an NDB station – the needle will point in the direction of the station, and if nearby aerodromes have DME you could use this to find out your distance from them. GPS can also help with navigation and possibly assist with terrain awareness if equipped with a moving map display.

Look at the Maximum Elevation Figures shown in each fifteen minute quadrangle on the Visual Navigation Charts. This gives (in feet above mean sea level) the highest known feature in each quadrangle, including terrain and obstructions. If you stay above this height, you will maintain terrain clearance.

When flying under low cloud towards rising terrain it can be tempting to climb through a hole. Don't do it – find an alternative route.

Fly higher – you will be able to see further, but remember there is a trade off between gaining height to see further, and requiring more power to maintain straight and level flight at higher altitudes.

If you climb above 10,000 feet be aware of how long you have spent up there as hypoxia will affect your decision making.

Adjust your power to fly at best range speed. You can find this setting in the flight manual. Don't go charging around at cruise power.

Subject to what you know about the weather behind you, in westerly conditions head east, the tail wind will help with range and the east coast will generally be clearer in westerly conditions, and vice versa in easterly conditions – head west.

Do not, under any circumstances, descend through cloud. The five hours of instrument time required for a fixed wing PPL (or 10 hours for a CPL) do not equip you with the skills to descend through a cloud layer, because of the dangers of spatial disorientation. You will also have no way of maintaining visual terrain clearance.

Fixed wing pilot Russell Baker has been flying for 40 years and clocked up 9500 hours. In Russell's experience, his students only lasted 90 seconds before suffering spatial disorientation in simulated IMC.

"If you inadvertently end up on top, have patience, because you have time to think about the situation and sort it out – if you end up in cloud you have no time at all – only a matter of seconds.

"VFR on top is a lonely experience. Anxiety builds, rational thinking becomes difficult, and every minute seems like an hour. Take note of your compass heading and make a gentle turn through 180 degrees. The return journey to clear skies seems to take an eternity. Once you can see the ground again your anxiety factor is still very high and good decision making can be some time away. It is essential that pilots take a good look at what has just happened and spend time reassessing the situation. Flying on top is throwing away your last trump card, and sometimes we all need a full pack of trumps," says Russell.

To get below a cloud layer again, find the biggest hole you can to minimise the angle of bank required to descend through it. Reduce your speed to minimise your turn radius, but caution is required due to a possible reduction in margin above the stall. The use of flap can assist in increasing your rate of descent but the increase in drag can make speed control more difficult – be careful not to exceed your flap speed.

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Make sure the aircraft is stable before you lose your visual horizon because at that point it gets harder to maintain attitude and air speed.

Position the aircraft at the edge of the hole and make a coordinated descent, anticipating the aircraft's position in advance. Be aware that the hole's position could shift and the dimensions may change. If in doubt, do not attempt to descend through it. Before starting a descent, anticipate the situation below it in terms of terrain, traffic, and the requirement for power to counteract a high descent rate.

Descending through a hole in a cloud layer is an emergency manoeuvre. In order to successfully complete this you must be competent in handling your aircraft. If you are not trained in, or competent in, carrying out a steep gliding turn, it is essential that you pick a hole big enough to make a straight descent through – with no angle of bank required.

Summary

Don't be tempted to go VFR on top. If you do, you compromise your ability to navigate accurately, your situational awareness of terrain below, and if you have an engine failure on top, you have no option but to go down blindly.

There is no guarantee that a hole will exist to enable you to get below a cloud layer again if you opt to go over the top, and descending through a cloud layer is not an option. This is incredibly dangerous due to the risk of spatial disorientation, and because you will have no way of maintaining terrain clearance. ■

SPATIAL DISORIENTATION

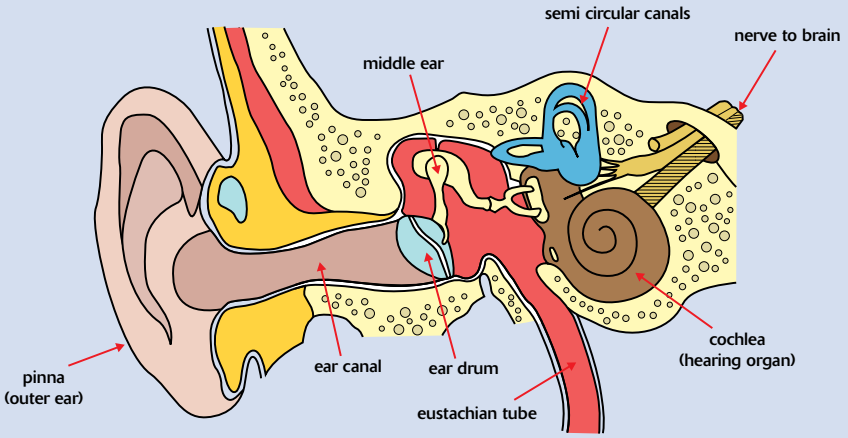
Our bodies orient themselves with reference to three things: visual cues, "seat of the pants" spatial cues, and the inner ear balance mechanism. If you completely lose visual reference, 80 percent of your orientation information has gone. The remaining two systems alone are not accurate.

The non-auditory portion of the inner ear contains three semicircular canals. Each canal is filled with fluid, and at one end of each canal are sensory hair cells or cilia. Rotation of the body moves the fluid in the canals, causing displacement of the cilia. This transmits messages to your brain telling it which way the cilia are displaced. The brain then figures out the direction of your rotation. Since the canals are located at approximately right angles to each other they can report on rotation in three dimensions, similar to a three axis gyro.

When outside visual input is obscured and the "seat of the pants" input is ambiguous, spatial disorientation can occur quickly because the fluid in the inner ear only reacts to rate of change, not a sustained change. For example, if a constant-rate turn continues for more than 15 seconds, it is impossible for the canals to detect that you are still in a turn, especially if it is gentle. If you are manoeuvring in IMC and believe what your body is telling you, instead of what your instruments are telling you, it can quickly lead to an unrecoverable situation.

For more information see the article "178 Seconds to Live", *Vector* January/February 2006.

The Inner Ear



Where is the terrain below?