Windshear

Where and when

If you've done more than a couple of hours' flying at Northam, there are a few things you're a certainty to have done. Using 14 or 32, seeing balloons, hearing Jandakot pilots yabbering too much on the radio. And dealing with windshear.

Windshear is a sudden, as opposed to gradual, change in wind velocity – either speed or direction – within a short distance. It can be either vertical or horizontal, it affects the speed and the flight path of an aircraft, and it's a well-known hazard.

Windshear can happen at high level near a jetstream or the inter-tropical convergence zone (ITCZ), but the only relevance of that to most of us is that it's another reason to keep your seatbelt on in an airliner. We're more likely to encounter shear around a front, near a thunderstorm, in an inversion, when the sea breeze is in, or where there are obstacles such as terrain or buildings. And the place it's most likely to bite you is on approach.

Climbing or descending through an inversion, where things are nice and calm below but windier and maybe bumpier above the inversion layer, you may get a sudden change of airspeed. Similarly with a sea breeze, which typically goes up to anywhere between about 1000 and 3000 ft, along with some turbulence you may notice changes of airspeed as you climb or descend through the level at which the sea breeze stops. And if it stops at about 1000 ft AGL, that can make your circuit harder work than normal.

Obstacles may cause windshear. Figure 1 illustrates how the wind can change with height due to obstacles, and there's no law that says those changes have to be nice and gradual. If they're sudden, that's windshear.

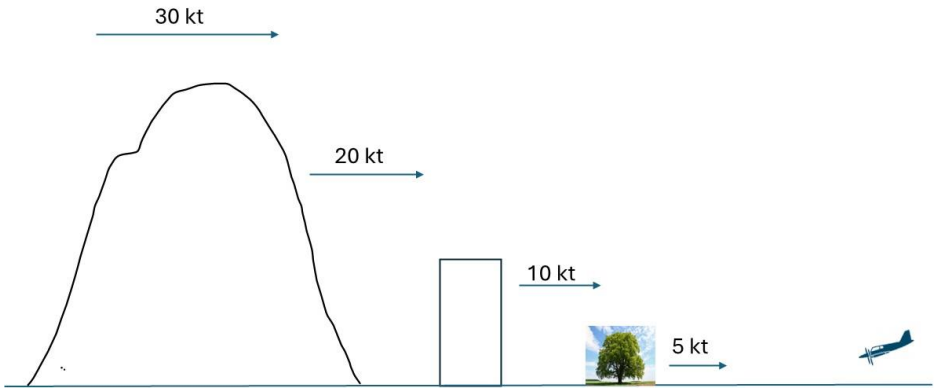

Figure 1: Obstacles causing windshear

The place where windshear is a hazard is not flying through an inversion or at the top of a sea breeze layer, but near the ground which, let's face it, is the biggest killer of aviators. (In 120-odd years of powered flying, and altercations between aircraft and the ground, the ground remains undefeated.) The worst place is in the downbursts under a good thunderstorm, where a 30 kt headwind could suddenly turn into a 30 kt tailwind. As well as the momentary loss of 60 kt of airspeed, the downdraught will kill you because you won't outclimb it. That's why even big jets don't take off or land under thunderstorms.

Alerting

It's enough of a hazard to aircraft of any size that larger aircraft have systems to detect it. Once upon a time it was part of a Ground Proximity Warning System (GPWS) – the one that says, usually in a stern female "don't argue" voice, "Too low, gear" or "Sink rate" or "Whoop whoop pull up". A windshear alert overrode all other modes. These days big jets have reactive windshear alerting systems that alert the pilots if they fly into windshear, and Predictive Windshear Systems, part of the weather radar, that scan for windshear within, say, 5 nm ahead of the aircraft. The systems give a warning, caution or advisory message if they detect windshear.

Major airports also have alerting systems, which are typically sensors at various points on an airfield, such as near each runway threshold. If the wind at a point differs by a specified amount from another reading, say 10 kt or 30°, ATC will put alert pilots individually and/or put an alert on the ATIS.

If it happens on approach, in many cases the company Standard Operating Procedures (SOP) will specify a missed approach – no ifs, no buts, go around.

The main source of windshear information is aircraft experiencing it. OCTA, if it's severe enough there's no harm in warning other pilots. In CTA, if you advise ATC, they will pass the information on. If you advise ATC of windshear at an intensity greater than "light" (minor excursions in flight path or speed), they will put it on the ATIS. And like a Traffic Collision Avoidance System (TCAS) warning, windshear is considered a serious enough threat that you'll get away with not following an ATC instruction. If you advise ATC that you have a windshear alert, you will get away with "Cannot comply, windshear escape", and they will generally shut up and leave you alone until you advise that you're clear of it.

And because as a light aircraft pilot you don't have all the toys that a Boeing or Airbus driver has, the forecast and you own local knowledge are good guides. At Northam, a windsock on Viagra swinging all over the place is a good message that windshear will be a factor – maybe enough to stop you flying. There are certainly days when I've looked at it and said, "Yeah nah but nah, no pre-solo circuit lessons today!"

Dealing with it

You're on finals with a 10 kt headwind. 70 kt on the ASI, 60 kt over the ground (Figure 2). Suddenly the headwind dies to nothing. After a few seconds, the result will be a groundspeed equal to your IAS (Figure 4). But the hazard is the aircraft's **initial** response (Figure 3). That's why, in the definitions of overshoot shear and undershoot shear in AIP GEN 2.2, it refers to the **initial** effect on flight path and/or airspeed. In our example, because the aeroplane has inertia, the initial response will be to continue downhill at its original GS of 60 kt. But with no headwind, that equates to an IAS of 60 kt.

All other factors being equal, less airspeed means, of course, less lift. That means sink, which you need to overcome with power. And unless you lose so much speed that you stall, and need to lower the nose to recover, you also want to use power to overcome the loss of IAS. Lowering the nose, when you're already sinking, will only make life harder than it already is.

Having applied that power, a few seconds later you'll have a higher IAS (Figure 4), so you'll need to reduce the power again. Like on short field approaches, wind shear is a reason to be even more dynamic with the throttle – small frequent movements – than on a nice smooth normal approach.

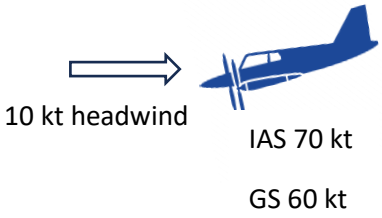

Figure 3: On final

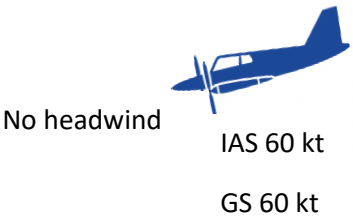

Figure 2: Aircraft's initial response

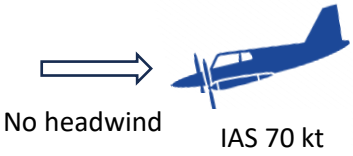

Figure 4: After a few seconds

And if you're dealing with typical Northam windshear on final, often it also means a crosswind that can't make up its mind about speed or direction. So your feet will be getting a good workout as well. And while we're on the subject of crosswind technique: if you use, say, right rudder to straighten the nose before touchdown in a left crosswind, an increase in crosswind just means more right rudder. But if the wind reduces, you can either release a bit of right pedal, push the left pedal or, most effectively of all, do both. Feet on both pedals make you feel more in control, and makes crosswind landings a whole lot easier.