

# STAY IN CONTROL



## Angle of Attack

Airspeed and angle of attack is a topic often debated, sometimes hotly, around airfields or in the bar and some positions go like this: “If you have good airspeed you’ll be fine” — not necessarily...

There’s a saying born of decades of experience that contends “you can stall an aeroplane at any airspeed and any attitude” and that’s true, even though such an observation might not always seem to make much sense.

After all, how for example can you stall with the nose pointing down or with the airspeed in the yellow arc, that doesn’t make sense... The problem is that only one number determines whether an aeroplane stalls or not, and it’s not one you’ll find on most instrument panels. That number is the critical angle of attack.

While airspeed, weight, pitch attitude and bank angle all change, the critical angle of attack remains the same. Exceed it and the wing will stall — every time.

So here’s why there can be confusion for some people about stalling — the angle of attack isn’t the same as the pitch angle. To distinguish between the two there’s a third angle to consider, the flight path angle, the angle between the flight path vector, where the aircraft is going and the horizon; think of it as the aircraft’s climb/descent angle if you like. Subtract the flight path angle from the pitch angle you get the angle of attack.

And just in case you’re thinking ‘yes, but I’m no Einstein or Newton’, you don’t have to be an expert in trigonometry to use this basic concept to visualise what the angle of attack is at any point in time.

“ Ask yourself ‘where’s the aircraft pointing compared to where it’s moving?’ ”

For example, in a normal climb the pitch angle might be 5° viewed on the attitude indicator, but that doesn’t mean the angle of attack is 5° because the aeroplane is climbing and the flight path angle is positive.

If you think about slow straight and level flight with a pitch angle of 5°, the flight path angle is now 0° paralleling

the horizon so the nose-up attitude will equate to a high angle of attack. Note this is the same pitch attitude as the previous example but a different result. Simple in practice.

So, when assessing the angle of attack ask yourself ‘where’s the aeroplane pointing compared to where it’s moving?’. That way you can build a visual estimation of angle of attack.

While a stall can occur at any airspeed, provided an aircraft is operated within its normal operating limits the risk of an inadvertent stall is fairly low. As taught, flying at the speeds given in the POH will result in an appropriate angle of attack below the critical value where the wing stalls. As you’ll be aware, the vast majority of stalls practised in training will be within the parameters of ‘normal flight’ (approximately a maximum of 10° in pitch and 30° bank) which results in a low-speed, nose-high stall scenario.

But it’s worth remembering when making steep turns or being in unusual attitudes that airspeed is not a reliable guide to determining the angle of attack. The ‘stall speed’ marked on airspeed indicators is valid for wings level and at 1g, but in a steep turn or at loads of more than 1g (which will accompany aggressive manoeuvres) the stall occurs at much higher speeds than you might expect, although the angle of attack at the stall will be the same as always.

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Having the ability to visualise angle of attack can be a great help in assessing how close to the critical angle of attack the aircraft might be, and therefore how prone to stall it is at that time.

“ It should be easy to avoid an inadvertent stall by maintaining an awareness of the angle of attack ”

If you're lucky enough to fly an aircraft equipped with an angle of attack indicator then you'll have a visual reference for the angle of attack. These come in different forms but are often small indicators with reference lines that change colour as the angle of attack increases, and in most cases there'll be some form of marking to show optimum angle of attack for the manoeuvre being flown.

Even if you don't have an angle of attack indicator it should be easy to avoid an inadvertent stall by maintaining an awareness of the angle of attack; just ask yourself if where you are pointing (pitch angle) is relatively close to where you are going (flight path angle) – a big difference is an indicator of a large angle of attack.

Flying in accordance with training and adhering to the procedures and figures given in the POH will result in angles of attack that won't result in a stall. Angle of attack awareness is a skill worth developing to manage the threat of stalling and possible loss of control.

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