HOW TO AVOID STALLS & SPINS

David Joyce considers stall/spin accidents and what we can do to avoid them

Stall/spin accidents are what happen to other people but not, of course, to pilots with your skills or mine! That is the way my mind and probably yours naturally works. There are some cautious, under-confident pilots around but most of us have a high opinion of our skills and a basic belief in our own invulnerability in an aircraft. So perhaps I can give you a personal view, which might change your perspective.

I have to admit to being slightly on the bold (but also old) end of the spectrum of pilot characteristics. To make it worse, I am a retired consultant surgeon and, as my wife will tell you, all such animals (despite evidence to the contrary) have an extraordinary belief in their own omniscience and omnipotence! So I hope that relating the things that have persuaded me that 'But for the grace of God, there spin I', you may also be convinced. I have something like 30 years' gliding experience and 20 years of power flying. Very early in my gliding training, I did a winch launch up to about 1,200ft and stalled and spun off the top of the launch. The instructor said, "I have..." and managed to correct the spin and pull out just feet above ground level to do an immediate landing in the reverse direction. One of my nine lives gone, but at the time I just put it down as a bit of excitement, due to the fact that we actually took off with a following wind.

I fly a Europa and there are 400 odd of the type flying. I do not believe they are more than usually prone to stall or spin – in fact I believe that the flying characteristics of the Europa are pretty much unsurpassed. However, four have come to tragic ends in stall/spin accidents in the last six years. The first felt particularly personal and horrible as it happened at my then home airfield of Kemble. A father and daughter, both qualified pilots, took off and fairly shortly afterwards had some problem (possibly engine or propeller), which caused them to begin to turn back at perhaps 500ft, from which height they spun in, with the daughter heard over the radio to be screaming all the way down. The aircraft burnt out. This aircraft was an N-registered one, which was not therefore required to have the stall strips or stall-warner that the LAA requires of UK aircraft, but there is no knowing whether this was relevant.

Exaggerated steep climbouts are not a good idea. An engine failure at a steep climb attitude and low speed requires rapid response from a surprised pilot to avoid a stall/spin situation that could well be unrecoverable

Not long afterwards, two much loved and respected (husband and wife) pillars of the American homebuilt scene died in an approach accident, spinning off the final turn. A year later another Europa with two on board experienced difficulties shortly after take-off in the States and spun in and burnt out after apparently turning back at about 200ft. Then last year a highly experienced Australian pilot had a similar occurrence shortly after take-off. So seven deaths in the Europa family in six years.

I guess the Europa experience is not out of the way of things. No doubt those keeping an eye on their own aircraft type happenings could recount similar statistics. In this country there were 216 deaths from stall spin accidents in light aircraft between 1980 and 2008, averaging seven to eight per year, and accounting for 36% of all fatal accidents. Only two of these were in a Europa, I hasten to add. Figures from the USA and Canada show a very similar picture, and the Canadian experience is of interest inasmuch as Canada has retained spin training in its PPL syllabus.

WHY THESE ACCIDENTS?

Why do stall/spin accidents occur? There have been a number of expert studies in recent years to try to answer this question, (Canadian CAA 1999: AOPA (USA) 2003; GASCo 2010; Brunel University 2011, and BGA 2011) and the main conclusions are worth repeating.

1 Measured height losses for small aircraft to correct and recover from a spin are

When taking off you must know where you are going if the engine quits. Unless you know the height at which you can turn back and have an ample margin, DON'T DO IT!

generally over 1,000ft, so a spin in the circuit is going to be fatal, regardless of skill or practice at spin recovery, a point supported by Canadian mortality rates being directly comparable to other countries.

2 Experience is no protection. Student pilots are much less likely to spin than qualified pilots, and students with an instructor more likely than solo pupils. In fact, in 22% of UK stall/spin accidents in the last 30 years there was an instructor on board. There has only been one UK fatal accident to a UK solo pilot since 1987.

Like students, airline pilots also are relatively immune compared to PPLs and non-airline commercial pilots who both run similar high risks. CPLs generally have thousands of hours experience and lots more hands-on flying in any one year than an airline pilot and it is interesting to speculate on why they should be at much greater risk than airline pilots. Three possible reasons spring to mind. Firstly, they fly similar sorts of aircraft to PPLs, lacking the sophisticated anti-stall systems found in airliners. Secondly, airline pilots across the spectrum spend two days every six months in the simulator working their way through all sorts of nasty situations. Finally, they are generally working as a two-man team, although the student v. student + instructor comparison casts doubt on the relevance of this factor.

3 Aircraft type matters. The Cessna 150 has a stall/spin accident rate around 17 times higher than the 152, and the tapered-wing PA-28 has a similarly dramatically better record than the earlier constant-chord PA-28. Brunel University research has ascribed the poor record of the Cessna 150 to the much lower stick forces needed to stall the aircraft compared with the 152. This does not apply to the PA-28 but the more abrupt stall characteristics of the older wing design may account for the difference.

4 The common trigger for the stall/spin has changed over time. In the UK, in the 1980s low-level aerobatics and beat-ups were predominant, but engine or airframe problems have triggered half of all such accidents in the last decade. On the other hand, the proportion of stall/spin accidents among all fatal accidents has not changed significantly.

5 Historically, the turn onto final has been the accident black spot but now the climbout has replaced this.

6 Stall/spin accident rates are considerably higher for planes under 600kg auw compared with heavier aircraft.

7 Psychological studies have found that in stress situations attention tends to narrow onto a single factor (like 'where the hell can I land?') to the detriment of other factors such as speed control. It is not improbable that tension and the subconscious desire to slow things down will also lead to some back pressure on the controls, and if elevator control forces are low, that is an easy route to disaster.

8 It has been repeatedly found that the mortality rate for those suffering an Engine Failure After Take Off (EFATO) who try to turn back is many times that of those landing ahead, yet people still try it!

9 It appears that the British gliding movement has been able to make a real impact on fatal accident rates by a concerted safety campaign. For the last decade or so, every pilot (even a World gliding champion) has been required to have an annual session with an instructor, practising stalls and spins. In addition, there have been major training programmes for all instructors aimed at the major causes of fatal accidents. Whereas in every four-year period since 1980 there had been around 15 deaths, in 2008-11 there were only five and no stall/spin deaths at all compared with about three in each previous four-year period.

10 There is a current CAA Safety Plan – *www.caa.co.uk/safetyplan* – but unfortunately it largely concentrates on commercial flying and the GA section strangely does not consider Loss of Control issues.

Naturally enough, we lack firsthand accounts of most stall/spin accidents in the circuit, but it appears that the common pattern is some problem such as engine failure causing a major distraction, followed by a loss of speed, often combined with an attempt to turn and then no way back. It is worth mentioning that partial engine failure with a rough-running engine may

> *"Partial engine failure with a rough-running engine may well mask the buffet and other signs that could otherwise alert the pilot to an impending stall"*

The British gliding movement has introduced a training and check flight initiative that has reduced spinning accidents in recent years well mask the buffet and other signs that could otherwise alert the pilot to an impending stall.

WHAT CAN BE DONE?

Firstly, it needs each one of us to take the problem seriously. The British Gliding Association and airline experience suggests that thought and practice can lessen the risk, should that distracting factor catch up with you at a critical time. So…

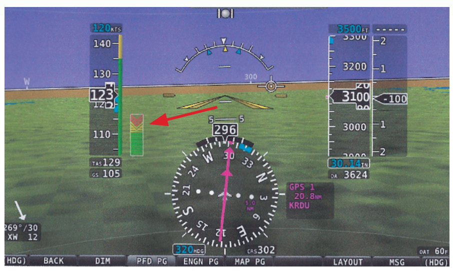
1 Practise stalls, EFATOs and PFLs a lot more than once every two years at your biennial renewal.

2 If you don't know the answer already, go and find out how much height you need to do a 180° turn after a simulated engine failure while maintaining a safe speed. Do this a few times, then add 300ft to the answer and vow never to contemplate turning back on an EFATO unless you have at least that height. It is almost worth placarding it: 'Never turn back unless over Xooft'.

This much at least gives you a somewhat better chance when it gets to be your turn for that unpleasant experience, but I strongly suspect that to make a real impact on the risks you need some bit of kit that will tell you unmistakeably that you need to do something about the speed, while you try to work out whether you have any chance of getting the aeroplane down in that small playing field. This of course is what stall-warners are for, but they only sound when already close to the stall, and as they usually wail continuously during landing and take-off, and even on taxying for taildraggers, it is easy to become accustomed to ignoring them.

Now this is an area where sloppy thinking may be relevant. We were all taught that an aeroplane stalls when the wing reaches a critical angle-of-attack (AOA), but it is all too easy to nevertheless think in terms of a stall speed as painted on your ASI. A few examples to illustrate this may point out the folly of thinking in this way. My Europa stalls at around 40kt in level flight but actually at 38kt one up with not much fuel and at 42kt at mauw. If at mauw I do a 45° turn, the stall speed goes up to 50kt and at 60° to around 60kt. Should I fall out of the sky and do a frantic 5g pull up to avoid hitting the ground, the stall speed is 94kt. In every case though, the wing stalls at the same AOA of around 16 to 17°. In a crisis, it is most unlikely that anyone is going to be able to compute actual stall speeds to ensure a proper margin, even if they have remembered to keep an eye on the ASI, but an AOA warning could be a different matter.

Airliners have stick-shakers and no doubt AOA-based audible warnings that are impossible to ignore, and comparable systems are now available for Permit aircraft in the form of AOA displays with audible warnings, and talking airspeed directors. The AOA systems I have seen installed in UK Permit aircraft are the AOA Pro and AOA Sport from Advanced Flight Systems, a US firm. They cost around £1,300 and £800 respectively in this country, with a few hundred more for the rather complex installation system. For some aircraft, installation would need to be done during the build process, as twin air lines need to run to the outer part of the wing. Both have attention-grabbing audible warnings when near to critical AOA. The less expensive version has what for me is the clearer display with eight lights, which come on progressively from the bottom upwards, as AOA increases. One green is lit for cruise, two green and two yellow on approach and everything shining brightly if you are about to fall out of the sky.



The latest Dynon SkyView EFIS with AOA display (marked by red arrow). In earlier versions the AOA was more prominent

The system that I have most experience of, and which seems especially well thought out, is the SmartASS from Smart Avionics, designed by Mark Burton, a long time Europa pilot. Although it is essentially a talking ASI it also compensates for g force so acts effectively as an AOA system.

The SmartASS has two modes, the speed director mode and the talking ASI mode. In the speed director mode you press a button when you have settled on your approach (or climb) speed and then a nice female voice (I call her Barbara to my wife's annoyance) says, "Speed good," at intervals as long as you remain within 5% of that speed (+/- three to four knots for most of us); "Speed slow," (or fast) in a slightly louder voice at shorter intervals if you stray between 5 and 10% off the target speed; "Speed very slow," in a more urgent fashion if you stray to between 10 and 15% off target; and finally the same message preceded by a chime if you have been remiss enough to ignore things beyond that point.

In practice, it is very difficult to ignore her, especially when she loses her initial calm approach. When out of the circuit and speed rises above 125% of target speed, pressing the button engages sleep mode and she says, "Goodbye," and keeps quiet (and doesn't snore!) until you return to circuit speeds, when she wakes up automatically.

In talking speedometer mode she just gives you your speed at intervals. At cruising speeds touching the button will put her into sleep mode.

What makes this such a clever bit of kit is that it includes solid state accelerometers and makes allowance for any g you are pulling, working out how much the stall speed will increase and adding that to the target speed – so you may be doing precisely your pre-set approach speed but if you are doing a 45° turn, you are pulling 1.414g so your stall speed will have increased by 19% and Barbara will be telling you very forcefully that your speed is very slow. When you next go flying she uses the same target approach speed unless you pick another (simply done by flying at that speed and pressing the button). There are other nice features to the system such as a wire you can connect to an undercarriage microswitch, which will enable her to tell you that you have forgotten to put the gear down when you hit approach speed.

The system consists of a box measuring 12 x 10 x 3.5cm that can be mounted out of sight in any orientation. It has wires to connect to earth and power, with a single wire to go into the intercom and another for the optional undercarriage switch. There is a very small panel to mount on any conveniently accessible surface, with a button and an on/off/volume control. The whole thing weighs just 310gr. It also, of course, needs connecting to the pitot/static system, but it's all comfortably within the scope of anyone who ever owned a Meccano set. It costs a bit over £200, and when I compare that to the cost of a ballistic parachute, a dinghy, a PLB or various bits of avionics kit, I reckon that it comes out well ahead in terms of potential lives saved per pound.

I am passionate about flying and I absolutely do not want to discourage anyone from enjoying this marvellous pastime, but I hope I have persuaded you that none of us is invulnerable and that stall/spin accidents are a significant threat to all, but that you can do something about it. Practise your stalls and the like, really get your ideas on EFATOs sorted out and make that modest investment in time, effort and cash so that you have Barbara or one of her friends looking out for you should things go wrong. ■