# SAFE SIDE-SLIPPING

We all know about side-slipping... or do we? LAA's ***Jon Cooke*** talks us through this potentially life-saving technique

THERE are some techniques that are taught well at PPL level, and some that are sadly omitted. In my experience, when teaching pilots to convert onto an aircraft that requires the use of side-slipping, it is something that has either been taught badly or completely omitted from private pilot training. However, it's still in the JAR-FCL syllabus, in Exercise 8 Descending, and all pilots should learn how to do it. Before I tell you why it is such an important lesson, I will take some time to describe what it is.

**SO WHAT IS SIDE-SLIPPING?**

An aircraft which is side-slipping is, in fact, flying slightly sideways. A side-slip is defined as "a combination of forward movement and sideward (with respect to the longitudinal axis of the aircraft) movement." Simply, the nose is not pointing towards the relative airflow [see fig 1].

Unintended side-slip occurs when the aircraft is placed into a turn with insufficient rudder applied; this results in the aircraft being out of balance, and the relative airflow and direction of movement through the air being offset from the longitudinal axis of the aircraft. Indication of this condition in the cockpit is the slip indicator (which in most modern aircraft is 'the ball') being off-centre. A common error seen in the flying of low-hour PPLs after take-off is that often insufficient rudder is applied to balance the effect of slipstream, so the pilot then incorrectly applies bank in order to maintain direction. A check of the slip indication, 'the ball', shows that the aircraft is side-slipping while they are maintaining a constant direction.

Intentional side-slip is the deliberate offsetting of the direction of movement from the longitudinal axis of the aircraft. This may be, for example, to generate more drag or improve forward vision.

Consult the Pilot Operating Handbook for your aircraft type as some types recommend avoiding side-slips in certain configurations; an example which springs to mind is the Cessna series. The Pilot Operating Handbook contains a recommendation to avoid slips with greater than 30° flap due to disturbed downwash over the tail resulting in a strong pitching moment. William D Thompson, an engineering test pilot and later manager of flight test and aerodynamics at the Cessna Aircraft Co, describes the reasons in detail in his book *Cessna, Wings for the World*.

**WHY WOULD YOU WANT TO SIDE-SLIP?**

Depending on the aircraft type you fly, there may be good reasons why side-slip is a useful tool. You may find when converting onto a particular type that it becomes a necessary technique to master – if you are already competent and confident when side-slipping, it will be one less thing to learn.

Quite a few LAA types are not fitted with flaps or spoilers so their pilots will be very familiar with side-slip techniques. This is usually mastered during type conversion as it becomes a necessary skill to make corrections to the approach to land. In this case, the sideslip is used to both reduce lift and generate more drag. Side-slip reduces lift produced by the wing due to flow obstruction by the fuselage; airflow near the root on the forward wing and airflow near the root of the rearward wing are both affected, thus reducing the lift being generated. Additionally, form drag is created by presenting a greater surface area to the airflow. This requires the pilot to pitch down in order to maintain airspeed, resulting in a greater rate of descent.

You may have seen aircraft such as Pitts, Christen Eagles and Tiger Moths side-slip on the approach. This is less likely to be about generating drag and more to do with being able

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to see! If you haven't yet flown an aircraft with poor forward visibility, side-slip is a great way to displace the longitudinal axis [and therefore the nose of the aircraft] from the ground track during the approach, thereby enabling you to see obstacles on the centreline of the approach and the runway itself. This is called the forward slip: this maintains constant track, whereas the side-slip maintains constant heading; while they are different in name and aim, they are essentially both flown using the same technique.

During an emergency such as an engine or wing fire, it may be appropriate to use side-slip to displace any fire and fumes away from the cockpit and fuel tanks. Indeed, many Pilot Operating Handbooks, including the Cessna series, recommend this technique to prevent fire and fumes from engulfing the cockpit.

The side-slip can also be used during a forced landing. Since side-slip allows a variable amount of drag by adjusting the depth of side-slip, the pilot can allow for wind gradient as the aircraft descends. This has the added advantage that during a forced landing pilots can maintain their aiming point and constant sight line angle through use of varying depth of sideslip, ensuring the aircraft lands on the intended touchdown point.

**HOW DO I FLY A SIDESLIP?**

Aircraft are designed to be directionally stable, such that inadvertent side-slip is corrected aerodynamically; this is covered in one of the very first exercises in the PPL syllabus, Effects of Controls, Part One. If the relative airflow is from the side, it strikes a greater area of the fuselage behind the centre of gravity, thereby causing yaw in the direction of the side-slip, bringing the longitudinal axis in line with the relative airflow, much like a wind vane. So, in order to maintain a deliberate slip with the lateral axis inclined, it is necessary to apply rudder in the opposite sense to the bank applied.

To enter a side-slip, the pilot applies aileron to attain a steady bank-angle in the direction of the slip. Opposite rudder is applied simultaneously to displace the longitudinal axis of the aircraft, thereby maintaining a constant direction of movement through the air. The amount which the aircraft is yawed will depend upon the bank angle applied. Drag that is generated will be increased if the pilot increases bank angle, up to the point where full rudder is applied. In most light aircraft, full rudder will be reached before full aileron application, thus providing a limit to the depth of side-slip, at a given airspeed.

Assuming the aircraft has been placed into a gentle descent with constant thrust, as the side-slip is entered, the pilot will need to adjust pitch in order to maintain airspeed, since drag has been increased. Blanking of the tailplane/elevator by the rudder/fin causes a reduced down force produced by the tail surfaces, resulting in a required elevator input to control pitch which, depending on type and configuration, may be either nose up or nose down. The elevator trim is not normally adjusted, since it is in the correct position for when the aircraft is returned to balanced flight. Care must be taken to control the airspeed accurately; consideration must also be given to adjust the target airspeed due to an increase in position error in the airspeed indicator at the pitot and/or static sources.

Maintain the side-slip with sufficient aileron input to maintain a steady bank angle while applying rudder to maintain constant direction. If it's your first go, you will feel you are being forced sideways in the direction of bank applied. I usually teach side-slip to the right [right bank angle] first, since the student has the opportunity to get used to the feel of a side-slip [with them sliding sideways into the cockpit] before they try a side-slip to the left where it feels like they are being forced out of the door!

To exit the side-slip, the pilot must smoothly level the wings while regaining balanced flight. The emphasis here is on smoothness, while also adjusting pitch to maintain airspeed.

Gaining experience at altitude will provide you with the confidence to use this technique during the approach. A few words of caution first though. A number of years ago, a fatal accident at Husband's Bosworth involved a de Havilland Chipmunk, which was glider tugging. The pilot had released the glider and was descending into the airfield. To lose height the aircraft was placed into a deep side-slip. Unfortunately, the pilot recovered from the side-slip too low, and essentially side-slipped the aircraft into the ground; the pilot received fatal injuries. So do ensure that you recover from a side-slip with adequate height.

Set yourself a sensible height limit on the approach to side-slip down to, and adhere to it. If you don't achieve a normal approach profile with nil slip by 200ft, GO AROUND.

If you who don't think you have ever flown a side-slip, here's a thought. If you have been using the correct technique for crosswind take-offs, you will have already been practising it. Also, those who use the wing-down technique for crosswind approaches and landings will also have been practising side-slips. Using both of these techniques, the aircraft is essentially set up to side-slip into the wind an equal amount that the wind is drifting the aircraft, thereby resulting in the ground track of the aircraft maintaining the centreline [see fig 2].

If you're interested in further reading, I recommend A C Kermode's *Mechanics of Flight* for the more technically minded, and by the same author *Flight Without Formulae* for those who prefer text without the number crunching.

As always, I encourage you to contact your nearest Pilot Coaching Scheme coach to arrange proper instruction. Side-slipping is an invaluable technique for pilots to have up their sleeve for the moment when it is needed. Not only will you gain confidence in handling the aircraft, but in the event of an engine failure, you will be better equipped to safely and consistently land your aircraft at your chosen point in the field. Safe slipping!

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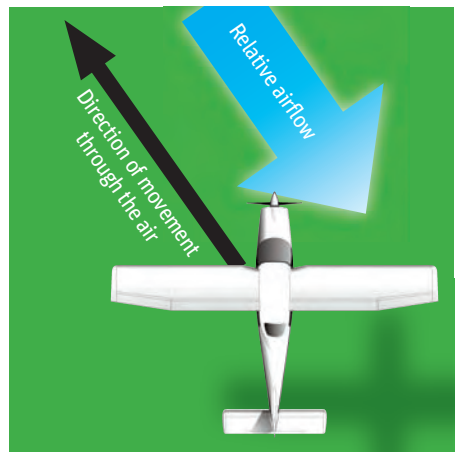
## FIG 1 SIDESLIP

**Explained simply, sideslip is forward travel where the nose is not pointing towards the relative airflow.**




## FIG 2 SIDESLIP ON APROACH

**Crosswind take-offs and the wing-down technique for crosswind approaches set the aircraft up to side-slip.**