



Spinning Out

IN some aviation circles, the mention of spinning may bring on a cold sweat, dry mouth and trembling hands. Thoughts (or memories?) of an aircraft tumbling out of control towards the ground are conjured up. Hollywood has done a great job of perpetuating this image, complete with the increasingly loud whine of a piston engine howling towards self-destruction - despite the said aircraft often being a jet.

In the circles of highly practiced, steely-eyed competition aerobatic pilots (!), the spin is yet another symbol on the sequence card in which to demonstrate mastery of that untamed beast - the heavier-than-air flying machine. It is in fact a very predictable manoeuvre and one that can often score highly - as well as providing judges with a few conundrums on their interpretation of the judging criteria.

Predictable Spins

But to set the record straight on the above 'predictable' statement - not all aircraft are created equal when it comes to spinning. Certification rules require a Normal Category single-engine aircraft to be able to be recovered from a one-turn spin in one additional turn following initiation of the first control action for recovery, unless they can be proven to be 'spin-resistant'. Another sub-category for those that can do neither requires further mitigation... a parachute!

However just because the Normal Category aircraft has been tested to this standard doesn't mean it can now be intentionally spun - far from it! Unless it has been specifically approved for intentional spinning, in the flight manual, DON'T. And most certainly don't try it

unless you are competent and trained, or receiving training from somebody who is competent and trained. People still die entering spins (normally unintentionally, but sometimes intentionally) in aircraft.

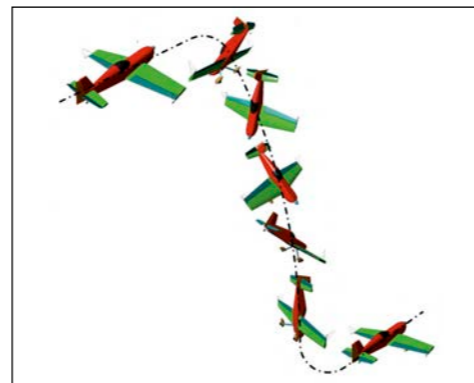
The rules for Aerobatic Category aircraft basically require a bigger rudder - after a six-turn spin the aircraft must be recovered after one-and-a-half turns. A six-turn spin (assuming the aircraft can be held in the spin that long (many can't) generates significant spin inertia and possibly airflow issues, hence the large and powerful rudder. For both categories, there are rules about differing configurations, weights, physiological effects on the pilot, etc.

And it must be remembered that type-certified aircraft in both categories go through an extensive flight-testing regime to prove their abilities in spin recovery. The same cannot be said for experimental or special category aircraft, or for that matter any aircraft that has undergone extensive repairs or modifications - will they still spin 'to spec'? Add into the mix differing weights and the location of the centre-of-gravity for a given aircraft, each time you fly, and you can imagine that the word 'predictable' can become somewhat stretched. The aircraft flight manual is the best source document to discover the spin capabilities of an aircraft, including the recommended spin recovery action. This can subtly vary across aircraft types, and will have been learnt the hard way by a factory test pilot.

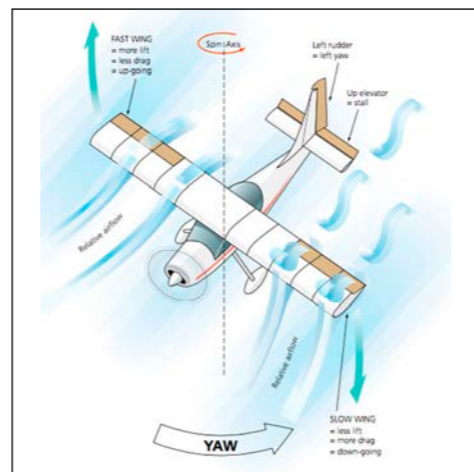
In display or competition flying, the predictability of the spin entry and exit is a 'must'. It must look good to impress the ice-cream lickers and/or judges. Predictability comes from understanding



Doug Brooker performing inverted flat spins for fun at the recent Tauranga Airshow.



Standard spin entry and exit.



What happens with airflow, lift and drag.

the basics, practice, knowing your plane, practice, and more practice!

The Basics

From an aerodynamic point-of-view, an established and stable spin is a thing of beauty (IMHO!). All the various aerodynamic forces are balanced and the aircraft seemingly spirals downward, like a sycamore seed pod.

Getting the aircraft into such a state, and keeping it there, is a combination of design elements of the aircraft (out of your control) and placement of control (most definitely in your control). Removing the aircraft from the spin is the correctly ordered input of control deflections.

When considering a basic, garden, upright spin, the entry is commenced well before pulling back the throttle - are you high enough? If not, keep the throttle all the way in and keep climbing. Height is your friend, as even just a one-turn spin can lose you 1000 feet or more. Now with sufficient height, the entry can be made by closing the throttle and maintaining straight and level flight as the aircraft decelerates towards its 1g stall speed. Remember how drag increases significantly as you approach the stall? The last few seconds will require significant elevator deflection to maintain level flight. Now comes the difference between a normal stall recovery and the spin entry... rudder. By quickly but smoothly applying full rudder at the point of stall entry, a large yaw is induced which simultaneously slows one wing and speeds up the other. The localised airspeed and angle of attack of each section of each wing changes dramatically - one wing has now suffered a significant decrease in lift whilst the other one has had a sudden increase.

A 'roll couple' is produced and the aircraft rolls in the direction of the rudder input. By continuing to hold back on the stick, the speed is kept low and the angle of attack is kept high, sufficient for one and normally both wings to be kept beyond their critical/stall angle. In this high-drag situation, the airspeed does not increase and thus the relative angle-of-attack of each wing stays the same. The rudder is held in the full direction of the spin in order to counteract the natural force of the longitudinal stability of the aircraft to return the aircraft to straight flight. The higher drag of the slower wing (with the higher angle-of-attack) also produces a drag couple, which assists the rudder input in maintaining the yaw. All the forces will now be in balance and an 'auto-rotation' is underway - the aircraft will be 'spinning' downward at low speed.

Generally, recovery is made using the controls in the opposite and reverse order to the entry - unwinding what you have done. Full opposite rudder is applied to stop the yaw, and forward elevator is then applied to reduce the angle of attack and get the wings 'flying' again. Of-course, we don't want to keep descending, so power can now be added to regain straight-and-level flight at a reasonable airspeed.

That's the basic theory - there is much, much more than that if you are really interested. A few years ago an American chap by the name of Rich Stowell was bought to NZ, courtesy of Air NZ and in conjunction with the RNZAC and the NZ Aerobatic Club, to discuss spinning. At that point he had done 30,000 spins in over 100 different types, over a vertical distance of 1500nm! His talks were very illuminating, and if you got the chance to fly with him both his knowledge and manner were superb. He has produced a series of books and on-line tutorials on the subject of spinning, and if you want to explore the subject more his website is definitely worth a look - www.richstowell.com



Aviation Performance Parts Ltd

- Comprehensive stocks of Aircraft AN, MS, NAS Hardware
- US Industrial Tooling • Skytec Starters
- Aircraft Spruce (NZ) distributor (weekly delivery from USA)

Contact: Lianne Bergin Phone: 09 476 0984 Fax: 09 476 0985
Email: sales@apparts.co.nz www.aviationandperformance.co.nz

For all Sports, Recreational and Aircraft Engineering

Solo Wings

Our TEAM is committed to provide Top Service with a Smile - every time



2 de Havilland Way, Tauranga Airport: Phone (07) 574 7973

ROTAX

Aircraft Repairs
Aircraft Restoration
Paint & Fabric Work
Dynamic Propeller
Balancing
NZ's only authorized
Rotax Sales & Service
Centre
Sales & Spares
Airworthiness Reviews
Aircraft Annuals
Managed Maintenance
Plans

www.SoloWings.co.nz



SPRATT

FINANCIAL SERVICES

Are your family and assets protected?

We are PILOT LIFE INSURANCE SPECIALISTS and can guide you through the process of PROTECTING YOUR FAMILY AND BUSINESS as well as INSURING YOUR DEBTS

Contact Craig Spratt
 Spratt Financial Services Limited
 Phone: 021 935 788 or 09 306 7250
 Email: craig@spratt.co.nz
www.spratt.co.nz

Independent brokers protecting pilots since 1992



avplan efb

PLAN SMARTER, FLY SOONER

- Complete flight planning and navigation EFB
- One month free trial
- For all pilots, at all levels
- Innovative
- Customer focused

[WWW.AVPLAN-EFB.COM](http://www.avplan-efb.com) • PHONE: 09 801 1084
 Established 2011

