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1 INTRODUCTION

a) While many pilots may have no intention of spinning their aeroplanes, or getting into an extreme attitude, there are several who need, or wish, to, and for them this should be required reading. For the rest of us, the most important part is the first sentence in the paragraph on “spin recovery action”.

b) Each year there are a number of occurrences which involve spinning in some form; there are probably still more incidents where pilots give themselves a good fright and put it down to experience, being too embarrassed to tell anyone about it. This is an attempt to give guidance to those involved in spin training or those who wish to explore the envelope of their aeroplane.

c) What is spinning? The spin is a stalled condition of flight with the aeroplane rolling, pitching and yawing all at the same time. There are aerodynamic forces and gyroscopic forces (caused by the rotating mass of the aeroplane) which may be either pro-spin or anti-spin. In a stable spin the aerodynamic and gyroscopic forces balance out leaving the aeroplane rolling pitching and yawing at a constant rate.

d) So what? A control input may have aerodynamic and/or gyroscopic effects and consequently it can be difficult to predict the effect that any pilot input may have on a spin. If you are going to spin (or fly aerobatics) it is important to minimise the unpredictable elements.

Firstly, have you read the manufacturer's recommendations in the Flight Manual? Is the aeroplane fully serviceable? Would you spin or fly aerobatics in an aeroplane that exhibits odd stalling characteristics? (Some have and regretted it!) Is the type cleared for spinning and are there any mass and balance considerations?



e) Have you got the right tool for the job? The Cessna 150/152 Aerobat is widely available but its spin characteristics are unusual. For example it is reluctant to spin, usually needs a small amount of power to sustain it, and will recover often before full spin recovery action is taken. This may be satisfactory as an introduction, but does it really prepare a pilot to spin other light aeroplanes?

2 **AGGRAVATED SPINS**

a) Using anything other than FULL pro-spin controls during the spin may well aggravate the spin:

- In many aeroplanes relaxing the rudder or elevator a little (or not continuing forward movement of the control column sufficiently during recovery) will induce a high-rotational spin.

- Using power can have several effects; firstly the propeller is a gyroscope and at high rpm it produces precessional forces, which may upset the gyroscopic balance of the spin, often flattening the spin attitude; the propeller slipstream will change the effect of the rudder and elevator. (For these reasons the first recovery action is usually to close the throttle.)
- Using aileron may promote recovery or it may increase the rate of yaw.

Any of these unusual inputs may cause flat, high rotational, or oscillatory spins (or some combination of these). It is important to realise that recovery from such spins may be considerably prolonged and lead to greater height loss.

3 **SPIN SAFETY**



Spin training requires a good horizon and visibility

a) **Weather**

Spin training requires better weather than for other general handling work. You should have a good horizon and visibility and good clearance from cloud both horizontally and vertically. You should not be over complete cloud cover or a smooth featureless surface to minimise the possibility of disorientation.

b) Handover/takeover of control

When two pilots are in the cockpit the captain must brief how control will be taken over if the flying pilot has a problem or intercom is lost. For flying instructors on early aerobatic or spinning exercises the chance of a student freezing on the controls is quite high. One way for an instructor to get access to the controls in a side by side set-up is to move his left arm smartly across the chest of the student; this is usually enough to attract the attention of the student and encourage him to release the controls.

c) Calculation of minimum spin entry altitude

Starting the spin from a safe height is imperative. Calculate the absolute minimum safe entry altitude from the ground up in the following steps, then add an extra safety margin if at all possible:

- 1) Minimum altitude to complete the manoeuvre.** Logically if you use 3000 ft above ground level (agl) for stall recovery you should use not less than this for completing your spin, i.e. ground + 3000 ft.
- 2) Minimum altitude to commence recovery.** Add the height required to take recovery action and pull out of the dive. For an erect spin this could be of the order of 1000 ft to 1500 ft (but depends on type and could be more), i.e. ground + 3000 +1500 ft.

- 3) Minimum entry altitude.** Add on height for each intended turn (typically about 200 ft per turn for a light piston aeroplane), i.e. ground + 3000 + 1500 + 800 ft (for four turns).

If you intend to do aggravated spins of any kind make extra allowance. For example a high-rotational spin could take an extra 4-6 turns in the recovery. (On early spin exercises wise instructors assume that the student *will* aggravate the spin!)

If you carry a parachute as a safety back-up, decide on a minimum abandonment height which allows time to get out and height for the parachute to deploy fully. Below this height you cannot abandon so the aeroplane must have recovered by this height. You must be familiar with the abandonment drill for your aeroplane and how to use the parachute. It is a good idea to simulate these drills in a practice session on the ground. If you have to use the parachute, quick and efficient abandonment with sufficient height is essential.

Military schools have gradually increased their minima over the years such that they use figures considerably higher than those suggested here for their light piston aeroplanes. Even these may seem very high, but there have been training accidents where pilots have chosen spin entry heights that guaranteed that they would hit the ground before completing the recovery!

4 **SPIN RECOVERY ACTION**

a) By far the best action is to initiate recovery *before* a spin develops; that is **centralise the controls as soon as control is lost**. However, if we are deliberately spinning or carrying out extreme manoeuvres we must be prepared for the case where we are too late for this to be effective, i.e. a fully developed spin.

b) The spin recovery action may vary according to type; **it is important to read the Flight Manual and follow the recommended technique**. Typically for an erect spin:

- **Throttle:** Closed.
- **Aileron:** Neutral.
- **Rudder:** Check the direction of yaw and use FULL anti-yaw rudder. A pause is often recommended between moving the rudder and elevator, and this is important to ensure rudder effectiveness.
- **Elevator:** Move the control column centrally forward. As the aeroplane starts to recover the attitude will steepen and the rate of rotation will increase; keep moving the column towards full deflection until the spin stops.
- **Centralise:** Centralise all controls as soon as the spin stops or the aeroplane will flick in the opposite direction!
- **Climb:** Roll towards the nearest horizon and pitch into a climb attitude applying power carefully.

c) Be confident that the correct recovery action will stop the spin. Do not go back to pro-spin control and start again because you will certainly delay recovery. (In the very unlikely event that normal recovery action fails, in-spin aileron may well help but this is a last resort action.)

d) In determining the direction of yaw for an inadvertent spin the *turn needle* is always the best indication (not the slip ball). Beware if you only have a turn co-ordinator; it measures yaw *and* roll. In an inverted spin yaw and roll are in opposite directions so a turn co-ordinator is of no help to you here!

e) Before you fly aerobatics and especially if you teach, it is essential to have a thorough understanding of how to recover from mishandled manoeuvres, and especially spinning. Competence in spinning will lend confidence and enjoyment to your flying, but do it safely.