THE SPIN — MYTH AND REALITY

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(Translated from German by Annette Carson)
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This subject could really fill a library. In contrast to all the more or less scientifically written texts, I want to try to assemble here one or two simple but important facts, with the object in mind of giving the aerobatic pilot — or indeed any pilot who finds himself getting desperate in an unintentional spin — an easy method of getting out. I know my theories are correct because, in addition to studying every existing text on the subject, I have practiced spins intensively myself, taking in the widest possible variety of aeroplanes that come into the class of "conventional" design (i.e., excluding canards, T-tails, etc.). If you were to put all these spins end-to-end, they would cover roughly the distance from London to Rome . . . in other words, that means twelve hours of spinning. But, more importantly, that means I have successfully stopped the spin 4000 times, exactly as required and without its getting out of hand.

Now, to begin. But without some basic theory we will not get very far:

The Angle of Attack

To keep an airplane in the air you need lift. In horizontal flight the lift must be the same as the weight, and the formula is:

$$L = C_L \frac{P}{2} Sv^2$$

This means that the lift (L) is dependent upon air density (P), wing surface (S), and speed squared (v^2), and all this is multiplied by the lift coefficient (C_L) which is the really important thing for the subject in hand. The lift coefficient increases to a certain extent with the increasing angle of attack of the wing (Fig. 1).

At a certain angle of attack the lift coefficient no longer increases and the critical angle is reached. Beyond the critical angle of attack the lift coefficient decreases — an "overcritical" angle of attack — and that is the vital point for the spin. We see in Fig. 1 that the lift decreases with the increasing angle of attack. If we now look at Fig. 2, the front view of an airplane which is turning around its longitudinal axis, we see that the downgoing wing has a greater angle of attack than the upgoing wing. If the wings have an overcritical angle of attack, the downgoing wing will have less lift and the upgoing wing will have more lift. These differences in lift create a self-perpetuating rotation which is called autorotation. Now we must briefly discuss drag. From our swotting for the PPL we will recall vague memories of the graph for the airplane (Fig. 3) in which it is evident that after reaching the critical angle of attack the lift coefficient decreases but the drag coefficient cheerfully goes on increasing. This means that with an overcritical angle of attack the downgoing wing has more drag, and for this reason is pushed backwards. Obviously, the reverse applies to the upgoing wing — less drag and more lift. So it is typical that we also have a twisting movement around the vertical axis of the airplane which, added to the twisting movement around the longitudinal axis, gives the typical movement of the airplane in the spin. Now we know why our airplane is merrily twisting and rotating, but what we want to know is how to decrease this twisting and then stop it altogether and resume normal flight. For that we need power, and as long as we are in the air we can produce it aerodynamically — but since we have a low speed it will be only a gentle power. If we return to the ground we will have power at our disposal to stop the spin which is very effective, but also very unhealthy. So we must stop the autorotation in the air, and do so as quickly as possible.

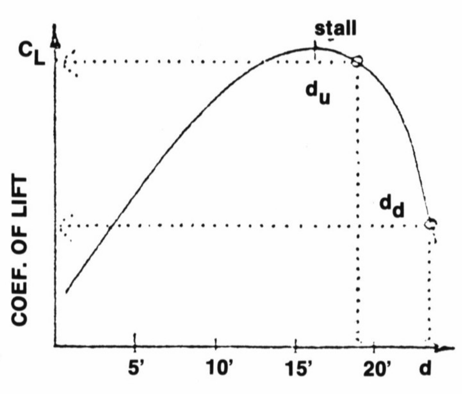

FIG. 1

Stopping The Autorotation

In the air we have at our disposal three controls and a motor. The motor will not help us in getting out of a spin because, by reason of precession, it produces an increased angle of attack when the spin is against the engine, and an increased rate of rotation when the spin is with the engine. So we must close the throttle. If we then release all three controls, they go of their own accord into a certain position. If we put them into another position, we will produce an aerodynamic force. Whether this force will be for or against the autorotation we must find out, and these are the observations I have made for you during my hours of spin tests. I have seen that the stick goes back, and the ailerons and rudder go in-spin. First I try to move just the ailerons against the spin rotation, and — how alarming! — the aircraft spins faster. That cannot be a good move, especially if I want to live to enjoy my pension. So I leave the ailerons where they want to go (in-spin) and try the elevator. I push it slowly forward as far as it will go, and I notice that the rate of rotation increases. Wrong again: so we must leave the stick where it was, almost fully back, and turn our attention to the rudder. I try kicking the rudder hard to the opposite side (anti-spin), and that needs strength, especially when you kick full rudder (and you **must** kick full rudder) but — how interesting — the rotation starts to decrease. The rate of decrease may appear at first to be slow, but the spin will stop. At the moment when the rotation stops, I observe my stick, and, as if by magic (but of course it isn't magic) it moves to neutral. The aircraft is now in a nearly vertical dive, so I centralize rudder at once and resume my hold on the stick, pulling gently back. If I pull too much I will again go into an overcritical angle of attack: if I do not pull enough I will exceed the Vne (maximum permitted speed). So my conclusion is that the easiest method of getting out of a spin is to close the throttle, take my hands off the stick, and kick full opposite rudder.

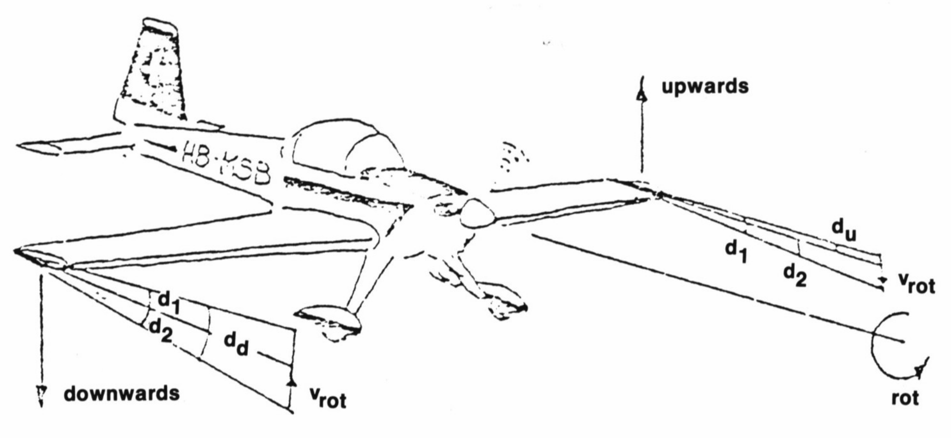

FIG. 2

But why, you will ask, has the spin always been such an awesome thing? Why has it cost so many human lives and given rise to so many written texts and articles, and now somebody comes along and says it's all really quite easy? I think I have an explanation: fear. Fear alters your state of consciousness, it interferes with perception, it upsets all sense of time and faculty of recall. So let us try to find the source of this fear. When you are told in the club bar, and you read also in the specialist literature on the subject, that in a spin you never know exactly what is happening, this is not likely to make you feel either very happy or very confident about spinning: and the spin smacks of Russian roulette. Then you encounter a real spin, and invisible forces come along to take hold of your airplane and rotate it like a toy, that same airplane which immediately before was flying so nicely, just as you learned in school. The effect is very discomforting and the result is fear. Even the oldest experienced pilot will react, in his first 100 or so hours of spinning practice, just like a fish when it finds itself thrown up on shore. That produces fear. The best-learned flying instincts, when wrong theories are applied, will be worthless — and all the time you are being tossed about like a mouse in a washing machine. Every pilot in-the-street knows that each change in controls will result in a change of attitude, but in the spin that just isn't so. I can push the stick forward with all my strength, and give ailerons to try to stop this nasty twisting, but nothing happens. The washing machine continues to turn. That can really produce fear. And the earth is coming nearer and nearer. And fear in an airplane is not a good counselor, but it is a very good myth-maker.

There are of course explanations why the spin can be so easily stopped with my method — close the throttle, release the stick, kick full opposite rudder until the rotation stops, then pull gently and centralize rudder — but such detailed explanations would be too long and complicated for this article and are best set out in a book about aerobatics (this I am presently preparing and will publish in 1982). Many pilots will ask why a different method appears in their aircraft manual. The methods given in the various manuals are not necessarily wrong if you use them exactly as prescribed, but they do often give rise to misunderstanding or mishandling, and they ask too much of a pilot unused to spinning: the accident statistics give proof of this. So my method is just simpler and easier. And it has one more advantage: it is absolutely the same whether you are in a negative spin or a positive spin or a flat spin. By the way, there is basically no difference between a normal spin and a flat spin, and essentially no difference in the method of getting out. The ailerons and elevator know best for themselves, and the rudder must be kicked on the side that gives the most resistance — but please, **full** rudder.

Now for a few additional recommendations. Only spin with an airplane that is certificated for spinning. With this aircraft, start by going high enough (minimum 5000 ft. above ground) until such time as you are really certain that you have full control of your actions: the first spins you practice will, in any case, be with an instructor accustomed to spinning, because he will not be liable to panic.

And now I wish you much fun with your spinning.

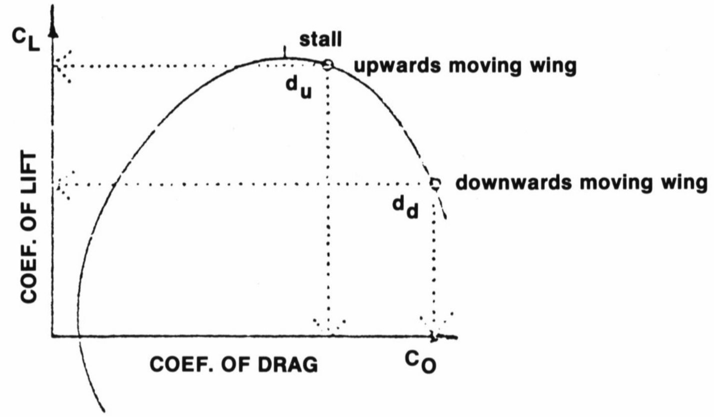

FIG 3