



Practice makes a Perfect Display

You've planned that ideal aerobatic display sequence, now it's time to practise it... over and again

By Bob Grimstead

My last piece, 'Showtime!' (*Pilot*, February) was about designing an aerobatic display to be a personal expression of flying artistry, a pleasure to watch and rewarding to

fly. The next stage is to put all this theory into practice.

I start by climbing my aeroplane to a great height (3,000 feet or more) and fly part of my new routine – say, the first half, or the first



couple of passes – to see how it goes, and to find any awkward parts. Next, I do the same with the remainder of the sequence, bit by bit, until I am happy it is all practicable. Then I try stringing the whole thing together. After flying the sequence a dozen or more times above 3,000 feet to establish which will be the tricky figures and combinations, I re-write it until it becomes easier and stays more or less in place over the ground.

Do not expect your own first ideas to be perfect. I often have to modify, or even re-write a planned sequence several times before it becomes feasible, let alone entertaining or visually interesting. Later, after I have a workable routine, I will undoubtedly make repeated changes and minor adjustments to make it more practical, safer or simpler - or suited to different venues with longer or shorter crowds or angled display lines. Over my five years of low-level aerobatic display flying, this has been a continuous process of evolution.

Next, when I am satisfied the whole thing is workable, I can string it all together and practice it fifty times, experimenting with maximum and minimum airspeeds for the various figures and combinations. This is important. Flying high-energy, high-speed aerobatics is super-safe, but squanders your height. Conversely, flying all the figures at their minimum speeds minimises height loss -

but courts disaster. You do need to be aware of the safe speed band for every manoeuvre. Because I fly two otherwise identical aeroplanes with ASIs in knots and mph, and because, in the hurly-burly of a display it can be difficult to recall numbers instantly, I've marked a safe speed bracket for all normal manoeuvres on both instruments.

Flying my finalised sequence forty or fifty times also helps to fix it in my mind. If it does not happen naturally during rehearsal, then I deliberately botch or miss out a figure here and there, to establish a safe alternative sequence afterwards. I also intentionally snap the throttle shut at various awkward points through the routine to practise my pre-planned recovery from engine failure.

It's tempting to skip this step, and it takes guts, but you should already be well-endowed with courage if you're going to be a low-level display pilot. In 2009, two Samson Pitts pilots crashed while relying on their engines to pull them out of the low-level 'cobra' manoeuvre. In one instance the big radial merely coughed, in the other it shed its propeller. One pilot was badly injured, but the other - Australia's foremost contest and display pilot - died. Practising for power failure is important.

Luckily, in a long-winged, low-drag Fournier like mine, providing I am flying over a runway, I can be fairly sure of gliding in to a safe landing, although completing some

manoeuvres without power can be exciting as the airspeed falls. Closing a Fournier's throttle while passing through the vertical pulling up into a loop or stall turn can be most instructive!

It is not easy to confirm one's positioning up at 3,000 feet, so I gradually come lower to see how things go. At first I bring it down 500 feet at a time then, approaching my legal minimum, I reduce the height by 100 feet at a time, carefully noting safe gates for each figure.

By now I should be able to fly this sequence in my sleep, in any possible combination of wind directions, with pre-planned recoveries for any cock-ups or unexpected problems, and the 'safety energy' (height and speed) gates absolutely fixed in the forefront of my mind. This should give me spare mental capacity to deal with the unexpected 'on the day'. And don't kid yourself; the unexpected and unplanned always happen.

Inviting a critic

Now it's time to persuade an aerobatic expert to watch you. You might think you know what your sequence looks like, or how safe it is, but only a knowledgeable aerobatic performer, critically regarding your flying from the crowd's point of view, can truly determine what your sequence looks like, how



"I start by climbing my aeroplane to a great height... I also intentionally snap the throttle shut at various awkward points through the routine to practise my pre-planned recovery from engine failure"

accurately you are flying the figures, and how safe you are. This is another vital step which takes courage, and also one you might prefer to skip, but all professional display pilots and aerobatic competitors invite such critiquing. Believe me, it not only improves your flying and the look of your presentation, but it might well keep you alive. Several such sessions with different critics will help even more.

It is tempting to practise early in the morning or late in the afternoon, when the wind drops to a zephyr and the temperature is low, giving both your engine and your wings their best performance, and this is certainly the easiest way to start. However, I believe it is much more important to practise in the worst possible circumstances, so that you are used to them, and do not find yourself suddenly confronted with difficult conditions for the first time during a display, when your mind is already preoccupied.

High temperatures rob your engine of power and your wings of lift. Strong and gusty winds need lots of small, sharp and draggy control inputs, while a steady on, or off-crowd wind requires you to make many corrections with occasional sideslips in some manoeuvres. All this robs you of energy.

Worse from the point of view of sapping your aeroplane's get-up-and-go, is a strong along-crowd wind, which will probably force you to fly at higher than optimum speed into wind, to prevent being blown away. The

problem is that, whenever you are flying at more than your aeroplane's steady maximum speed, you must be descending and eating into your total energy margins, so you need to start higher on a breezy day.

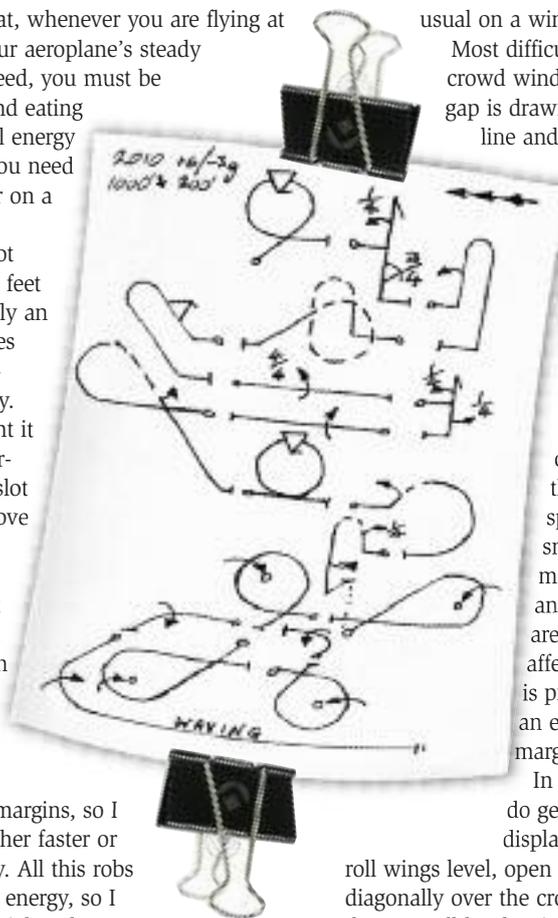
A thirty-knot wind at 1,500 feet forces me to fly an extra two miles during a four-minute display. Not only might it make me over-run my time slot if I don't remove at least one pass from my sequence, but it might bring me lower than expected. A gusting wind or thermal turbulence reduces stall margins, so I have to fly either faster or more carefully. All this robs the routine of energy, so I need to start higher than normal and perhaps fly more precisely than

usual on a windy day.

Most difficult of all is the fierce on-crowd wind. For obvious reasons, a gap is drawn between the crowd line and the display line. It is

important not to cross the display line, but the crowd line is absolutely inviolate. Not only is it vital to practise with an on-crowd wind, but I find myself most closely studying my routine, the site and other performers in those conditions. Low-speed aeroplanes get a small margin of just 100 metres between display and crowd lines, but these are the types that are most affected by the wind, so it is prudent to give yourself an extra fifty metres or so of margin in breezy conditions.

In the final analysis, if you do get blown across the display line, it is far better to roll wings level, open the throttle wide, climb diagonally over the crowd and apologise later, than to pull hard trying to avoid them – although resisting this impulse in the heat of



the moment can be very difficult. Once again, practice is the answer.

Best use of the worst of conditions

For all the foregoing reasons, whenever possible I try to fly my low-level practices just after lunch, in the worst hot, bumpy, gusty, breezy conditions. That way I am confident to fly in these circumstances when I encounter them. Doing this also gives me a good idea of how much height to add at the beginning of my routine if I happen to find the air rough at a particular display.

On the big day, if I do get blown downwind, just once, in the middle of my routine, I can keep the throttle wide, gently pitch up thirty or forty degrees and then pitch down again when the airspeed gets low. This gives a kind of humped figure that looks to the uninitiated as though it might be some sort of

aerobatic manoeuvre. It takes ten or fifteen seconds and is all flown at below 100 mph, so it actually gains a useful hundred feet of height as well as getting me a quarter of a mile back to windward.

If I become really low, I stop aerobating and fly a balanced 360-degree turn. This takes fifteen to twenty seconds, gains me nearly 200 feet and only the experts know it's not a proper manoeuvre. Believe me, I've done it and been congratulated by the organisers on my 'thrilling display'.

From time to time, on show day the visibility will be limited, robbing you of a clear horizon reference, or there will be a low cloudbase, limiting your start height. Again, it is a vital to have encountered and practised in these conditions beforehand, and I always carry a 'flat' sequence card in my overalls. This features merely a succession of loops and barrel rolls, and one full cloverleaf, with gentle wingovers and steep turns as the turn-around manoeuvres at each end of the display line. I can fly all these without losing any height, even in the most difficult conditions.

Yes, it is more boring to watch than my usual routine, but it is better for the poor, sodden crowd than just looking at my rain-soaked aeroplane parked on the flight line. And we Fournier fliers have two advantages over the bigger, heavier types. With a small looping and turning radius, our low speed enables us to stay within the crowd's visual range on a murky day, so we can perhaps fly when the unlimited competition machines, warbirds and jets cannot.

It is essential to practise these 'flat' routines, initially in fairly good weather, and then in poorer weather, so you can become used to the myriad unexpected difficulties (like water droplets streaming back over your

canopy or spraying on you through the gaps, or condensation from your exertions forming inside it) and the visual illusions of reduced visibility and cloudbase. Then you must stick to your personal limits, rather than guessing whether or not you can fly on a particular occasion. And, believe me, there is a very strong temptation to go ahead and fly your display when you've practised for months but the weather is poor and everybody else seems to be getting on with the show.

Setting your personal limits

As I approach my one-hundredth display, my personal limits are now 2km visibility and an 800-foot cloudbase, with only light drizzle at the most. Any more precipitation will

damage my wooden propeller at

airshow

rpm.

Similarly,

having a monowheel

undercarriage, I will not take off

in more than a 25-knot

wind or a 15-knot

crosswind. But I do regularly

practice in those conditions, so I will not be out of my depth when I encounter such crud.

If poor weather prevails at a venue and I have not practiced in those conditions during the past month, I will not fly. It is disappointing, but much less disappointing than frightening yourself and the crowd, or worse.

When assessing the suitability of your routine for a particular site, do try to bear in mind the sun's direction. In an ideal world, all airshows would put the crowd to the south-west of the display area, and schedule your flight for late in the afternoon, when the sun's low rays make your aeroplane and its smoke glow golden against an azure sky. In harsh reality, many sites have the poor spectators squinting into-sun, so you need to consider your positioning and the sun's azimuth to ensure they can even see you against its glare.

I believe you should practise not only in the worst wind, cloud and visibility conditions you might encounter, but also late in the day. Airshows often run behind schedule, and if you're the last act, you might find yourself flying as much as half an hour later than planned. Low sunshine can blind you at an unexpected moment, and a bright, clear upper sky contrasts greatly with gloom down where the hard ground is.

I recently witnessed a nasty moment when a very experienced and able pilot flying a top-notch aeroplane had to display later than intended. The location was over calm water ringed by tall buildings. By the time he was

called on, the sun had set over the hills beyond, although the sky was still bright and his spiralling smoke trail stood out clearly for us spectators.

His third figure was a series of downward rolls, and it was clear soon after he started that things were going wrong. Heading straight down as he was, he must have been confronted by a dark, bottomless pit, with absolutely no surface clues from the flat, black water. Being a professional, he stopped and pulled to the horizon, re-orientated himself and after a momentary pause that only the knowledgeable would have noticed, continued with a rather more subdued display than he had probably intended. This just goes to show that, however often you practise and whatever your experience, you can still be caught out, but it behoves us all to prepare as thoroughly as possible.

There is good reason to fly at least some of your practices with smoke. As with all these other scenarios, it's best to experience the possible failure modes for the first time without an audience. Will your cockpit fill with eye-watering noxious vapours during certain (or even all) manoeuvres? Will you repeatedly have to switch the smoke pump on and off to prevent this? Is there a fire risk?

I use orange marine distress smokes in wing-tip pods, and the first time I got a 'flamer' was towards the end of a display over the river right outside our front door.

Glancing to my right, I saw a foot-long blaze roaring off my wing-tip. About to execute a stall turn (always to the right in a Fournier) I was momentarily frozen. Should I splash down in the river before I fried? How would I turn around? Eventually my brain responded, I executed the gentlest-ever wing-over and stayed on station above the water for an extra minute until my smokes were expended. A little prior exposure to this phenomenon would have saved an uncomfortable fright.

But by far the best reason to practice with smoke is the thrill of flying back through your own trail. It's sad I know, but I still get the biggest buzz from blasting through my own smoke.

We fly aerobatics because we enjoy them and for the feeling of mastery over our machine, plus the freedom of using all three of the sky's dimensions. So, practising our routine should be a pleasure we are happy to repeat again and again. I have never found that practice makes perfect, but it continually helps me to improve, and I love doing it.

Once you're up to speed, you can bid for that airshow slot. Go for it, good luck, have fun, and stay safe.

For details & videos of Bob's Fournier formation duo, see www.redhawksduo.co.uk

