



SHOWTIME!

A seasoned professional - invited to display at Red Bull Air Races, no less - offers his advice

By Bob Grimstead

So, you have a shiny new CAA Display Authorisation, you own (or have access to) a suitably strong and manoeuvrable aeroplane, you have an extrovert streak and you want to fly an aerobatic display.

Aerobatics are the ultimate three-dimensional expression of flying artistry and skill, and a well-flown low-level display can be a delight to watch. Unfortunately, a poorly thought-out or ill-prepared display can be uninspiring, boring, or even frightening for the experienced observer.

A display sequence should flow – each manoeuvre blending nicely into the next. This is where the knowledgeable spectator can immediately differentiate between a true display pilot and an aerobatic competitor who is merely using airshows to get some reimbursed practice. Contest aerobatics

require a short, straight line to be drawn between each manoeuvre or figure, to show where one finishes and the next starts, with abrupt jerks into each new figure. This is ugly to watch, and I much prefer the flowing style you see in figure-skating or ballet – or from a proper display pilot.

For airshow flying you do need a smoke system. Contrary to the claims of many competitors contest judges generally have quite good eyesight. Not so the general public, many of whom could not see your aeroplane at all without its distinguishing smoke trail to lead their eyes. Competition aerobatics don't need smoke, display aerobatics do. Since I happen to fly a graceful aeroplane with very long wings, I carry smoke generators on my wingtips. If you don't have smoke, don't bother, nobody will watch you.

I'm sometimes asked whether it's legal to ask a fee for display aerobatics. Of course,

unless you have a Commercial Licence, your aeroplane has an Aerial Work Certificate of Airworthiness and you operate under an Air Operator's Certificate, you cannot earn money from this flying. However, the CAA does allow you to reclaim your expenses, and these would include not only your direct, on-the-day costs, but also an allowance for maintenance, insurance, annual certification, DA renewal costs, your smoke system and maybe even depreciation, so you don't need to end up out of pocket.

An aerobatic display routine must be comfortable to watch. Your spectators should not have to lift their heads to look up at an angle of more than 45 degrees nor to pan left and right through more than sixty degrees. So you will probably have to start the first, higher portion of your display further away than the bare minimum separation provided by the nominated display line. ➔

Bob with his underpowered, but graceful Fournier



Low enough to be seen clearly, even basic manoeuvres look good



“ Spectators should not have to lift their heads more than 45 degrees, nor pan sideways over 60 ”



Additions like music and smoke can transform a display



Coloured tape stuck to the inside of the canopy can be used to mark the inverted horizon or an accurate 45 degree line



Upside down, head on roof - and with no inverted system, the Fournier is gliding!

“As with after dinner speeches, brevity is paramount. Stop with the crowd wanting more - don't wait until they've wandered off for another ice cream”



Wingtip generators that make coloured smoke are a must

Then, as you descend, you should plan to creep each subsequent pass ever closer to the spectators. You will also have to make your later passes shorter. Generally, I try to fly two or three figures in front of the crowd when I am high, reducing to a single mid-crowd manoeuvre as I get lower. Any aerobatic sequence is made up of a number of figures. Each figure might be constructed from one or two manoeuvres (or more in intermediate or advanced sequences). A half Cuban is 5/8 of a loop joined to a half roll, or a quarter-clover is half a barrel roll and half a loop. A slightly more complex triplet might be a vertical upward roll with a stall turn or humpty-bump at the top and a flick roll or two on the way down. These figures are the building blocks of your sequence.

Repeated research has established that, however impressive you and your aeroplane may be, the audience's concentration will start to waver after four minutes. As with after-dinner speeches, brevity is paramount, so you should stop with the crowd wanting more, and not wait until they've wandered off for another ice-cream. In my little Fournier, each figure takes me from ten to fifteen seconds, so twenty of them are quite enough for a four-minute sequence.

There are several basic guidelines to aerobatic sequence design. These include generally looping into wind, so that the wind makes your loops look more rounded, and rolling downwind, so your rolls look straighter. However, in my slow-rolling Fournier, a four-point hesitation roll takes so long and uses up so much distance that I now

fly them into-wind. There always have to be compromises.

Similarly, a half-Cuban should be started into wind, while a reverse half-Cuban is begun downwind if possible. Stall turns are best flown into wind, partly so that, if you don't have an inverted fuel system, you can cheat a little and make the vertical component slightly short of perpendicular to keep your engine running. Watch other performers and you will soon discern which figures are best flown in which direction.

Some manoeuvres, like stall turns, flick rolls and barrel rolls will cause you to move a little across the A-axis while running along it. Rather than considering this a disadvantage, these figures can either be used to battle an on- or off-crowd wind, or to bring your sequence closer to the crowd as you descend.

You can make a virtue of your high start by using the extra altitude below you as a buffer for the more difficult or less predictable manoeuvres. After his first nasty accident, the great Neil Williams said, "Never fly any autorotational manoeuvre in a low wing-loading aeroplane below 1,000 feet". That is exceptionally sound advice. I firmly believe that all other extravagant figures, or manoeuvres that are in any way capricious (like stall turns against the engine) or those with which you do not have a 100 per cent record, should come early in your sequence, when you are both nice and high, and fairly distant from the crowd. That way, if you do make a mess of it, you have the height and space to recover safely and continue with a curtailed sequence without endangering you

Feature Aerobatic displays

life or anybody else's.

I also believe that an aerobatic display should not be repetitive. My basic plan is to fly just one example of every manoeuvre my little aeroplane can safely accomplish, so I start by making a list. If you have trouble with a particular manoeuvre or figure, remove it from your sequence, and then get good instruction or coaching until you can fly it properly. Do not put it back into your proposed sequence until you are sure you can fly it perfectly every time.

When composing routines, I begin with a blank sheet of paper on which I've drawn a wind direction, and twenty or so tiny Post-it strips, on each of which I've written a figure: loop, slow roll, half-Cuban etc. I string these together into possible passes, with initially two, and then later one simple, central manoeuvre between each pair of turn-arounds. Ensure the exit speed from each preceding figure or manoeuvre is appropriate to entering the next, or allow space for a dive to increase your airspeed.

I arrange (and re-arrange, and re-arrange) these Post-its on the paper, in the order I think I should fly them, until I have run out of figures or, more usually, have a few crowd-front manoeuvres left, but no more turn-arounds. That's when I have to try and ensure the repeated stall turns and wingovers are separated by as many other figures as possible, so that things don't become monotonous.

As well as performing figures sideways on, include some manoeuvres flown towards and away or even at 45 degrees. This of course means having some ninety or 45-degree turning figures in your repertoire. Quarter-clovers are good for this, and so are quarter up or down vertical rolls with perhaps

a humpty-bump (two vertical lines separated by a half loop at the top).

When I am satisfied that I have a pleasing and flyable sequence that is not too repetitive, then I draw it out in Aresti notation on a sequence card to see whether it will stay approximately centred on the card – and thus in front of the crowd. If the picture heads off downwind, I need to start all over again.

If it traverses into-wind, that's great. In four minutes a mere fifteen-knot wind will blow you a full nautical mile downwind, and in a slow aeroplane like mine, it's important to allow for this in any planned sequence, because motoring into wind between figures breaks the rhythm and wastes energy.

Finish your slot with a fifty-foot waving flypast, so the crowd can see there's actually somebody in the aeroplane, otherwise you might just be a model. It's easy, it gives you a glimpse of who's watching, and it gives the spectators an opportunity to register their thanks by waving back. The announcers like it too, because it gives them a chance to tell the audience something about you. In my case the big news is that I and my aeroplane are between us over a hundred years old!

Once you have what seems to be a feasible sequence, then walk it through a few times on the ground. This helps you get a feel for how much space it will occupy on-site, plus enabling you to see where you can lay off drift (or double or treble drift) to compensate for likely on- and off-crowd wind effects. It will also help to memorise the sequence.

My routine is optimised for an 800-metre display line, but some are shorter, while many are longer. Several regular display sites have angled or even right-angled display lines, so you might choose to modify your standard routine accordingly.



Running in low at the end and rocking the wings to say goodbye is showmanship as old as aviation - and it works



“As well as performing side to side, include some manoeuvres towards and away”



Smoke won't lie, and here it shows a perfect stall turn

Quark tickled two bourgeois sheep. The elephant gossips.



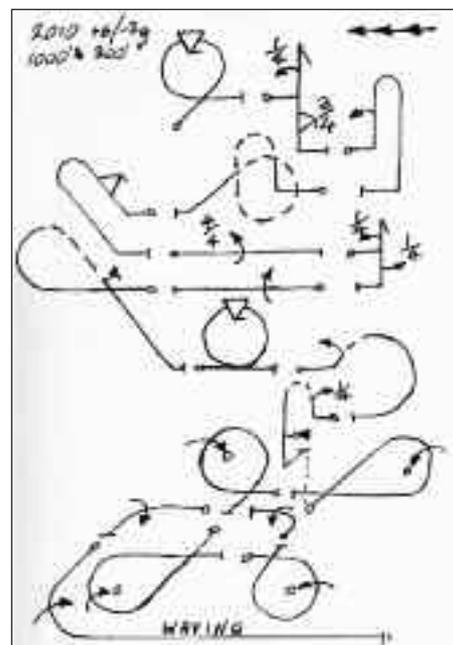
Last year I flew around twenty displays and had to make minor (or major) modifications in every single case for one reason or another. This is one of several factors making a mockery of the CAA's latest change to CAP 403, which requires pilots to submit their sequence in advance, so this year we will all have to think well ahead and amend our standard routines in good time.

Last winter I was very smug about my complex sequence (illustrated here), which featured several intermediate-level manoeuvres and quite a lot of negative G (necessarily engine-off, since my aircraft doesn't have any inverted systems). These were quite difficult and challenging in my little Fournier, and I was proud to be able to demonstrate that this under-appreciated aeroplane was capable of much more than many pilots realised.

However, I have since come to understand that these more advanced figures were lost on all but the most knowledgeable of spectators.

I'm no market-researcher, but a straw poll of audience members suggested they were dissatisfied with my high and distant start, necessitated by the subsequent big energy-losses. It transpired that they preferred simple manoeuvres low down and close to the crowd. Indeed, it was mostly the pretty, swirling smoke patterns they remembered. So this year I am flying a low and simple sequence, rather than a demonstration of virtuoso aerobatic skill. Why knock myself out when this is both a lot easier and much more popular?

Finally, don't forget to choose some music to fly by and type out some commentary notes. Think of your audience and pitch the information to them: do they care that your engine produces 400 horsepower (or, in my case, 35.1hp) or would they be more interested to know that you're a part-time nuclear physicist? Tell them your tailwheel came off a Tesco trolley or that your smoke system burns old chip fat!



■ This testing sequence started too high - it's simpler now