Compulsory Known and Unknown Sequence Design
Sports to Unlimited

Guidance for designers, pilots and judges

Background

Each year British Aerobatics publishes compulsory known and unknown sequences for different levels of competition. These will be designed either to BAeA rules, CIVA rules or modified CIVA rules according to the level and the structure of each competition.

Each level from Club to Unlimited is targeted at pilots with different skill levels and, inevitably, each level requires different minimum aircraft performance capabilities.

As such, there is a requirement to design sequences which are at the correct technical level to test the pilots' abilities at each level of contest, and which can be flown within the performance constraints of the aircraft types likely to be flown.

To achieve this:

1. The BAeA for Sports level and CIVA for Intermediate, Advanced and Unlimited levels publish a restricted list of allowable figures for use in Unknown sequences together with rules governing the construction of known and unknown sequences. These rules may govern the number of figures, maximum k per figure and/or per sequence, and versatility requirements.

[Rules for Sports are published in the BAeA General Rules and those for Intermediate to Unlimited in CIVA Section 6 Part1.
Additional rules may be applied to specific competitions which will be specified in the entry details. For domestic purposes, deviations from CIVA rules for Intermediate to Unlimited may be appropriate and these will be specified in the BAeA General Rules and/or specific competition entry details.]

2. For BAeA events, to accommodate the performance differences between aircraft types a "base" type is assumed for each level of competition as follows:

Club & Sports:	Cessna Aerobat
Intermediate:	Cap 10B
Advanced:	Pitts S2A
Unlimited:	*not applicable*

Design Guidelines

Each sequence is designed by a person nominated by the BAeA such that it is:

- safe;
- compatible with the relevant rules;
- at a technical difficulty appropriate to the competition level;
- has a total k comparable to or higher than the known sequence (so that the overall result is not biased towards the known sequence if only one unknown is flown);
- has energy requirements appropriate for the performance of the base aircraft.

The intent should be that the sequence could be flown by a *skilled* pilot in the base aircraft within the confines of the box without the need to take a break to regain energy (speed and/or height) or to reposition. *This does not mean that every pilot flying such an aircraft will necessarily be able to achieve this!*

The designer must make a judgment on aircraft capabilities with which they may not be familiar and therefore will need to make educated assumptions.

The sequence will be checked independently and any adjustments made as required. Ultimately, the CD and CJ have the final say for each competition.

In designing a sequence to meet the requirements above it should be appreciated that a high k total does not necessarily make the sequence harder technically or aircraft performance-wise, although that of course could be the case if wanted.

As an example of the application of the guidelines with respect to aircraft performance at different levels, consider the suitability of including a roll off the top followed by a stall turn:

> Sports: This combination is unacceptable. An Aerobat will struggle to accelerate to the necessary speed to execute the stall turn.
>
> Intermediate: Acceptable if no rolls up on the stall turn. Consideration should be given to having the first figure flown downwind to allow a longer acceleration into wind for the stall turn. Additionally, allow for a greater height loss on the down line for the Cap 10 (compared for instance to an Extra) and therefore be wary of including a roll on the downline.
>
> Advanced: Acceptable with limited rotation on the Stall turn upline.
>
> Unlimited: Acceptable with appropriate rotation on the Stall turn upline.

Typical safety considerations will be for a sensible height loss and, particularly at Intermediate, restrictions to high positive g following prolonged negative g.

For Pilots

You've probably noticed that not all aircraft have the same performance capabilities. As outlined above, it is the intention that all sequences should be capable of being flown in the base aircraft for each level. However, that still means that some figures are going to be more difficult in some aircraft than in others. It simply isn't feasible to create a completely level playing field and the bar has to be set somewhere. But that's all part of the challenge – learning to get the most out of your aircraft and the techniques to "cheat" certain figures (eg. descending during a turn to achieve a greater entry speed for the following figure).

If in the unlikely event that you still consider a particular figure is beyond the capabilities of yourself or your aircraft, don't be tempted to try it anyway; it could end badly. Either omit the figure or insert an alternative to maintain the sequence orientation. You will then need to accept a zero for that figure and the respect of the judges for making a sensible decision.

For Judges

Although covered extensively in the judging rules, it is worth emphasizing that looping radii, roll rate and line length (except where it needs to be balanced either side of a roll for example) are not judging criteria. A lower-performance aircraft should not be penalized in any way for drawing short lines or nice rounded radii. Equally, it is important that all judges are familiar with the characteristics of the zero lift axis for the aircraft which are competing. Particularly, lower performance aircraft often have non-symmetrical aerofoils and may have the wing set at significant incidence to the fuselage. This can lead to an inexperienced judge assuming such an aircraft is not vertical or at 45 degrees even when its zero lift axis is perfectly so. Also beware that slower aircraft on, say the 45 line will be more affected by wind effects which may suggest the aircraft is too steep or too shallow – but you are judging on attitude, not track, so this will not affect the scoring.