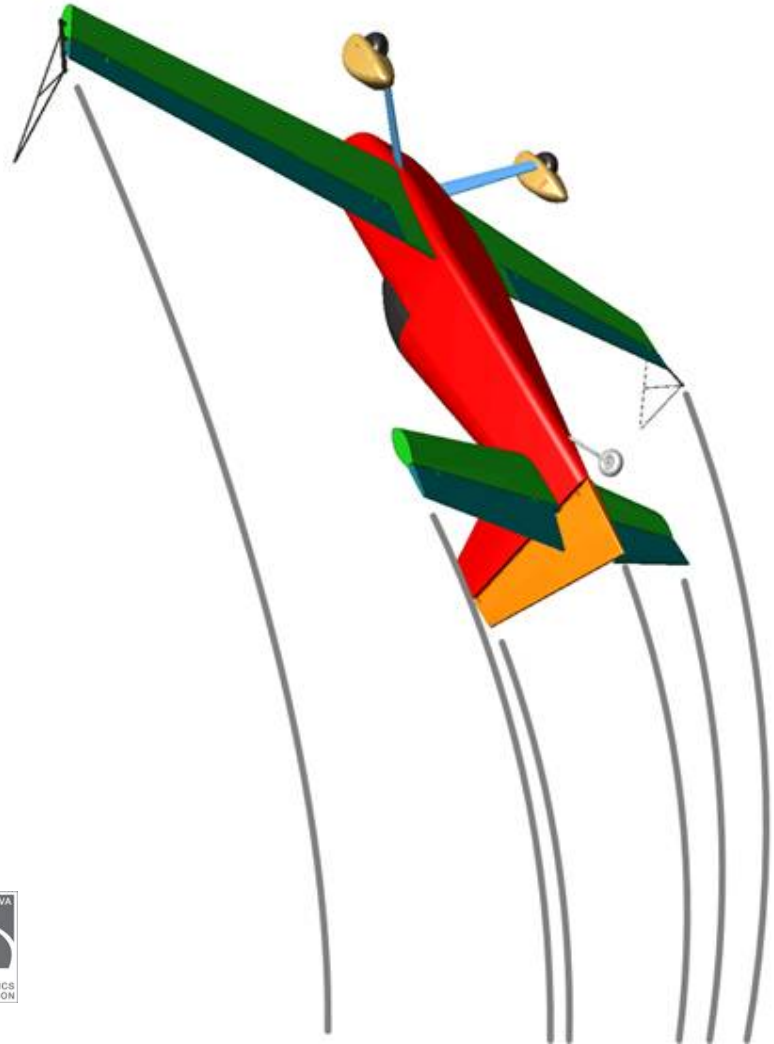
# A Quick Zoom through the Rules



- *Centre of Gravity Track*
- *Zero Lift Axis*
- *When to use each one ?*
- *The "Box"*
- *Wing Rocks*
- *Steep / Shallow, Neg & Pos*
- *Basics Rules of Judging*
- *Turns*
- *Slow Rolls*
- *Flick Rolls*
- *Spins*
- *Loops and Eights*
- *Stall Turns*
- *Humpty Bumps*
- *Tail Slides*
- *Rolling Circles*
- *Positioning mark*
- *Handling the major errors*

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# Centre of Gravity Track (CGT)

**The Centre of Gravity Track (also called the Flight Path) is the imaginary line that the aircraft centre of gravity draws as it flies along.**

*Imagine the aeroplane condensed into a dot, and watch the path that the dot takes through the sky. This is the **CGT** or if you prefer the **Flight Path**, the Track of the aeroplanes' Centre of Gravity.*

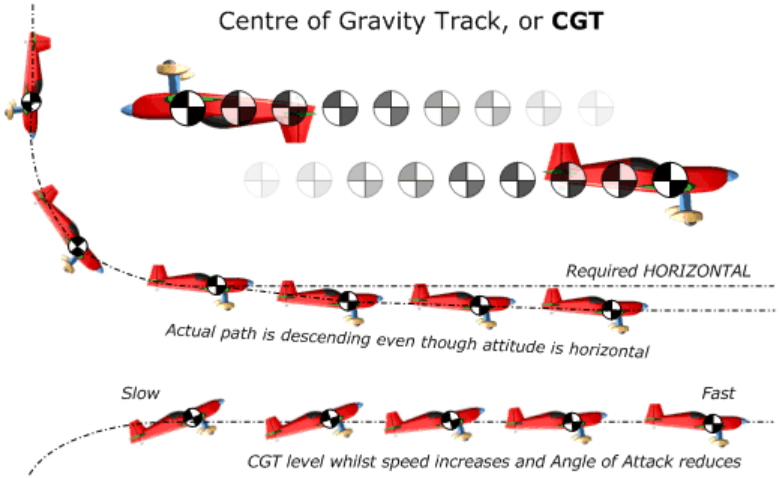
**To judge the flight path, compare the CGT against the horizon or the box 'A' or 'B' axes.**

**Example 1**

The aeroplane is required to transit from a vertical down-line to horizontal flight. Although the **ZLA** (the **Zero Lift Axis**, explained in the next slide) remains horizontal after the 90° corner has been completed, the **CGT** will in reality continue to descend a little below the required horizontal line.

**Example 2**

Here the transit is from a vertical up-line to normal horizontal flight. The **CGT** must remain in a level horizontal line, whilst the aircraft speed will increase from very slow and the angle of attack reduces accordingly.




**CGT and Angle of Attack**

Judges must always look at the **CGT** or **Flight Path** and not be "fooled" by a high angle of attack at low speed – this can be particularly noticeable when the aeroplane is inverted, as with most aircraft the nose will appear unnaturally high with the **ZLA** pointing upwards.

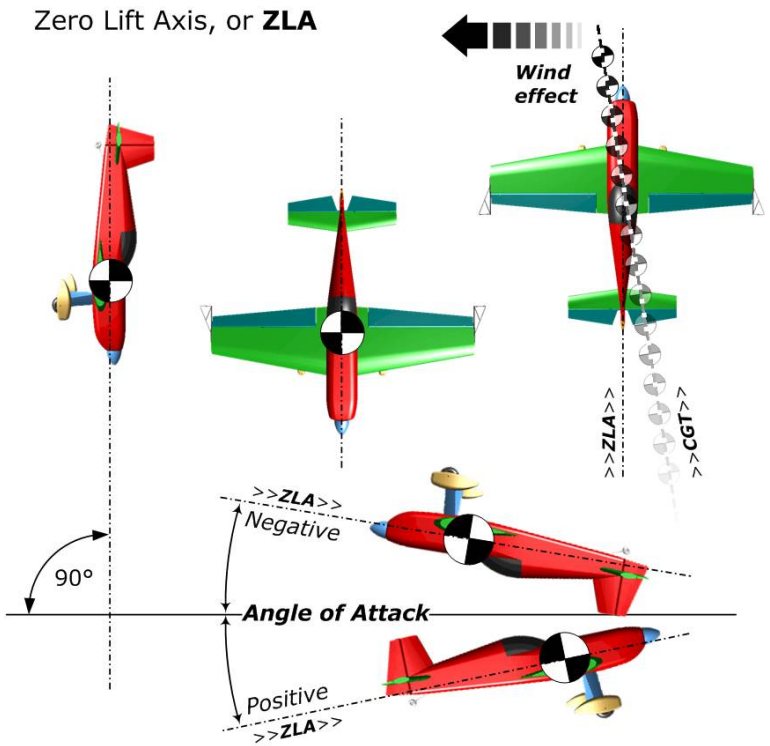
# Zero Lift Axis (ZLA)

**The "Zero Lift Axis" of an aircraft is purely a function of its shape and aerodynamic qualities.**

**When flying a true vertical line in still air, the ZLA will be exactly perpendicular to the ground.**

- In the left and centre sketches the aeroplane is flying vertically downwards with its **ZLA** through the main axis.
- The sketch on the far right shows that the **CGT** can be different to the **ZLA** because of the wind.

**On all 45° and vertical lines we use the ZLA to tell us how accurately the aircraft is flying the figure.**

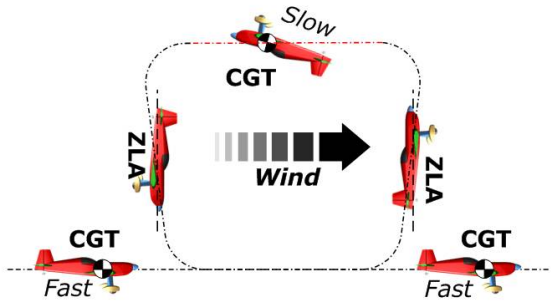


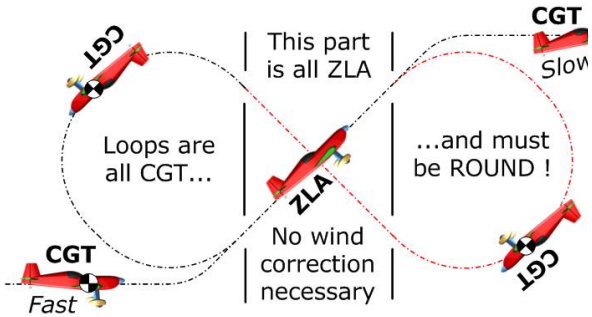

Note again that in level **CGT** flight the wing must have a positive or negative **Angle of Attack** relative to the airflow to keep the aircraft flying. Don't be fooled into thinking that the **Flight Path** is incorrect.

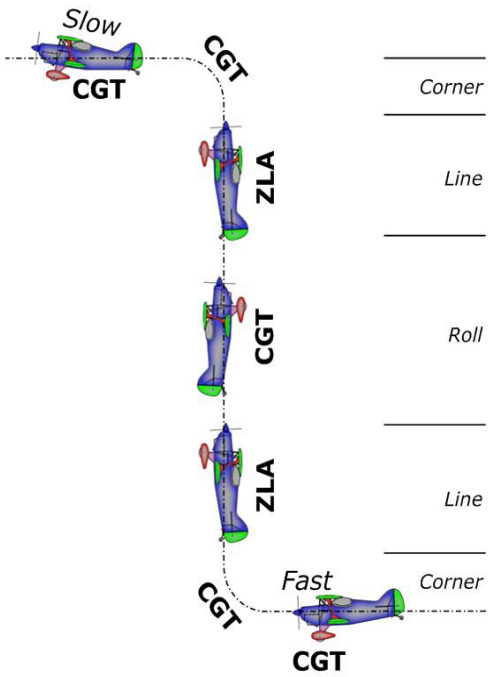
# When should we use CGT and when should we use ZLA?

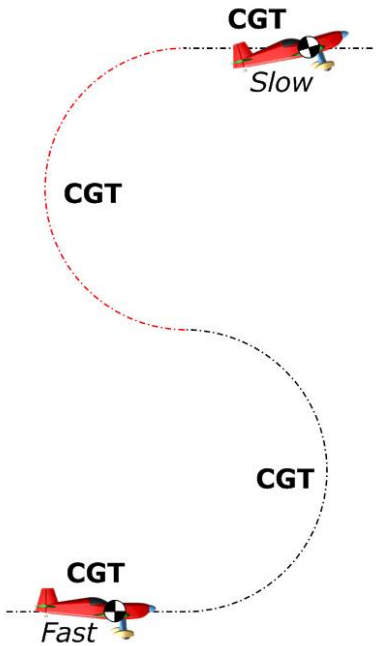
**In horizontal lines or curving, rotating or rolling manoeuvres –
use CENTRE OF GRAVITY TRACK (CGT). This is the Flight Path of the aeroplane.**

**When we are judging vertical or 45° lines up or down –
use the ZERO LIFT AXIS (ZLA). This is the neutral centre line through the plane.**

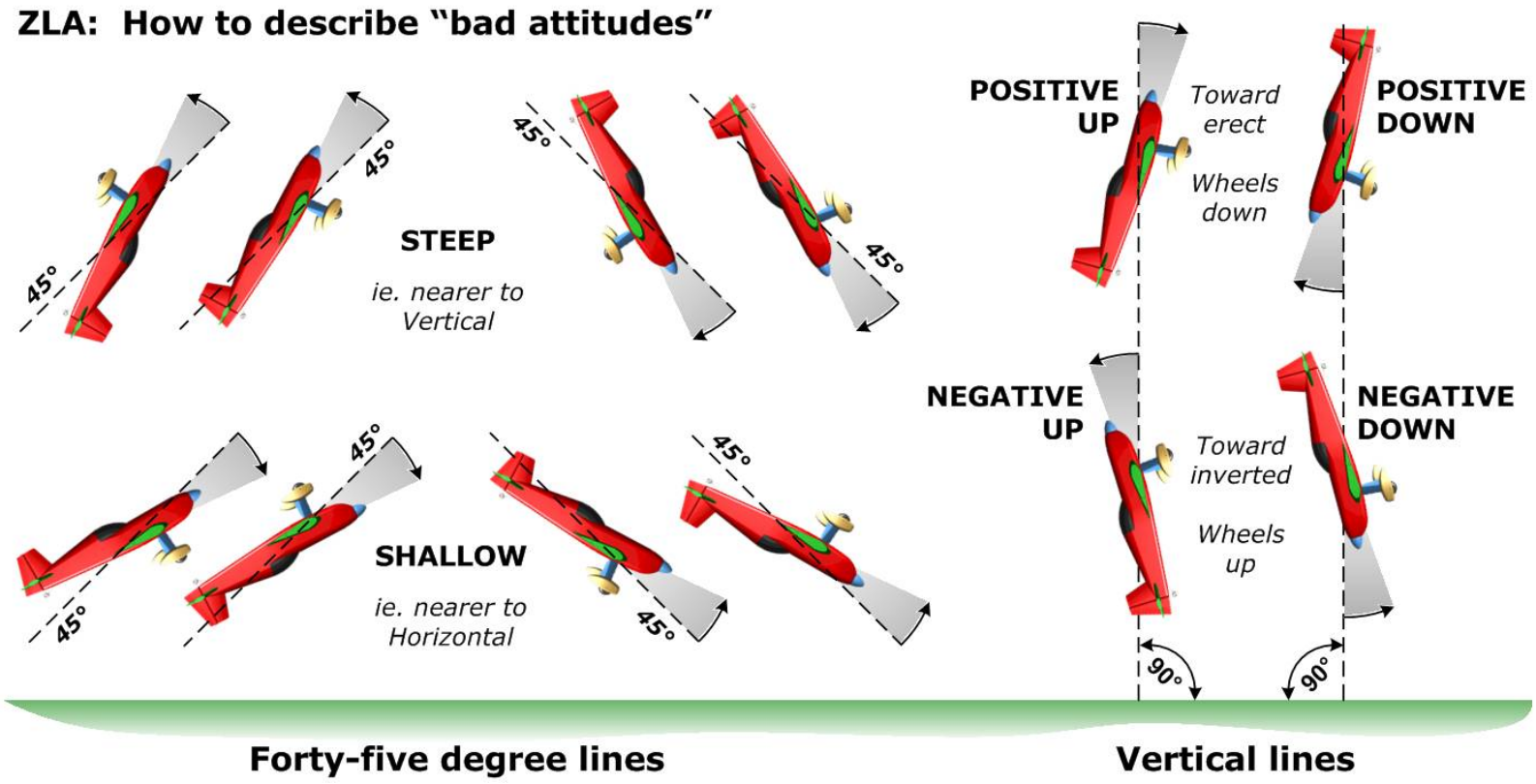


# Steep or Shallow .... Negative or Positive

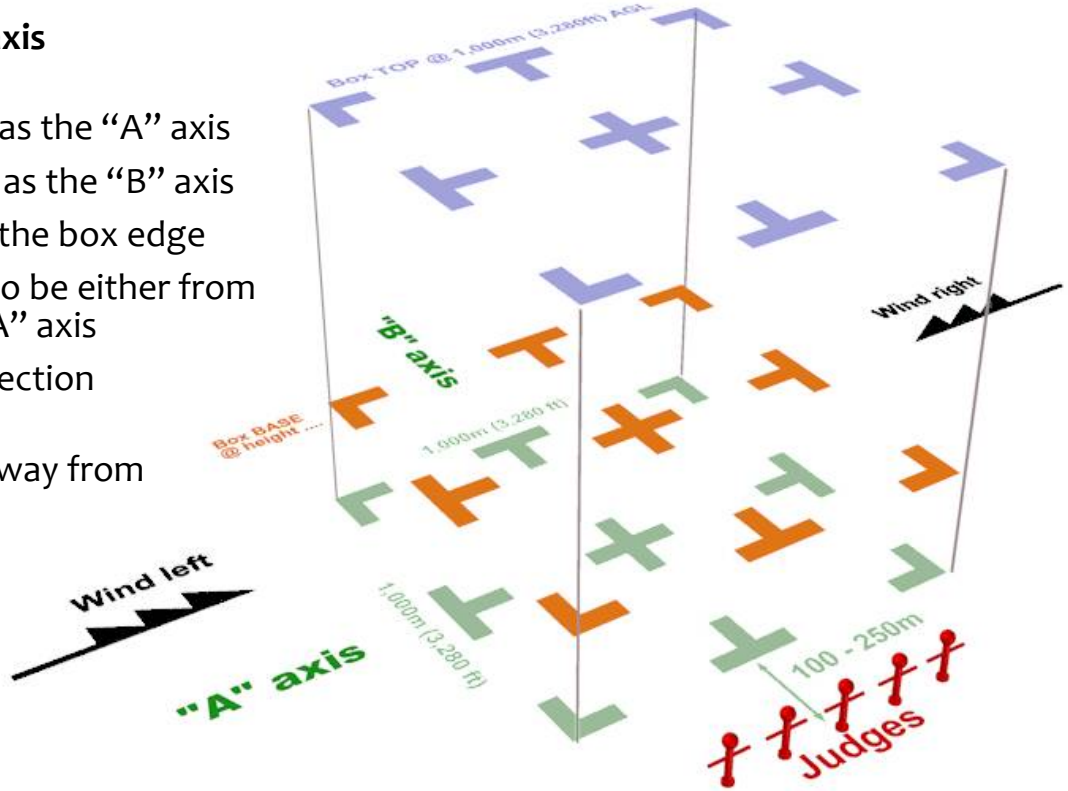


# The Aerobatic Performance Zone

**The “box” is the 1,000m cube of airspace within which all competition aerobatic flights are executed.**

**The ‘Official Wind’ defines the main box axis**

- The main box centre-line is shown here as the “A” axis
- The cross box centre-line is shown here as the “B” axis
- Judges sit between 150 and 250m from the box edge
- The official or contest wind is declared to be either from the left or the right, always along the “A” axis
- Figures **must** be flown in the correct direction on the main or “A” axis
- Figures can be flown either toward or away from the judges on the secondary or “B” axis




**The minimum operating height depends on the category:**

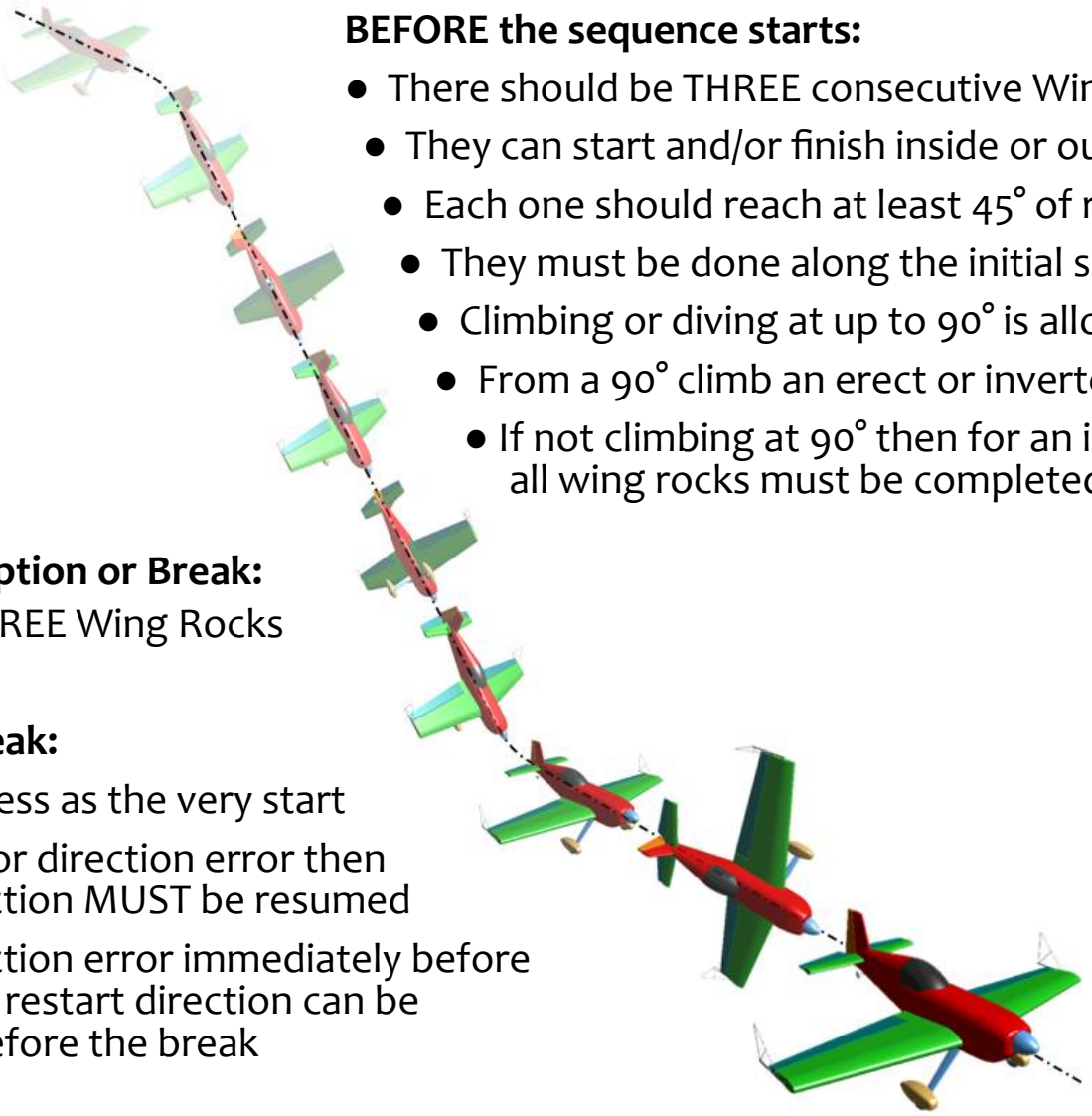
- 100m - power Unlimited
- 200m - power Advanced
  - glider Unlimited and Advanced
- 300m - power Sports and Intermediate
  - glider Sports and Intermediate
- 450m - power and glider Club

# Wing Rocks

**For Power only ...**

**BEFORE the sequence starts:**

- There should be THREE consecutive Wing Rocks
- They can start and/or finish inside or outside the box
- Each one should reach at least 45° of roll
- They must be done along the initial sequence axis
- Climbing or diving at up to 90° is allowed
- From a 90° climb an erect or inverted exit is OK
- If not climbing at 90° then for an inverted start all wing rocks must be completed while inverted



**To signify an Interruption or Break:**

- We need to see THREE Wing Rocks

**To restart after a Break:**

- It's the SAME process as the very start
- If there was no prior direction error then the pre-break direction MUST be resumed
- If there was a direction error immediately before the break then the restart direction can be different to that before the break

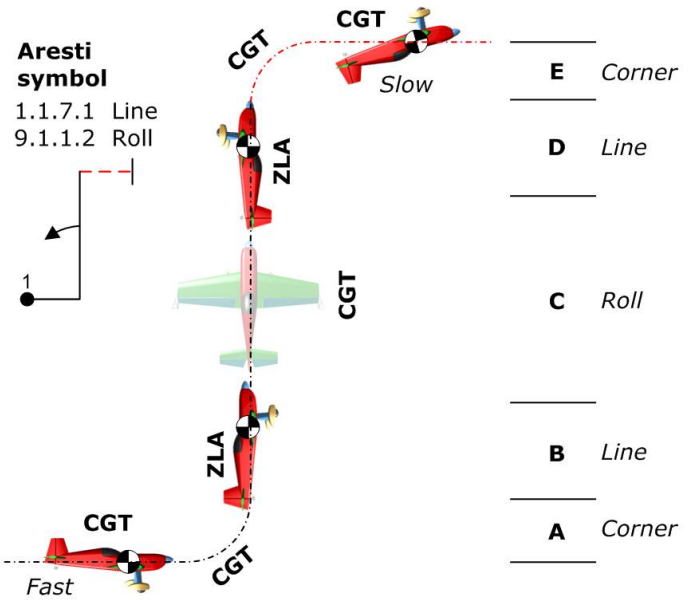
# The Basic Rules of Judging

- **Every figure starts with a potential 'perfect' mark or grade of 10 points**
- **The basic judging rule is : an error of 5° equals a 1 point downgrade**
- **Deduct whole or half points to get your personal final mark for each figure**

Radii 'A' and 'E' need not be the same, but 'E' is flown much more slowly.

Lines 'B' and 'D' must be the same length.

- For a 2/1 ratio : deduct 2 marks
- For a 3/1 ratio : deduct 3 marks
- No line at all : deduct 4 marks




**For example:**

- If the aircraft starts the figure climbing at 5°, no yaw and between 5° and 10° of bank
- During the figure is pitched OK but yawed 5° and rolled 10° off axis at a key point
- The figure ends with 5° of yaw, between 0° and 5° nose-down and no bank angle

**The result is: 10 points - 1 - 0 - 1.5 ... - 0 - 1 - 2 ... - 1 - 0.5 - 0 = 3.0 marks for the figure**

**This is a *FAULT* driven process - you are not marking "Goodness" !**

# Turns

- **This is NOT a 'PPL' turn – think more of a "jerky marionette"**

**Types:**

Turns can be either erect or inverted

Amounts are 90°, 180°, 270° and 360°

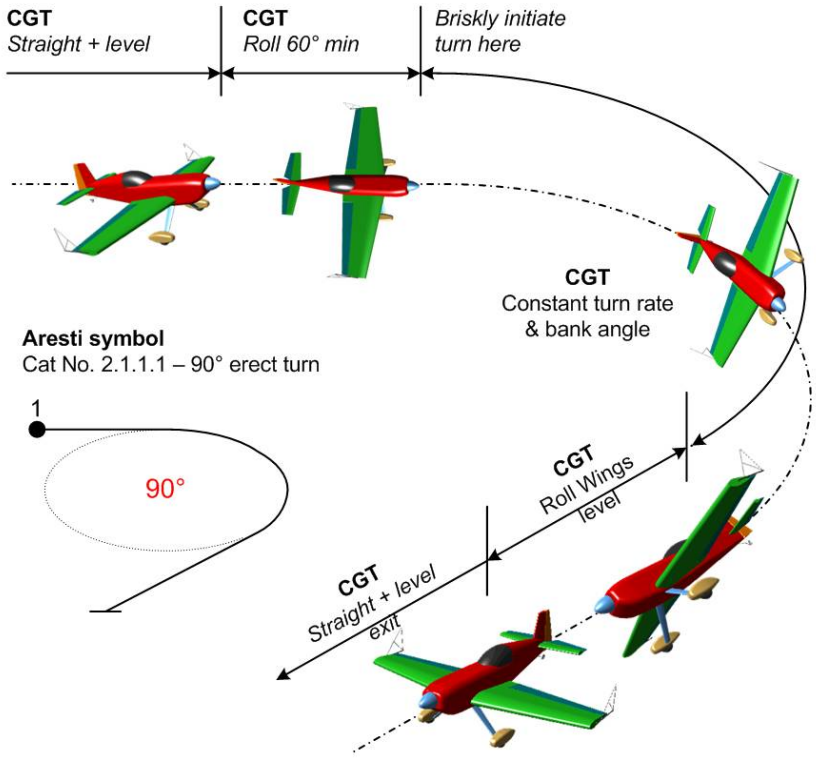
**Actions:**

1. Roll to at least 60° of bank (gliders exactly 60°)
2. Turn at a constant rate through the required angle
3. Maintain turn rate and altitude
4. Stop exactly on heading, then
5. Roll back to wings-level

**Not judged:**

The shape of the turn (no wind correction)

The size of the turn

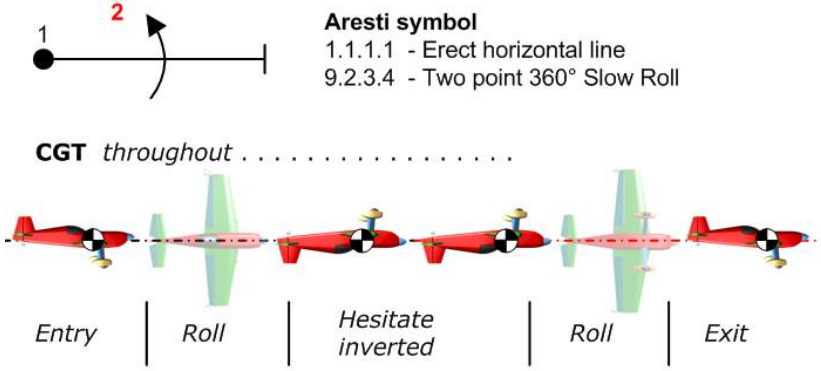


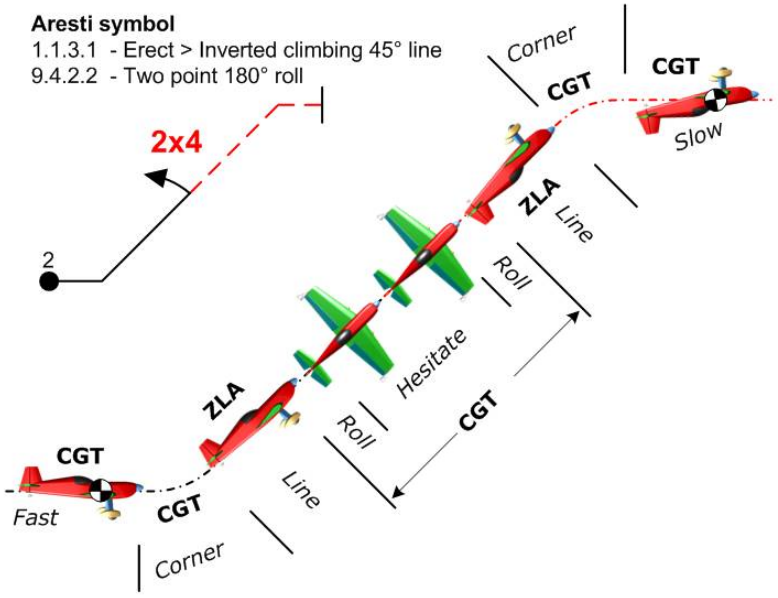
# Slow Rolls

**Slow rolls, many of which include hesitations, are sometimes called aileron rolls to distinguish them from flick or snap rolls.**

**In a slow roll the rotation is primarily driven by aileron action, whereas a flick roll combines yaw and pitch inputs to cause rapid 'auto-rotation'.**

Many variations of slow rolls are used in a great variety of figures, often preceded and followed by lines which must be judged for **CGT** (where horizontal) or **ZLA** (where at 45° or in the vertical) and also for comparative length.



# Flick or Snap Rolls

**Flick rolls are initiated by rapid pitch and yaw control inputs, which cause one wing to stall while the other one continues to fly. This leads immediately to very high acceleration in roll.**

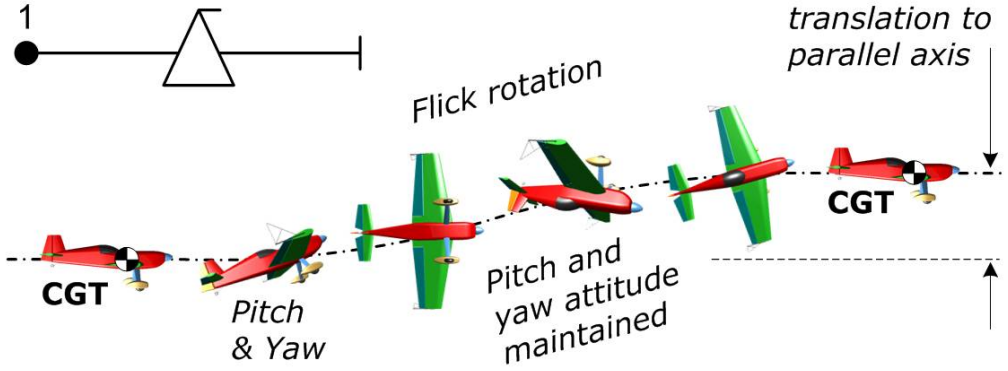
**This abrupt high energy translation makes the manoeuvre hard to study and hence difficult to judge accurately. Flicks are over very quickly – it helps to watch how the tail moves throughout.**

Flick-rolls happen so quickly it is your subjective 'perception' as to whether the pitch and yaw have –

- caused auto-rotation
- stayed there during the roll
- been removed to stop it

**If you are not convinced that the aeroplane "flicked" or "snapped", i.e. there was no auto-rotation, then you *must* apply a 4-point downgrade and carry on marking the rest of the figure in the normal way.**

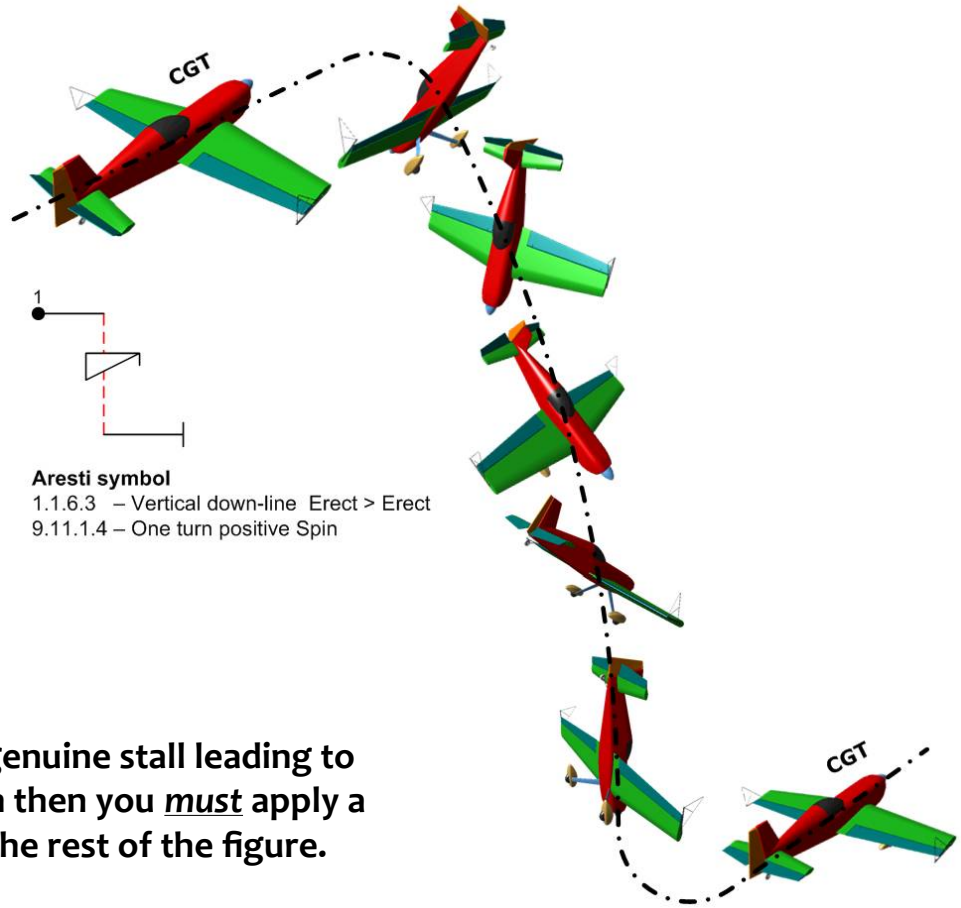
**Aresti symbol**
1.1.1.1 - Erect horizontal line
9.9.3.4 - Horizontal one-turn Positive Flick Roll



# Spins

**The 'competition' spin must display these characteristics –**

- A clean initial stall on-heading in **level CGT flight,** leading to
- An immediate combination of nose drop + wing drop + and yaw into true auto-rotation
- The auto-rotation must stop on the correct heading
- We must then see rapid translation to a vertical **ZLA** line, and after a SHORT pause there may be a following roll
- Finally a smooth radius pull or push to … (level flight exit, remainder of figure etc.)



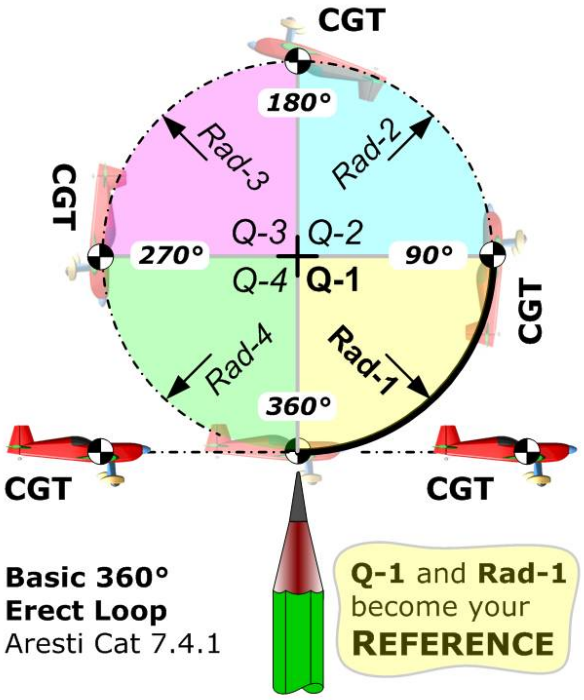

**Aresti symbol**
1.1.6.3 – Vertical down-line Erect > Erect
9.11.1.4 – One turn positive Spin

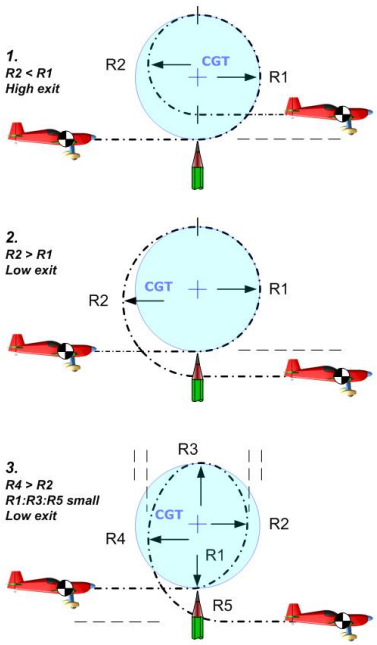
**If you are not convinced that there was a genuine stall leading to the combined wing-drop and auto-rotation then you *must* apply a 4-point downgrade and carry on marking the rest of the figure.**

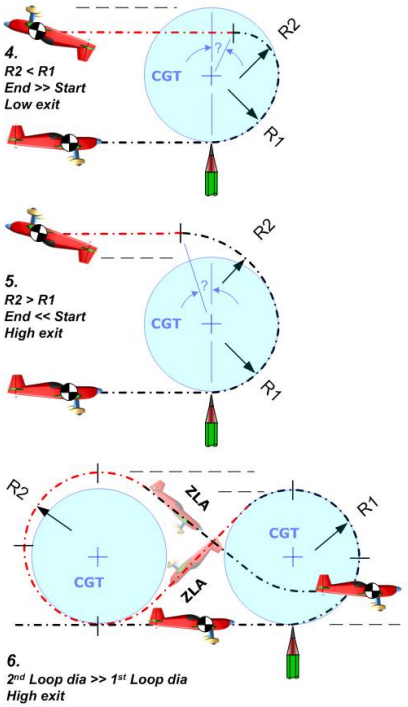
# Judging loop shapes

- The exit point should be at exactly the same level as the entry point.
- The four quadrant radii and centre points are all exactly the same.
- The centre-top point is exactly above the start point.

**Wherever you see these 3 'truths' you can be sure that the loop is round.**



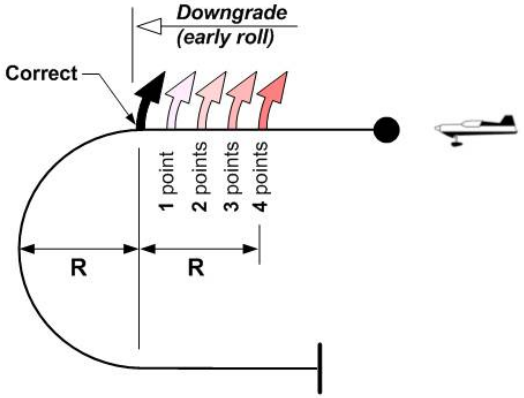



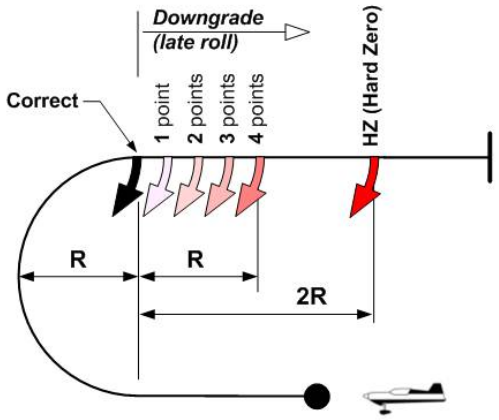
# Half-loops with Rolls

**When a half-loop upwards or downwards has some rolling at the start or end of the looping segment, there must be NO horizontal line between the rolls and the looping arc.**

**Fix in your memory the RADIUS of the looping arc while it is being flown:**

- Where no line is drawn between the arc and the roll there is no downgrade to apply.
- If you see any line **AT ALL** then at least a **one point** downgrade must be applied.
- As the length of this unwanted line increases but remains less than the radius of the half-loop, **two** to **three points** should be deducted.
- If the length of the line is as long or is longer than the half-loop radius you must award a **four point** downgrade to the figure.
- If the roll is at the **END** of the figure and the length of the line flown between the half-loop and the roll reaches two times the radius then you must apply a **HZ (Hard Zero)** to the whole figure and state “Wrong Figure” on the sheet.



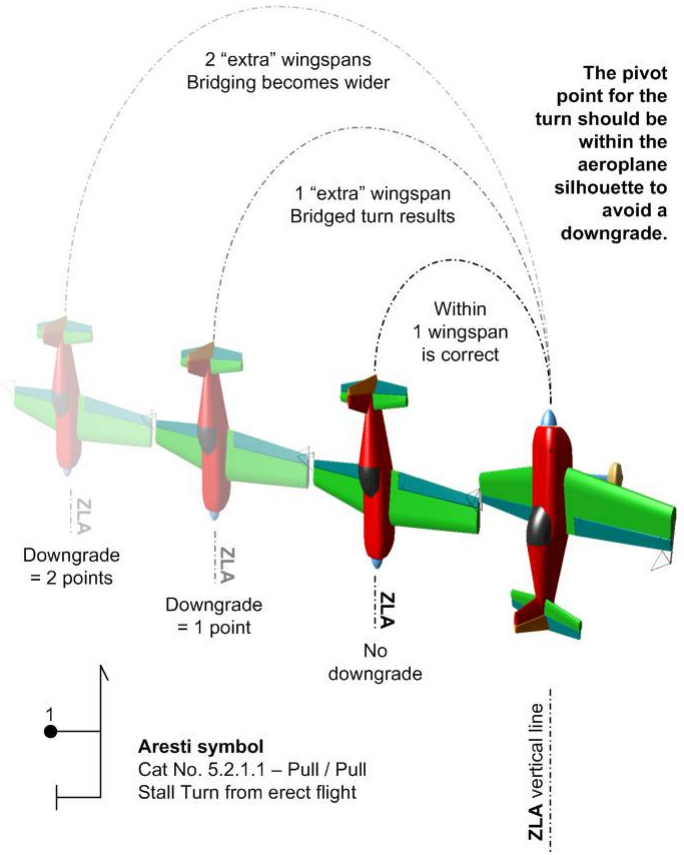
# Stall Turns or Hammerheads

**The Stall Turn is one of the most graceful aerobatic figures.**

**The figure can be divided into a series of sections for judging:**

- Smooth radius **CGT** entry and pull / push to the vertical.
- The **ZLA** vertical up-line, and assessment of any rolls super-imposed.
- The turn itself, which must be purely yaw with no rolling or pitching.
- The **ZLA** down-line, and assessment of any rolls super-imposed.
- The smooth radius pull / push and exit to level **CGT** flight.

**Stall Turns with 45° entry and/or exit segments may also have rolls superimposed there.**



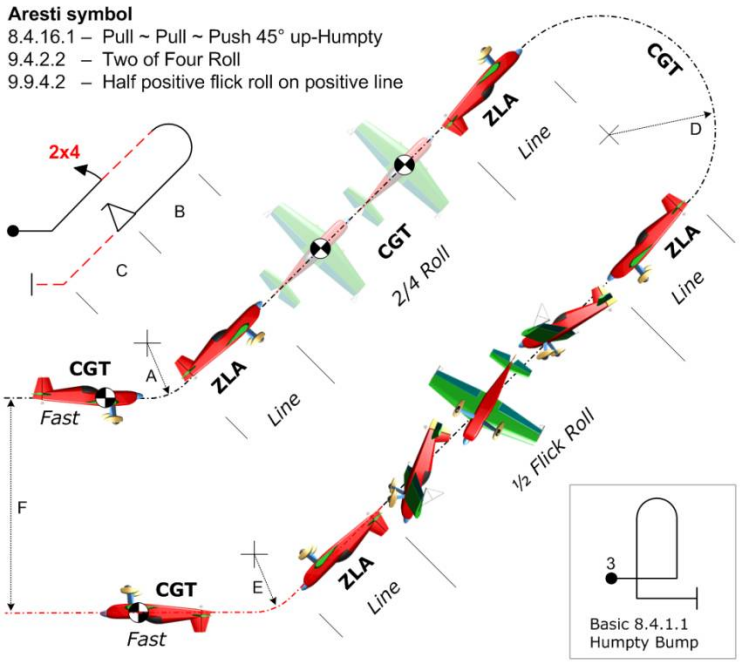
# Humpty Bumps

**The 'Humpty' can be vertical or at 45°, it can start by going up or going down, and there is even a 'double' version with one vertical up and one vertical down.**

**All types are basically similar – they comprise looping segments that connect lines upon which a great variety of rolls can be placed.**

- Smooth **CGT** radius entry and pull / push to reach the first line.
- The first **ZLA** line, and assessment of any rolls super-imposed.
- A smooth radius half-loop.
- The second **ZLA** line, and assessment of any rolls super-imposed.
- The smooth radius pull / push and exit to level **CGT** flight.

**All partial loop segments may have different radii, and in a double humpty the two half-loops may also be of completely different sizes.**

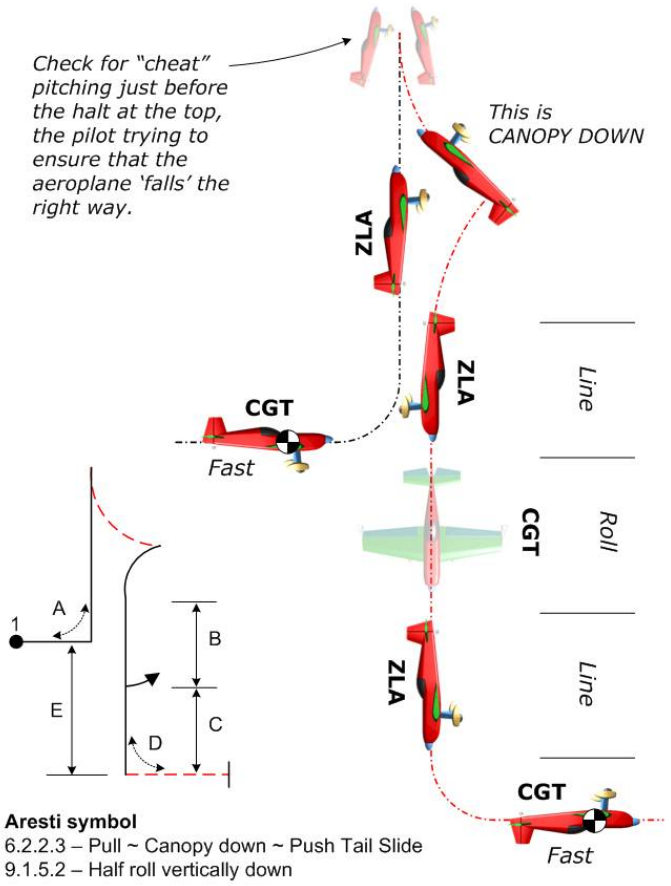


# Tail Slides

**Tail Slides have very similar judging criteria to Stall Turns, but there are no 45° entry and exit options – they are all vertical, and upwards!**

**Break the figure into the following parts for judging:**

- A smooth **CGT** radius entry and pull / push to reach the vertical up-line.
- The first **ZLA** line, and assessment of any rolls super-imposed.
- The slide must be either canopy-up or canopy-down, or you can think of it as wheels-down or wheels-up.
- **If the slide is less than a half fuselage length the downgrade is four points**
- The vertical **ZLA** attitude must be maintained to the top and in the slide.
- After the pendulum is finished, assess the second **ZLA** line, and any rolls that are super-imposed.
- A smooth radius pull / push and exit to level **CGT** flight.

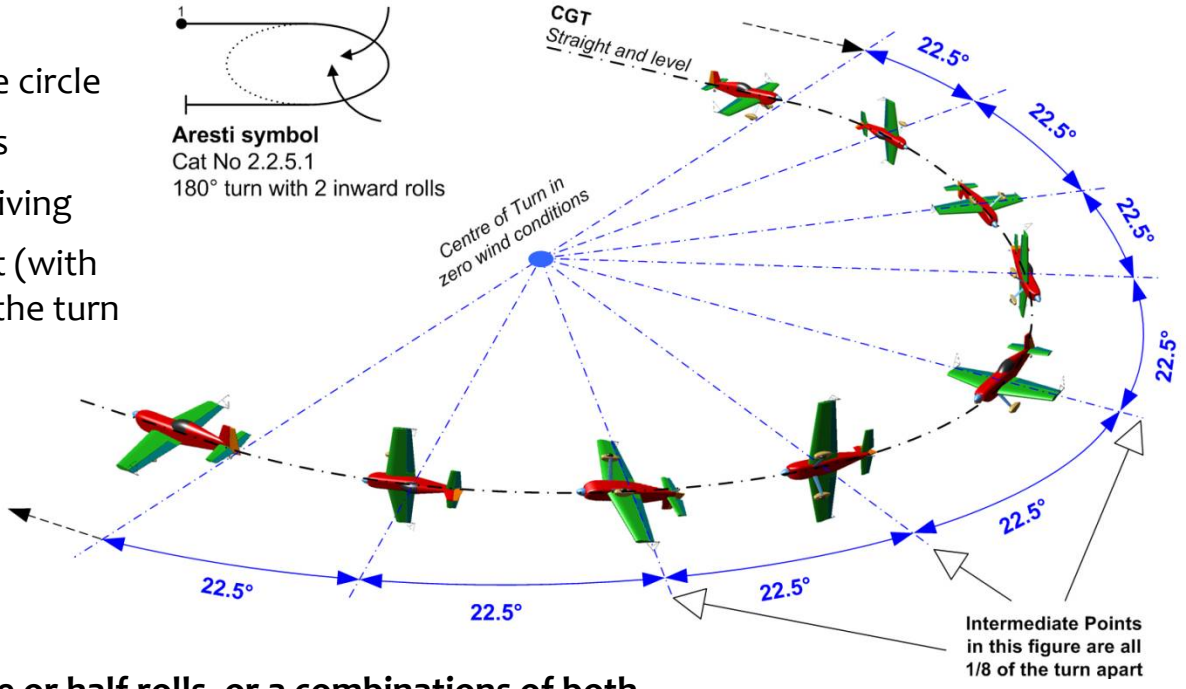


# Rolling Turns – *page 1*

**All versions of "Rollers" combine turns with continuous rolling, and they all follow the same set of rules and judging criteria.**

**Break the figure into the following parts for judging:**

- Start in level **CGT** flight precisely on-heading.
- There must be a constant –
  - rate of turn round the circle
  - rate of roll at all times
  - with no climbing or diving
- At every Intermediate Point (with the wings level or vertical) the turn angle must be correct
- The exit point must be reached on-axis with all rolling exactly completed




**Rolling Turns can include whole or half rolls, or a combinations of both.**
**The rolls can be inwards (inner wing going down) or outwards (inner wing going up) or both types alternated for the In / Out versions with a short pause between the roll elements.**

# Rolling Turns – *page 2*

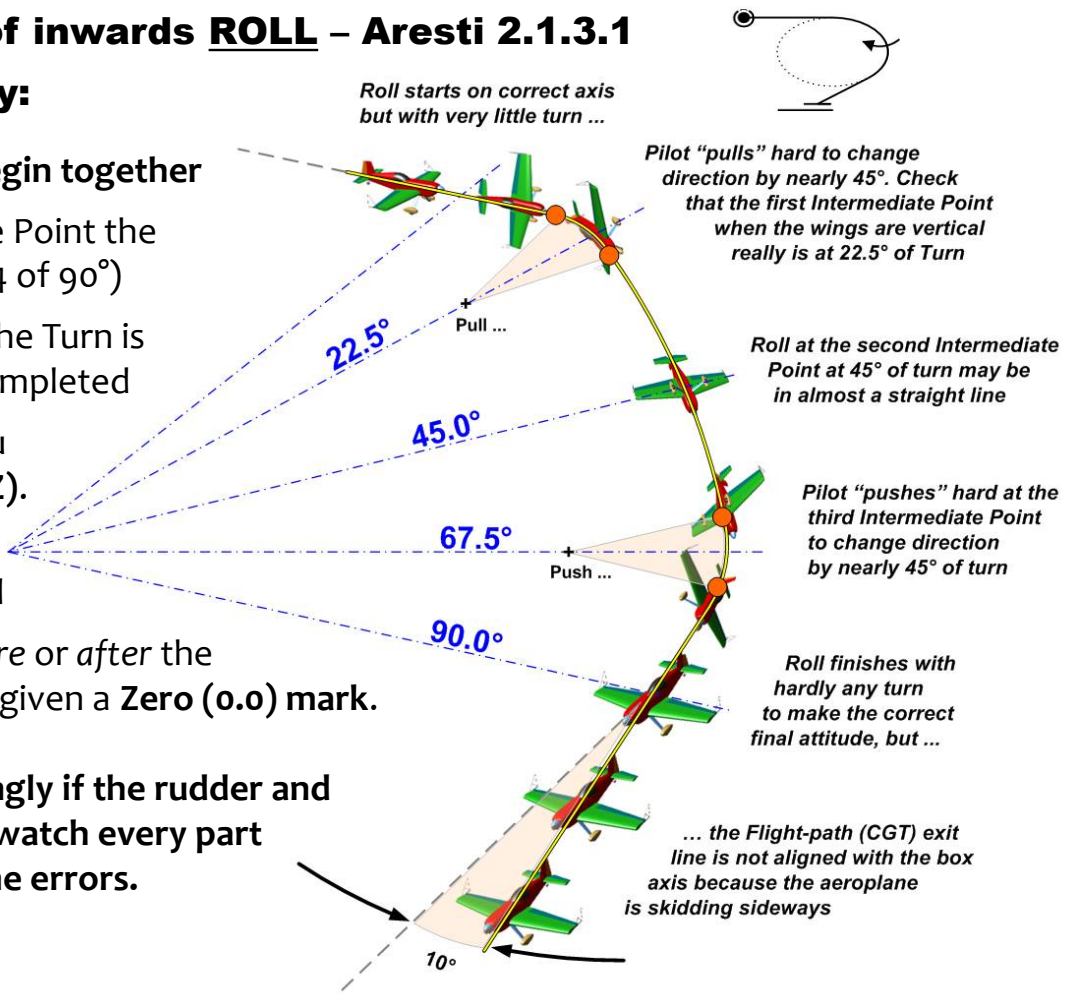
**In reality many Rolling Turns are flown as a series of "pull" and "push" arcs with straighter segments between them, giving a jerky appearance with 'corners'.**

**Here is a 90° <u>TURN</u> with 360° of inwards <u>ROLL</u> – Aresti 2.1.3.1**

**Watch the START very carefully:**

- You must see Rolling and Turning **begin together**
- At the 1st wings vertical Intermediate Point the turn angle reached must be 22.5° (1/4 of 90°)
- At the inverted Intermediate Point the Turn is 45° and the figure is exactly HALF completed
- If you see a flick-roll at any stage you must give the figure a **Hard Zero (HZ).**
- The Roll and Turn must both finish exactly when the exit axis is reached
- If the exit **CGT** is **more than 45°** *before* or *after* the correct direction the figure must be given a **Zero (0.0) mark.**

**This figure <u>CAN</u> be flown very convincingly if the rudder and stick inputs are well co-ordinated. Just watch every part carefully and make a running total of the errors.**



# Flight in the "wrong place"

1. **If a figure is started in front of the judges but part of it is then flown behind the judging line, you should turn around and continue to mark it in the usual way. Your Positioning Mark will naturally be affected by this (NN).**

   This sometimes happens with rolling turns, or when the pilot fails to pay enough attention to where the figures are being flown. Just keep marking the flight and try not to fall over!

2. **If a figure starts behind the judging line you should continue to mark it regardless, and put a note "Behind" on the judging form. Your Positioning Mark should also reflect this poorly located flying.**

   After the flight the Chief Judge will review all the judging sheets to check whether there is a majority of "Behind" comments. If so the figure will be declared a Confirmed Hard Zero (**CHZ**) and judges will be directed to ensure their mark is revised to **HZ** if it is anything else.

3. **If all or part of a figure is flown so it is not possible to judge it properly -**
   - ***for example a cross-box looping element exactly in front of you, or***
   - ***the plane is so far away that you really can't see what it is doing***

   **then you should apply a downgrade of two (2) points to <u>every element</u> that you are unable to judge.**

   It is the pilot's job to to fly the figures so that you can judge every part and reach a mark for each completed figure as required. If any parts of the flight are presented in such a way that elements are impossible to judge properly then the performance must be downgraded, and 2-point deductions are your way to make this happen. Your comments should also bring this to the pilots attention!

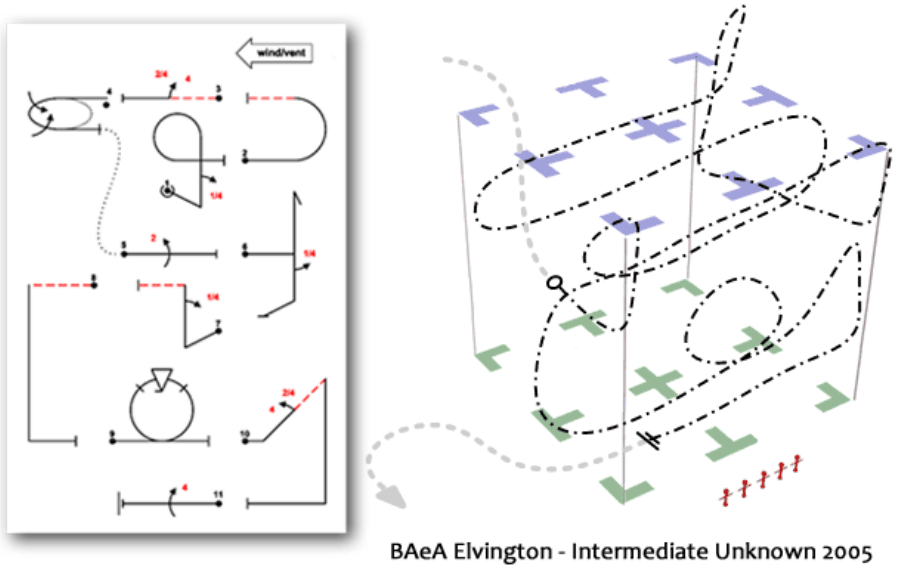
# The Positioning Mark

**Use the CIVA system to identify figures that are not placed in an optimum position to be judged, *within the context* of the sequence.**

**Where they are –**

- Too far to the left = "**L**"
- Much too far left = "**LL**"
- Too far to the right = "**R**"
- Much too far right = "**RR**"
- Too near = "**N**"
- Much too near = "**NN**"
- Too far = "**F**"
- Much too far = "**FF**"

*so a figure could be "**L**" or "**NLL**" or "**FFR**" or even "**NNRR**" etc.*




BAeA Elvington - Intermediate Unknown 2005

**After the flight –**

- Total the number of letters
- Count each one as a half mark *(e.g. "**N**" and "**FR**" and "**LL**" and "**NL**" gives **3.5** downgrades)*
- Deduct this total from ten *(e.g. **10.0 – 3.5 = 6.5** as the **Position Mark**)*

**This is your "starter" Positioning Mark, which you can 'adjust' up / down by 1 mark if necessary.**

# Handling the Major Errors

- A figure that receives ***ten*** or more downgrades must be awarded **a** **Numeric Zero = 0.0**
- When cumulative errors in roll / pitch / yaw total ***more*** than **45°** but ***less*** than **90°** you should award a **Numeric Zero = 0.0**

Subjective personal Judgement

***No Video***

- Where a **Major Error** is seen: an element is flown in the wrong direction, part of the figure is different to the Aresti symbols on the Judging Form, the wrong hesitations in a Roll are seen, or there is ***more*** than **90°** of cumulative error detected …. the figure must be awarded a **Hard Zero = HZ**

Clear matters of Fact

***Video***

# Your questions please … !