Supplementary Explanations to the

F3 RC Aerobatic Aircraft
Manoeuvre Execution Guide

2022 Edition

FAI Sporting Code Section 4 – Aeromodelling
Volume F3 Radio Control Aerobatics, Annex 5B
The purpose of the Manoeuvre Execution Guide is to give accurate guidelines for the proper execution of aerobatic manoeuvres to both judges and competitors.
The flight path of a model aircraft is used to judge the shape of all manoeuvres. Every manoeuvre must be entered and exited with a straight level upright or inverted flight of recognisable length.
Centre manoeuvres start and finish on the same heading, while turn-around manoeuvres finish on a track 180 degrees to entry. When appropriate, entry and exit of centre manoeuvres must be at the same altitude, unless specified otherwise.

Positioning adjustments in altitude are allowed in turn-around manoeuvres.
THE PRINCIPLES of flying and judging the performance of a competitor in an RC Aerobatic competition is based on the Perfection with which the competitor’s aircraft executes the aerobatic manoeuvre as described in Annex 5A. All manoeuvres should be executed with:
Geometrical Accuracy
Constant Flying Speed
Correct Positioning within the Manoeuvring Zone
Size Matching to the Size of the Manoeuvring Zone
GENERAL CRITERIA FOR DOWNGRADING MANOEUVRES

“Criteria…are standards by which something can be judged”
1. **WHAT WAS THE DEFECT**, or mistake?

- Over, or under-rolling (or spin, or snap)
- Poor shape or geometry
- Rolls not on middle of lines
- Absence of lines
- Entry, exit poor
- Wrong angles
- Misrelation between line lengths
- Different roll rates
- Etc.
2. **HOW SERIOUS** was the defect, or mistake?

- Was it big (major)?
- Or was it small (minor)?
3. HOW OFTEN did you see the same defect, or mistake in a particular manoeuvre?

How many defects were there in TOTAL?
4. Was the Flying Speed constant in climbing and descending parts of the manoeuvre?
5. WHAT WAS THE POSITIONING of the manoeuvre?
6. WHAT WAS THE **SIZE** of the manoeuvre?
7. Was the manoeuvre **partially or completely outside** of the manoeuvring zone?
100%
GEOMETRICAL ACCURACY
+
CONSTANT FLYING SPEED
+
CORRECT POSITIONING
+
CORRECT SIZE
=
NO DOWNGRADE
=
10 POINTS!
Deduct/Downgrade System
Use the deduction/downgrade system not impression!

ALWAYS START WITH PERFECT 10 ...
As the pilot starts!

Then

9.5...9...8.5...8...7.5...7...6.5...6...5.5...5... etc..

A mark resulting from downgrading steps must not be upgraded again in any case, ie. because the manoeuvre contained „something nice“!
QUALITIES OF A GOOD JUDGE...

CONSISTENCY

JUDGING ACCURACY

IMPARTIALITY

QUALITIES OF A GOOD JUDGE...

CONSISTENCY

JUDGING ACCURACY

IMPARTIALITY
Judging ACCURACY

Downgrade by up to 1 point for a minor defect
Downgrade by up to 2 points for a larger defect
Downgrade by 3, 4, 5, more points for major defect

Do NOT downgrade 4 points for a minor defect
Do NOT downgrade 1 point for a major defect
CONSISTENCY

Minor defect on manoeuvre  3 = score 9,5 ✓
Minor defect on manoeuvre  7 = score 9,5 ✓
Major defect on manoeuvre  9 = score 4 ✓
Major defect on manoeuvre 11 = score 4 ✓
Minor defect on manoeuvre 12 = score 6,5 ✖
Major defect on manoeuvre 15 = score 9 ✖

(Scores must be in the same range, for similar defects)
## Maintain Your Standard!

<table>
<thead>
<tr>
<th>Pilot</th>
<th>1st Value</th>
<th>Difference</th>
<th>2nd Value</th>
<th>Difference</th>
<th>3rd Value</th>
<th>Difference</th>
<th>4th Value</th>
<th>Difference</th>
<th>5th Value</th>
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<td>480</td>
<td>-1.2</td>
<td>495</td>
<td>+8.8</td>
<td>477</td>
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<td>464</td>
<td>+1.0</td>
<td>482</td>
<td>+19.0</td>
</tr>
</tbody>
</table>
A judge must not, under any circumstances, favour a competitor, or a national team, or a particular flying style, or brand of equipment, or propulsion method.

Defects by “Celebrity-Competitors” must be downgraded the same way as with “Average-Competitors”

Judges must only look at the lines of manoeuvres described in the sky.
Conversely, acts of **negative bias** towards a competitor, or a national team, or a flying style, or brand of equipment, or a propulsion method, must be viewed in a serious light, and **corrective action** may be necessary.
ARESTI SYSTEM

Please become familiar with Aresti symbols used in F3 Aerobatics.

- Beginning of flight
- End of flight
- Start of manoeuvre
- End of manoeuvre
- End of manoeuvre with exit higher than entry
- End of manoeuvre with exit lower than entry
- Upright flight (positive G)
- Inverted flight (negative G)
- 90 degree angle (1/4 loop)
- 45 degree angle (1/8 loop)
- 135 degree angle (3/8 loop)
- 180 degree angle (1/2 loop, reversal)
- Cuban 8 (1/8 loop and 5/8 loop)
- Stall turn
- One full roll (aileron roll, slow) Arrow always curved in direction of flight
- Half roll
- 1 ½ roll
- 1 ½ rolls, reversed
- Two consecutive half rolls
- Two consecutive quarter rolls
- Four consecutive quarter rolls
- Two consecutive one eighth rolls
- Negative G snap roll on inverted flight
- Two positive snap rolls in opposite directions
- 1 ½ positive G snap roll
- Knife-edge flight
ARESTI SYSTEM

- Inside loop (positive G)
- Outside loop (negative G)
- ¾ outside loop (Figure 9)
- Loop with negative snap (Avalanche)
- Loop with four consecutive quarter rolls over top 90 degrees
- Rolling loop (roll is integrated with entire loop)
- Upright spin (positive G, inside)
- Inverted spin (negative G, outside)
- 1 ½ inverted spin (negative G, outside)
- Two upright spins, opposite (positive G, inside)
- Humpty bump (centre manoeuvre)
- Humpty bump (turnaround manoeuvre)
- Cross box manoeuvre (Inverted top hat shown without rolls)
- Rolling circle (with three rolls to the outside)
- Inverted rolling circle (with one roll to the inside)
- Connector lines between manoeuvres
Devices for entering scores

Score input without scribe

Electronic Scribe by Peter Vogel/USA

+ No scribes needed.
+ Scores input directly to the computer.
+ Live scoring is possible.
- Very experienced judges needed, especially with unknown schedules.
- Somebody who knows the system must be present, if problems with network occur.

Notaumatic/FRA

Bartovsky System/CZE, similar to Krawiesen system by O. Hajek/AUT

Escribe from Switzerland

Electronic Scribe

Notaumatic/FRA

Escribe from Switzerland

Bartovsky System/CZE, similar to Krawiesen system by O. Hajek/AUT
CRITERIA FOR JUDGING INDIVIDUAL MANOEUVRES

(Method)
The flight path of a model aircraft is the trajectory of its centre of gravity. The attitude is the direction of the fuselage centreline in relation to the flight path. If not otherwise stated, all judging is based on flight path.
All manoeuvres are required to be wind corrected. The exceptions to this criterion are in the snap-rolls, stall turns, and spins, where the model aircraft is in a stalled condition.

Flight path of model aircraft must describe correct geometric shape when viewed from the judges position.
As a guide for downgrading deviations from the defined manoeuvre geometry, the manoeuvres are divided into their different components:

- Lines, loops, rolls, snap-rolls, horizontal circles,
- Line/loop/roll/horizontal circle combinations,
- Stall turns, and spins.

GEOMETRICAL ACCURACY
OF THE MANOEUVRE
1 POINT PER 15° DEVIATION

1 point must be subtracted for each approximate 15 degrees deviation, but 0.5 points only for half of this.

Perfect geometry = No downgrade

Wings level - roll axis

Horizontal lines - pitch axis

Approximate 15° deviation = 1 point downgrade

Approximate 30° deviation = 2 points downgrade

Approximate 45° deviation = 3 points downgrade
Approximate 15° deviation = 1 point downgrade
Approximate 30° deviation = 2 points downgrade
Approximate 45° deviation = 3 points downgrade

Perfect geometry = No downgrade

Vertical lines - pitch axis

Vertical lines - yaw axis

0.5 point downgrade for approximated 7.5 deviation,
1.5 points downgrade for approximate 22.5 deviation, …
In general, lines must be judged more critically than deviations in yaw and roll.

Reason: Lines can be evaluated easier than roll and yaw.
5B.8.3 All aerobatic manoeuvres are entered and exited by a horizontal line of recognisable length.

When no horizontal line is flown between two manoeuvres, the just-completed manoeuvre must be downgraded by 1 point and the upcoming manoeuvre must be downgraded by 1 point.

All lines within a manoeuvre have a start and an end which define their length. They are preceded and followed by part loops (or part circles).

The length of a line should only be graded when a manoeuvre contains more than one line with a given relationship to each other ie as in a square loop.

If there is a minor deviation in the relationship then 0.5 point is subtracted, and more points are subtracted for greater deviations.
Minor mis-relation between line lengths = minus 0,5 point!

No line between manoeuvres... = minus 1 point here... and minus 1 point here!

Line after and Before roll = not equal... up to minus 2 points!

No line after roll... = minus 3 points!

(This example maybe minus 2 or 3!)
LOOPS
The first radius of a manoeuvre does not define the radii for the remaining radii of a manoeuvre but it is a starting point. As the manoeuvre progresses, the judge will compare each radius that was just flown to the last radius flown and if there is a difference, then a downgrade will be given based on the severity of the difference.

- Each segmentation... minus 0,5 point!
- This = minus 2 points!
- All part-loop radii equal.
- Minor misrelation... minus 0,5 point!
- Radius too tight
Part loops must have a recognisable radius which must not be too tight (very high G-load) or too loose (a well-defined line between the part loops is not clearly recognisable). If part loops are performed too tight or too loose, up to one point must be deducted.
Rolls

(Continuous Rolls and Part-Rolls)
Rolls
(Continous Rolls and Part-Rolls)

**Continous Rolls:** Continuous rolling 360 degrees and more.

**Part-Rolls:** Rolling less than 360 degrees.

The roll-rate must be constant. Minor variations in roll-rate must be downgraded by 0.5 point, while more severe variations must receive a downgrade of 1 or more points. Slowing down (or speeding up) the roll-rate towards the end of a roll must be downgraded using the 1 point per 15 degree rule.
In all manoeuvres which have more than one continuous roll, the continuous rolls must have the same roll-rate. In all manoeuvres which have more than one part-roll, the part-rolls must have the same roll rate.

Where there are continuous rolls and part-rolls within one manoeuvre, the roll-rate for the part-rolls does not necessarily have to be the same as the roll-rate for the continuous rolls.

This doesn't apply to integrated rolls and integrated part rolls because roll rate depends on the length of the flightpath in which the roll or the part roll is integrated.
The roll-rate of the first continuous roll or part roll of a manoeuvre does not define the roll-rate for the remaining continuous rolls or part rolls of a manoeuvre but it is a starting point. As the manoeuvre progresses, the judge will compare the roll-rate of each continuous roll or part roll that was just flown to the roll-rate of the last flown continuous roll or part roll and if there is a difference, then a downgrade will be given based on the severity of the difference. In a manoeuvre with both continuous rolls and part rolls the two types of rolls must be considered separately for roll rate deviations.
The start and stop of the rotation must be crisp and well-defined. If a start or stop is badly defined, 0.5 or more points are to be subtracted for each.
Between consecutive continuous rolls and part-rolls in opposite direction there must be no line!

Roll rate of part-rolls may be different to roll rate of continuous rolls.

Not equal length of lines between part-rolls up to minus 1 point for each!

Different roll rate... up to minus 1 point!

If, in the manoeuvre description of a roll combination, the roll direction is not specified, then the rolls must go in the same direction.

Between consecutive continuous rolls and part-rolls in opposite direction there must be no line!
Missing or additional Part-Rolls: Use the 1 point per 15° rule

• 1 missing ½ roll: (180 degrees) = Zero points
• 1 missing ¼ roll: (90 degrees) = - 6 points
• 1 missing 1/8 roll: (45 degrees) = - 3 points
• the same deductions apply with additional part-rolls
You first pull into a 45° upline, then at mid level you start to perform a full roll with the flight path going around a horizontal cylinder in a spiral (as the thread of a screw in a 45° pitch).
A SNAP ROLL is basically a spin in the horizontal axis.

The model aircraft rolls rapidly, with a continuous high angle of attack (positive or negative).

The tail should describe a corkscrew path.
SNAP ROLLS

“BREAK” here

FLIGHT PATH (centre of gravity) must be level

Separation of fuselage attitude from flight path
SNAP ROLLS

NEGATIVE SNAP ROLL —

POSITIVE SNAP ROLL +

In the F3A schedules snap rolls may be positive or negative!
SNAP ROLLS, DOWN (and UP)

NEGATIVE SNAP = DOWN elevator

POSITIVE SNAP = UP elevator

NEGATIVE SNAP = DOWN elevator
Barrel roll or axial roll instead of snap roll:
downgrade more than - 5 points
Spotters say:

If it is not a BARREL ROLL...

...and it's not an AXIAL ROLL...

...then it's probably...

A SNAP ROLL!
Torque - Rolls

The model aircraft is hovering in a vertical attitude and in a fixed position at no flying speed.

Absence of a hover must be zeroed.

Otherwise torque - rolls are judged the same way as axial rolls.
Horizontal circles are performed in a horizontal plane and mostly used as centre manoeuvres. Horizontal Part Circles are mostly part of a manoeuvre.

Circles and Part Circles within a manoeuvre must have the same radius.

Each occurrence of a minor deviation in radius must be downgraded by 0.5 point, while more severe deviations may be downgraded by 1, 1.5, 2 or more points for each occurrence.
Horizontal Circles and Part Circles

- Constant high or low altitude
- Circular flight path maintained
- Continuous rolling, at constant rate
- Rolls positioned correctly
- Any reversals to be immediate
$45^\circ$ Plane circles are performed on a $45^\circ$ plane and mostly used in centre manoeuvres.

$45^\circ$ Plane Part Circles are mostly part of a manoeuvre.

They are judged with same criteria as Horizontal Circles and Part Circles. As they are not horizontal they cannot be judged by constant altitude.
May be AWAY from competitor...

OR...

...towards competitor.
Rolling Circles

Second roll to inside

With one roll to outside, and one roll to inside

Reversal is immediate

Constant Roll rate

At 90° position of circle

At 270° position of circle

First roll to outside
Line/Loop/Roll/Horizontal Circle
COMBINATIONS

Whenever a continuous roll, part-roll, snap roll, or a consecutive combination of these is placed on a line, the length of the line before and after the roll or the combination of consecutive rolls must be equal. 0.5 point is subtracted for a minor difference, and 1 or more points for a major difference. If there is a complete absence of a line before or after the roll, 3 points are subtracted.
Line/Loop/Roll/Horizontal Circle COMBINATIONS

There is nothing about the length of the lines between the part loops in the Sporting Code!

SINGLE IMMELMANN

1/2 roll before completing 1/2 loop...
...use 1 point/15 degree downgrade!

1/2 roll directly after 1/2 loop

Double IMMELMANN

1/2 roll before 1/2 roll...
up to minus 2 points!

1/2 roll directly after 1/2 loop

Radii are equal
Line/Loop/Roll/Horizontal Circle COMBINATIONS

SQUARE LOOP ON CORNER

All lines 45°.
All lines equal length

1/4 loop
Radii all equal

Rolls in middle of lines

1/8 loop entry and exit

3/4 loop

1/2 roll on middle of line
Radii equal

1/4 loop

FIGURE 9

Line/Loop/Roll/Horizontal Circle COMBINATIONS

COMBINATIONS
Line/Loop/Roll/Horizontal Circle COMBINATIONS

GOLF BALL

1/8 loop
3/4 loop
Radii equal

1/8 loop
1/8 loop

1/2 roll on middle of line
45° DOWN

Radii equal

Rolls on middle of the lines, but not necessarily in the centre of the manoeuvre.
Line/Loop/Roll/Horizontal Circle COMBINATIONS

HUMPTY BUMP

- 1/4 loop
- 1/2 loop
- Radii not equal!
- Loop not round
- Straight flight here... downgraded!
- Loop not round
- VERTICAL 8 (Note shape: loops are barely touching)
Line/Loop/Roll/Horizontal Circle COMBINATIONS

LOOPS WITH INTEGRATED ROLLS

Rapid rolls MUST score less. This example = minus 4 for non-integration of roll

Rolls or part rolls integrated with loop

Loops must be ROUND!
STALL TURNS

Pivot on CG... no downgrade!

Up to ½ span radius of pivot... minus 1 point!

Up to one wing span radius... minus 2/3 points!

More than 1½ span radius but less than two minus 4/5 points!

Roll on middle of line... no downgrade!

Roll not on middle of line... minus 1 point!

Pendulum after stall... minus 1!

Roll not on middle... minus 1 point!

Over 15° off vertical... minus 2 points!

No line before roll... minus 3 points!

The model must stop before pivot. If not, downgrade.
STALL TURNS

“Skid” or “no stop” before reaching Stall position…

Wing-over... ZERO!

Wing-over = 2 wing spans or more.

Torque-off... 1pt/15 degree downgrade

Flop forwards, or backwards... ZERO!

Drift of the model aircraft during the stalled condition must be ignored, provided the model aircraft does not drift outside the manoeuvring zone.

Minus 1 point!
Drift caused by wind as the model slows and stops prior to, during and after the pivot must not be downgraded.
SPINS

Level entry

Nose-up attitude increases model aircraft is close to stall

Stall... nose and wing drops... rotation starts

Model aircraft spins around CG

Nose-up attitude

STOP, with no over- or under-spin

Vertical (wind corrected) downline after spin

If wind compensation (yaw) with a crosswind is necessary this is maintained before the spin. Drift caused by wind must not be downgraded as the model slows before, during and after the spin. The wings must be maintained level before and after the spin.

Level entry

Nose-up attitude increases model aircraft is close to stall

Stall... nose and wing drops... rotation starts

Model aircraft spins around CG

Nose-up attitude

STOP, with no over- or under-spin

Vertical (wind corrected) downline after spin

If wind compensation (yaw) with a crosswind is necessary this is maintained before the spin. Drift caused by wind must not be downgraded as the model slows before, during and after the spin. The wings must be maintained level before and after the spin.
No penalty for drifting with wind close to stalled condition.

Severe yawing (rotation with wing level) before stall has to be downgraded by 1 point per 15 degrees with ½ point steps.

No penalty for wind compensation.
No penalty for drifting with wind close to stalled condition.

Direction of wind:

Direction of flight:
Wing lift (snap entry)...ZERO!

Forced with down-elevator... minus 4 or 5!

Climbing... downgrade, using 1pt. per 15 degrees!

Spiral dive...scores ZERO!
The model aircraft shall maintain a constant flight speed throughout the various manoeuvre components; for example, in climbing and descending sections.

For significant differences up to one point is subtracted.
Manoeuvres should be primarily performed along a line of flight approximately 150m.

Exceptions to this rule are cross-box manoeuvres, 3D - manoeuvres, or manoeuvres in a stalled condition, as well as the horizontal circle manoeuvres which, of necessity, must deviate from the 150m distance of flight.
5B.10: “Manoeuvres on a line greater than 175 m MUST BE DOWNGRADED”

The main criterion is visibility!
LONGITUDINAL POSITIONING

- more than 200 m: minus 2 to 3 points
- 175 m-200 m: minus 1 point
- 140 m-175 m: OK

120°

150 m

300 m

LONGITUDINAL POSITIONING
Manoeuvres out of box here, are penalised more...

...than manoeuvres out of box here.

Manoeuvres positioned here not penalised
VERTICAL POSITIONING (Height)

More than 60 degrees use 1 Point per 15° Rule
A centre manoeuvre must be flown so that it is centred on the centre line indicated by the centre flag.

The centre of a centre manoeuvre is in the middle between vertical limits left and right.

If the manoeuvre is flown off-centre, it must be downgraded according to the misplacement. This may be in the range of 0.5 to 4 points subtracted. The centre of a centre manoeuvre is in the middle between vertical limits left and right.

Exceptions need to be noted in the manoeuvre description.
Size of the Manoeuvre

The size of a manoeuvre is scored by its matching size relative to the size of manoeuvring zone and the relative size of the other manoeuvres performed throughout the schedule.

For mis-matching size up to 1 point downgrade.
Proportion of the manoeuvre outside of the manoeuvring zone

Box markers are indicators only.

Do not downgrade unnecessarily!
Proportion of the manoeuvre outside of the manoeuvring zone

No downgrade (positioning only) (Entire manoeuvre = inside box marker)
Proportion of the manoeuvre outside of the manoeuvring zone

2 points downgrade
(20% of manoeuvre = outside)
Proportion of the manoeuvre outside of the manoeuvring zone

5 points downgrade (50% of manoeuvre = outside)
No downgrade
(Entire manoeuvre = inside box marker)
Proportion of the manoeuvre outside of the manoeuvring zone

3 points downgrade for positioning. (30% of manoeuvre = outside box marker)
How to prepare as a judge?

• Know your schedule(s)!!
  – Like you would fly it yourself or even better
  – Know where the options are so you won’t be surprised

• Be able to read Aresti quickly as a backup reminder sheet

• Make sure you get regular breaks

• Have some protection with you:
  – Sun
  – Rain
  – Wind

• Bring your own (good) chair, if possible.
SCORE BETWEEN 10 and 0!

(NOT 8,5-7,5-6,5 or 6,5-6-5,5 or 6-5-4!)

Use Deduct/Downgrade System!
EVERY COMPETITOR... STARTS EVERY FLIGHT...

WITH A PERFECT SCORE!
BE CONSISTENT!
BE ACCURATE!
BE IMPARTIAL!
DON’T DISCUSS
FLIGHTS WITH
FELLOW JUDGES
USE N/O
(NOT OBSERVED)

Be **FAIR** to competitors, and yourself!
Remember

Forget **WHO** is flying
   (friend, rival, countryman, flier from other nation)

Forget **WHAT** is flying
   (2-stroke, 4-stroke, electric, contra-drive or mono-drive)

LOOK **ONLY** AT LINES DESCRIBED IN THE SKY!
   (and the precision, flying speed, positioning, and size)
What is the game?

• The pilot should do as good as a job as possible to hide errors from the judges

• The judges are there to spot the errors and judge how good the flight appears to be.
Respect each other

- Pilots and judges are all human...
- Humans make errors - pilots and judges
- People who work make errors
- People who work a lot make a lot of errors
- I do not know people who don’t make errors.....

- So, judges are just humans and can get it wrong or sometimes miss something.
Enjoy flying and judging!

A special thank you to Bob Skinner who initiated this presentation.