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.

Principles

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

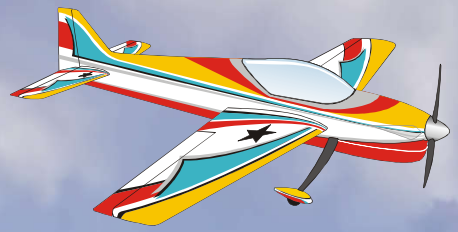
Size Matching to the Size of the Manoeuvring Zone

GENERAL CRITERIA FOR DOWNGRADING MANOEUVRES

“Criteria…are standards by which something can be judged”

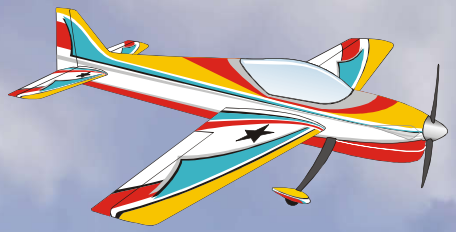
1. WHAT WAS THE DEFECT, or mistake?

- 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.



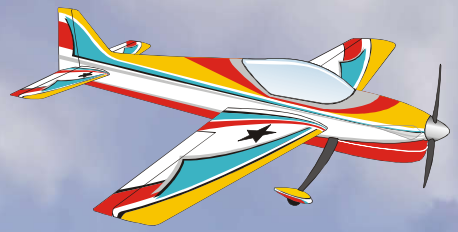
2. HOW SERIOUS was the defect, or mistake?

- Was it big (major)?
- Or was it small (minor)?

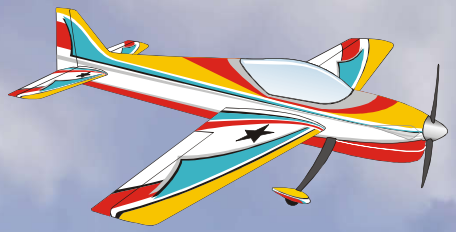


3. **HOW OFTEN** did you see the same defect, or mistake in a particular manoeuvre?

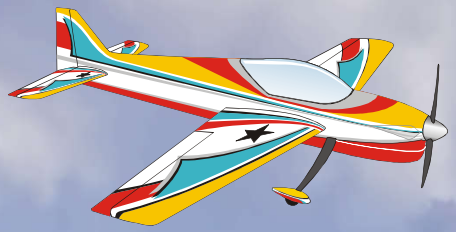
How many defects were there in **TOTAL**?



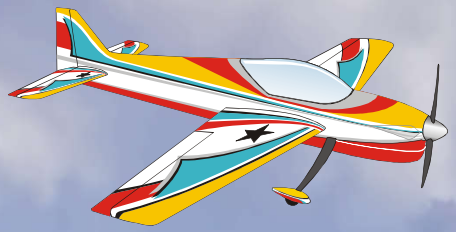
4. Was the Flying Speed constant in climbing and descending parts of the manoeuvre?



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

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!
PILOT 1 480 - 1,2 495 +8,8 477 -4,2 484 +2,8 470 - 11,2
PILOT 2 364 - 14,8 385 +6,2 416 +37,2 374 - 4,8 355 - 23,8
PILOT 3 491 - 2,6 513 +19,4 486 - 7,6 496 +2,4 482 - 11,6
PILOT 4 505 +9,4 502 +6,4 461 -34,6 511 +15,4 491 - 4,6
PILOT 5 460 - 3,0 477 +14,0 432 -31,0 464 +1,0 482 +19

IMPARTIALITY

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”

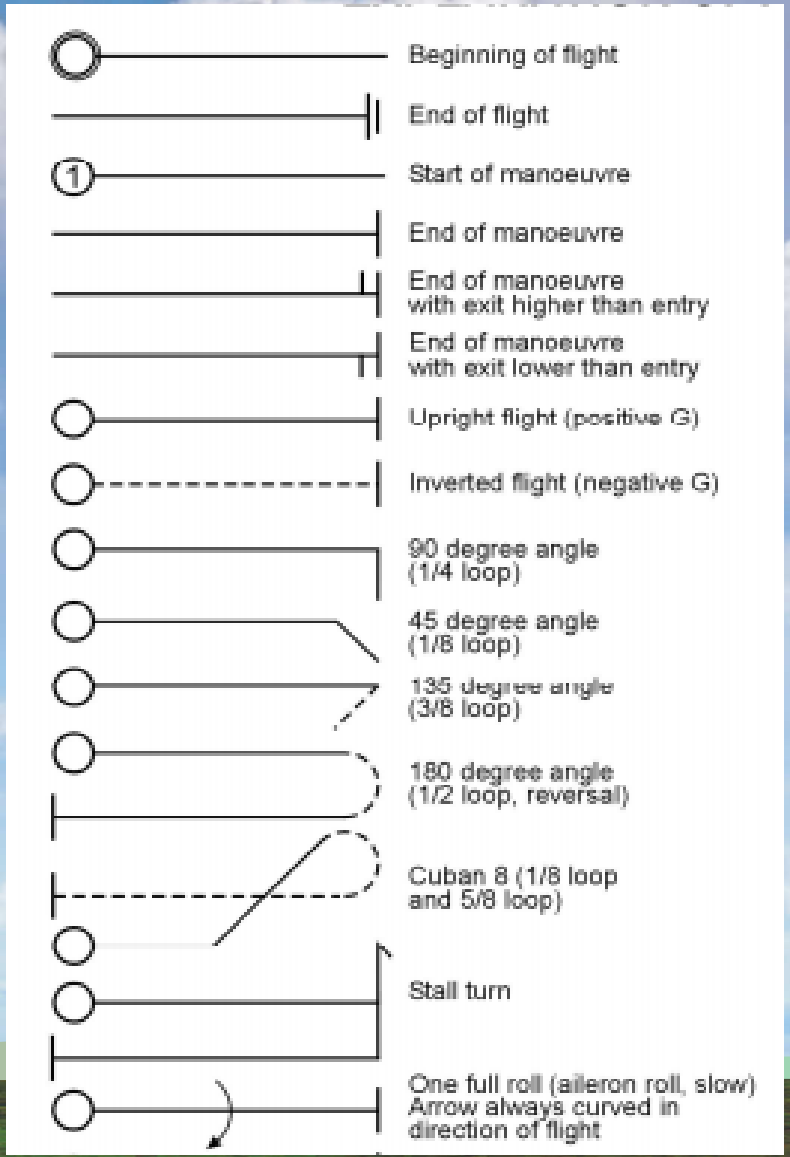
Judges must only look at the lines of manoeuvres described in the sky.

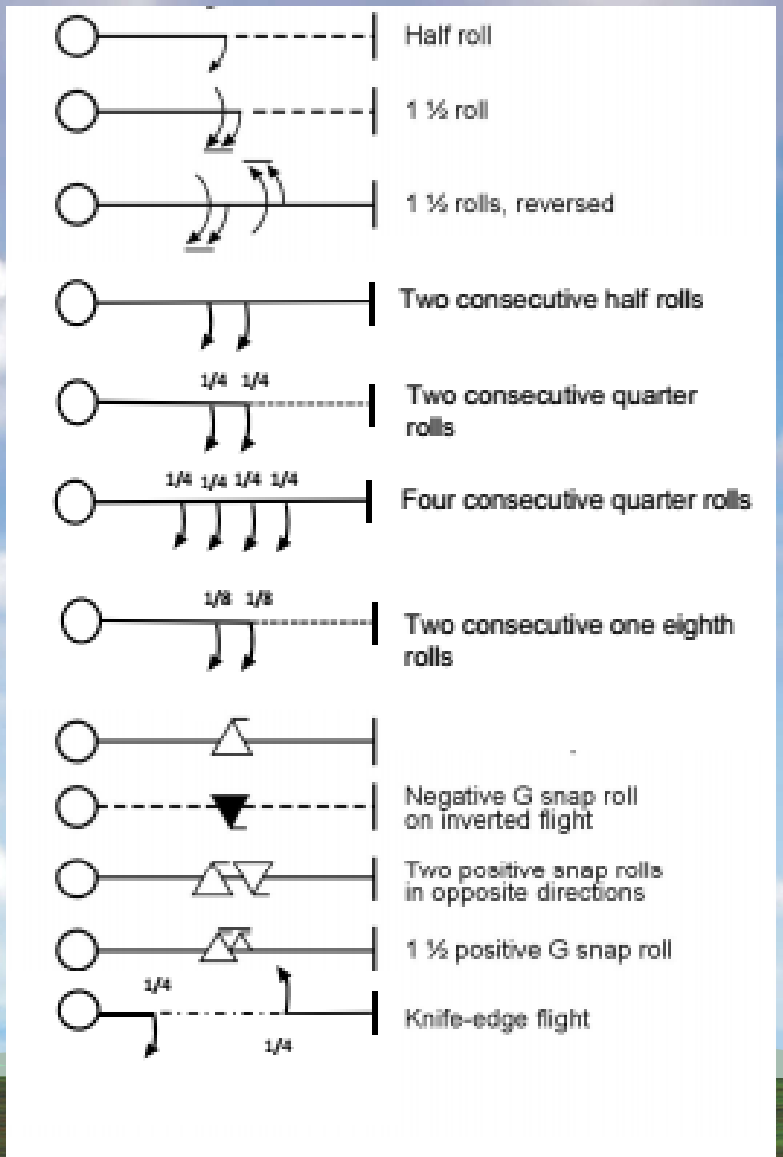
IMPARTIALITY

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.

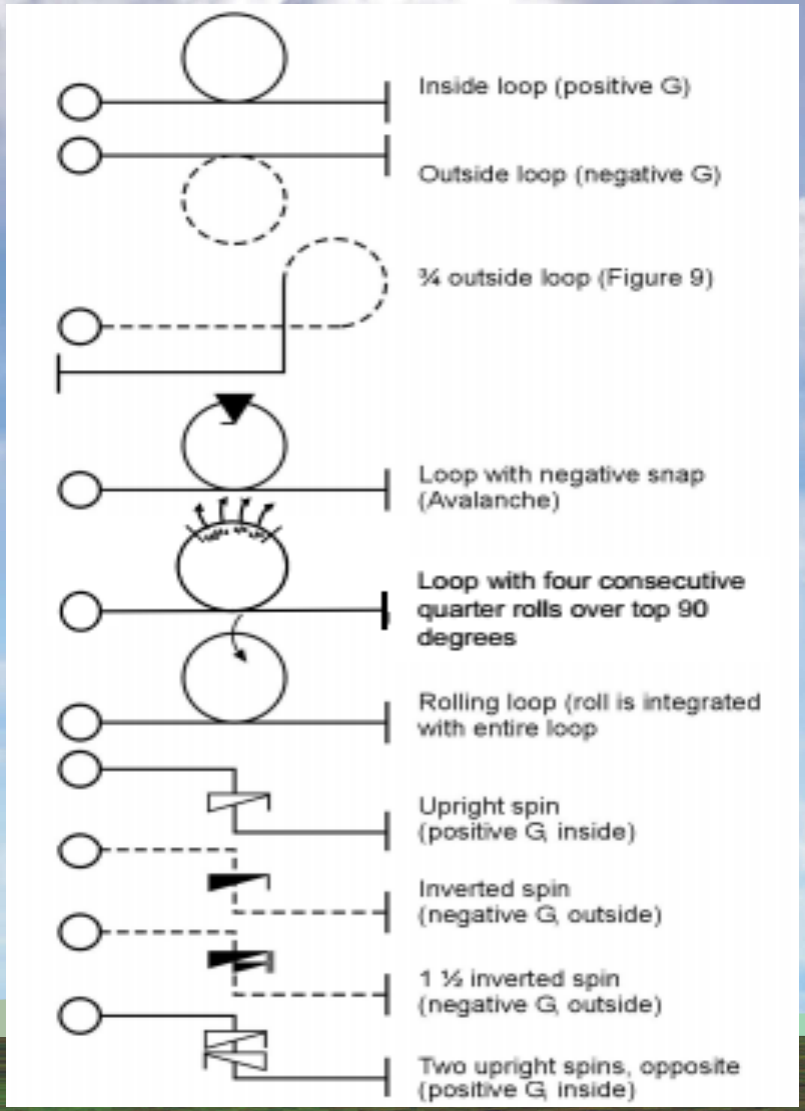
ARESTI SYSTEM

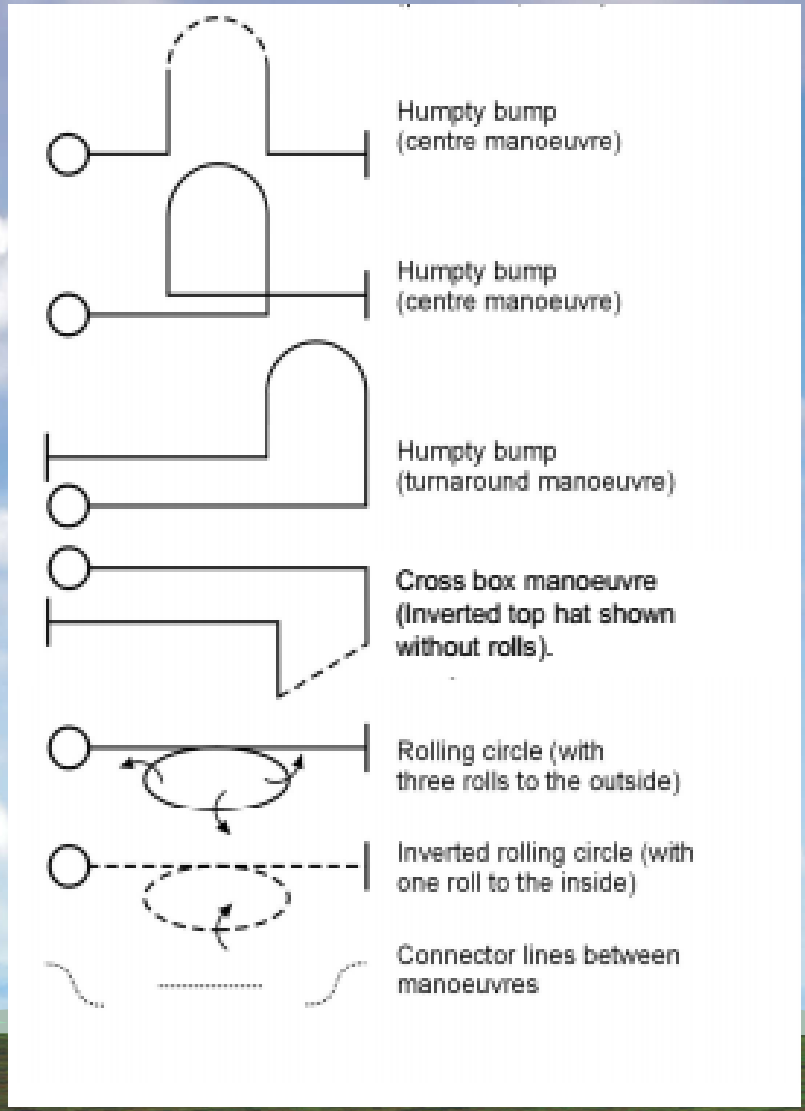
Please become familiar with Aresti symbols used in F3 Aerobatics.





ARESTI SYSTEM





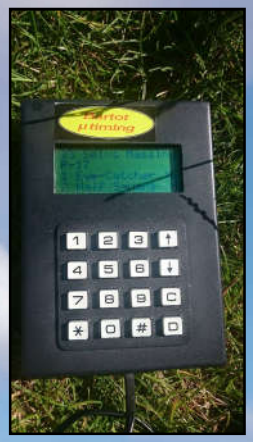
Devices for entering scores

Score input without scribe

Electronic Scribe
by Peter Vogel/USA

Notaumatic/FRA

Escribe from
Switzerland



Bartovsky
System/CZE,
similiar to
Kraiwiesen
system by O.
Hajek/AUT

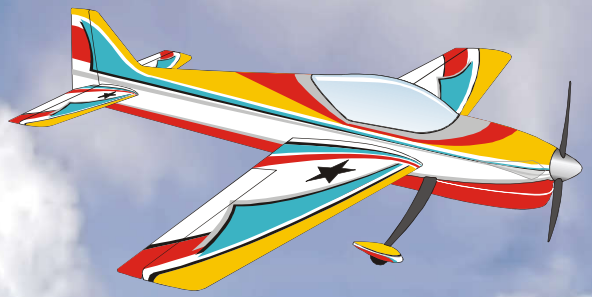
+ No scribes needed.

+ Scores input directly to the computer.

+ Live scoring is possible.

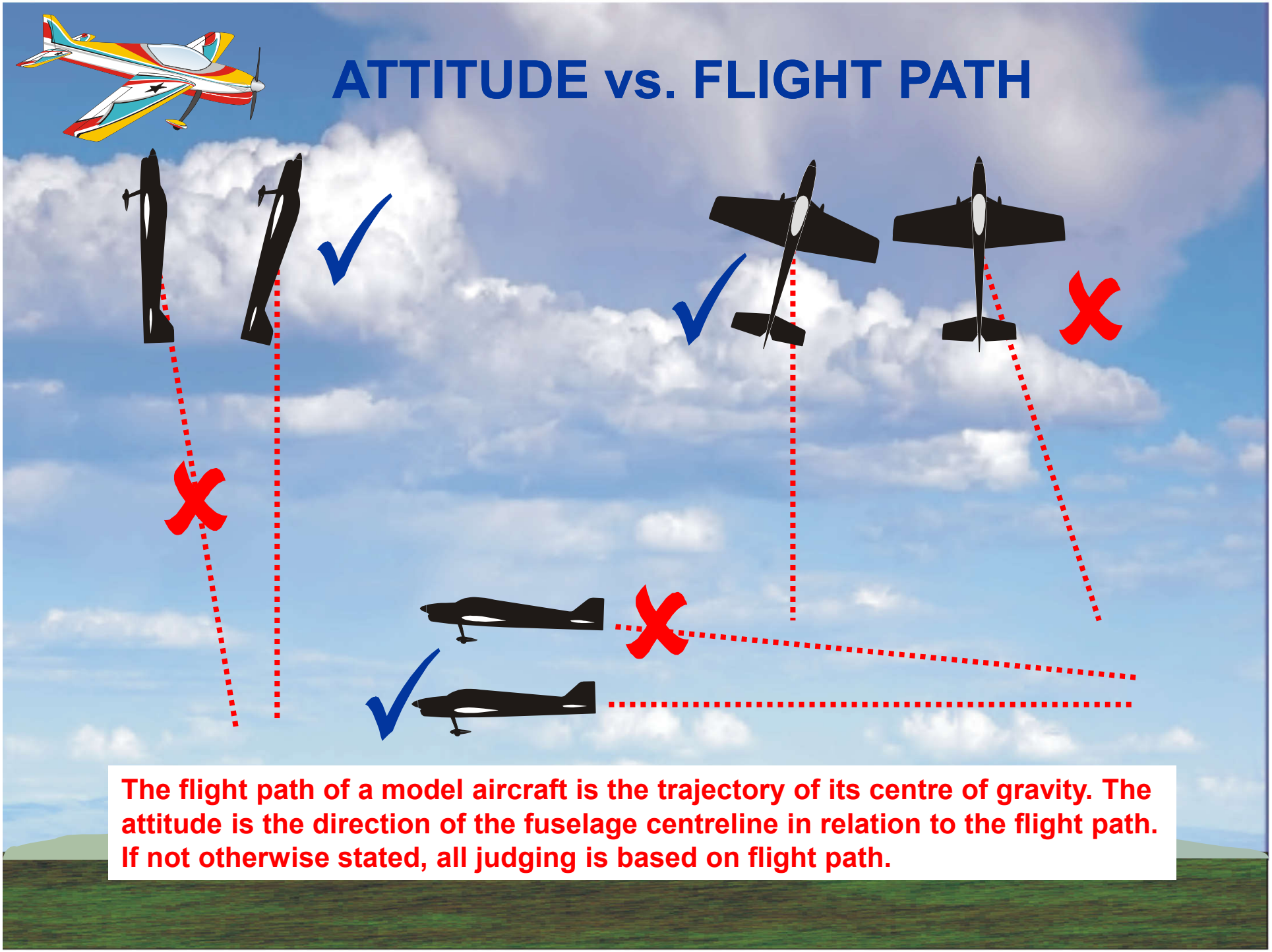
- Very experienced judges needed, especially with unknown schedules.

- Somebody who knows the system must be present, if problems with network occur.



CRITERIA FOR JUDGING INDIVIDUAL MANOEUVRES

(Method)


ATTITUDE vs. FLIGHT PATH
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.

Wind Correction

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.

Fuselage attitude

Flight path

Flight path of model aircraft must describe correct geometric shape when viewed from the judges position.

GEOMETRICAL ACCURACY OF THE MANOEUVRE

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.

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

Approximate 15˚ deviation = 1 point downgrade

Approximate 30˚ deviation = 2 points downgrade

Approximate 45˚ deviation = 3 points downgrade

Wings level - roll axis

Horizontal lines - pitch axis

1 POINT PER 15˚ DEVIATION

Perfect geometry =
No downgrade

Approximate 15˚
deviation =
1 point downgrade

Approximate 30˚
deviation =
2 point^s downgrade

Approximate 45°
deviation=
3 points 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, …

1 POINT PER 15^0 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.

LINES

Horizontal

90°

60°

45°

LINES

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).

<u>The length of a line should only be graded when a manoeuvre contains more than one line with a given relationship to each other</u> 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.

LINES

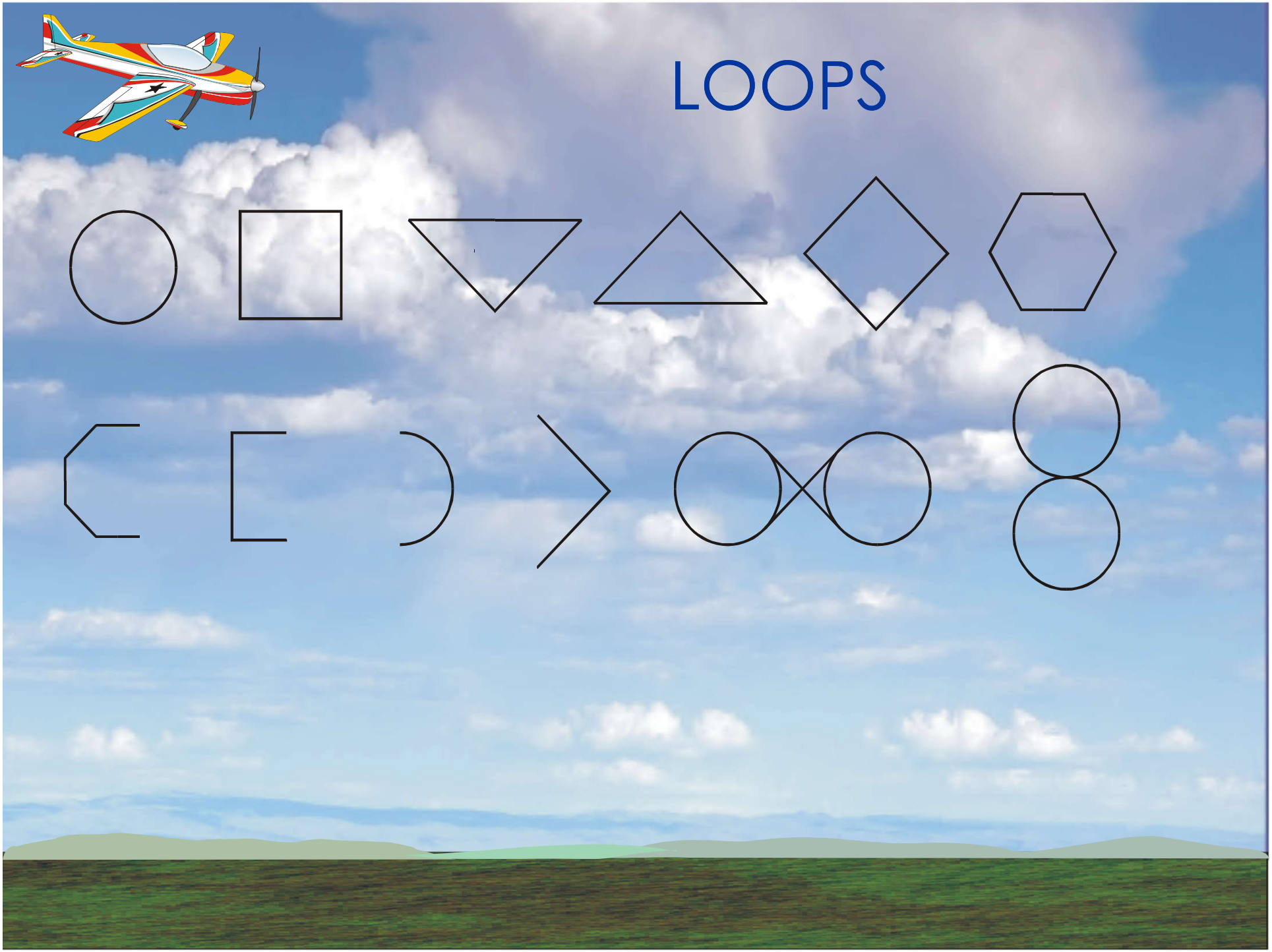
Minor mis-relation between line lengths = minus 0,5 point!

(This example maybe minus 2 or 3!)

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!


LOOPS

LOOPS

All part-loop
radii equal.
Minor mis-relation…
minus 0,5 point!

This = minus 2 points!

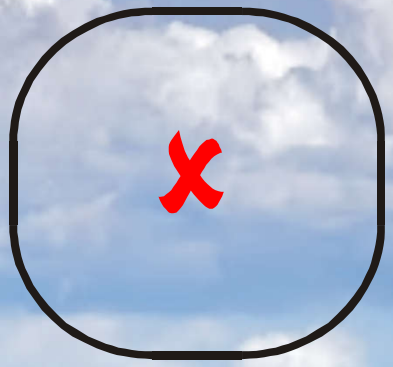
Each
segmentation...
minus
0,5 point!

Radius too
tight

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.

LOOPS

Radii too tight...



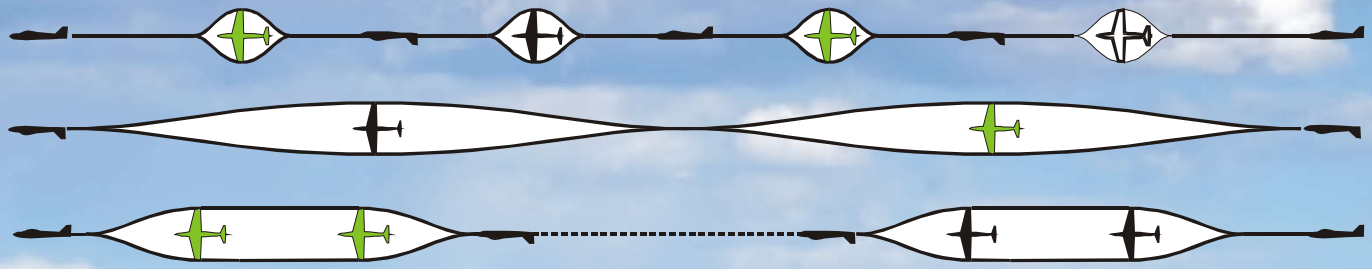
…too open/loose...

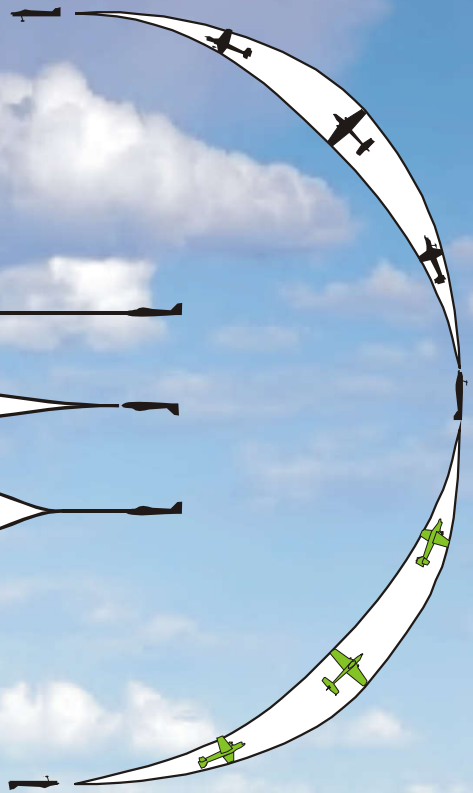
Good compromise!

up to minus 1 point

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
(Continous 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

ROLLS

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.

ROLLS

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.

ROLLS

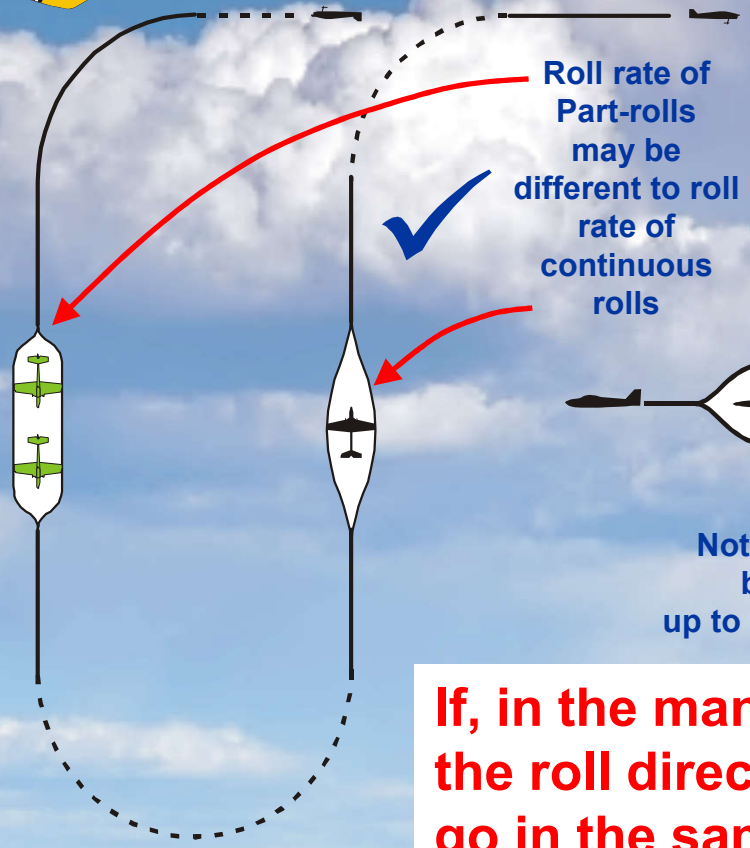
Roll not on middle of line... This example, minus 3 points!

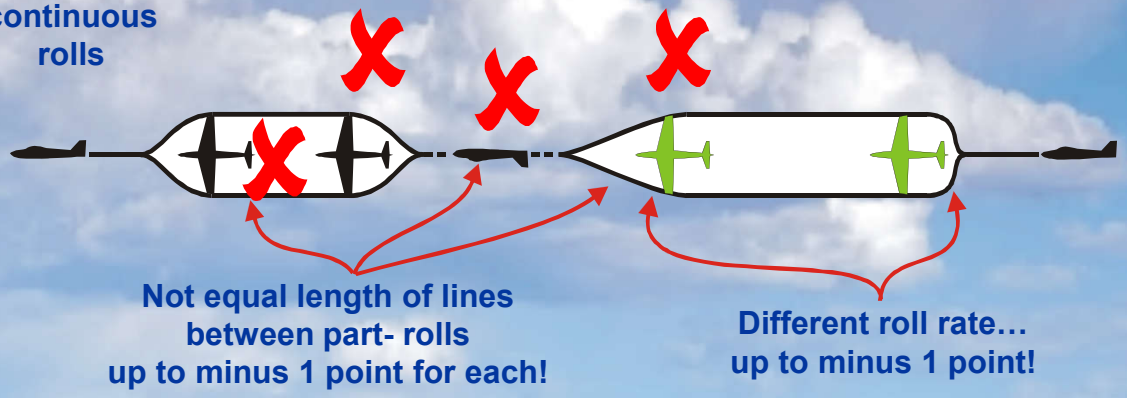
Roll rate not constant (increasing here)… this example minus 3 or 4 points!

Difference in roll rate… up to minus 1 point!

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.

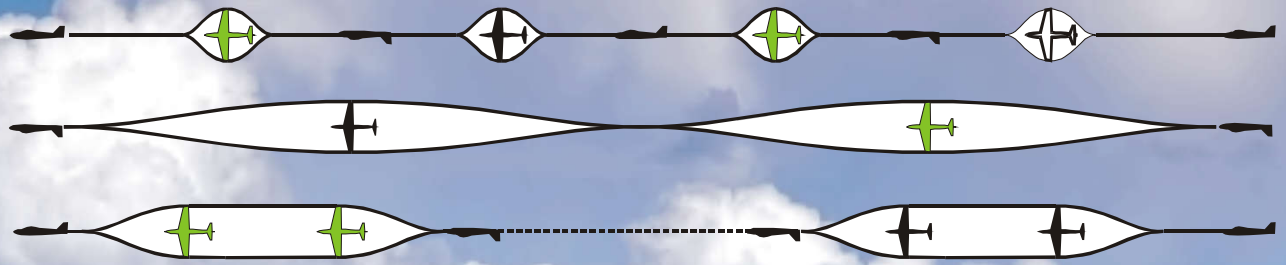
ROLLS





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 continous rolls and part-rolls in opposite direction there must be no line!

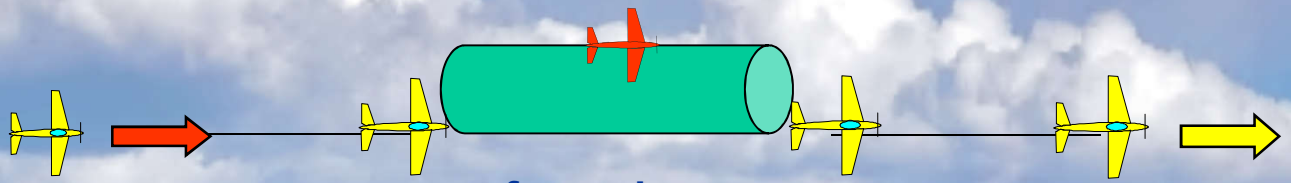


Missing or additional Part-Rolls:
Use the 1 point per 15° rule

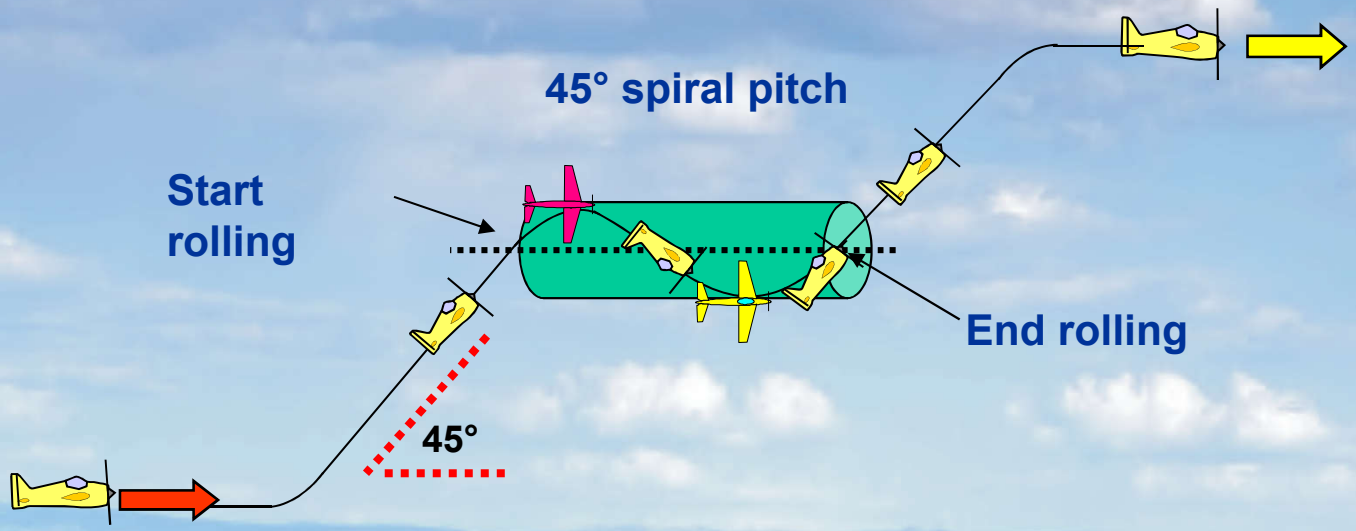
- 1 missing ½ roll: (180 degrees) = Zero points
- 1 missing ¼ roll : (90 degress) = - 6 points
- 1 missing 1/8 roll : (45 degrees) = - 3 points
- the same deductions apply with additional part-rolls

Barrel 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).



from above



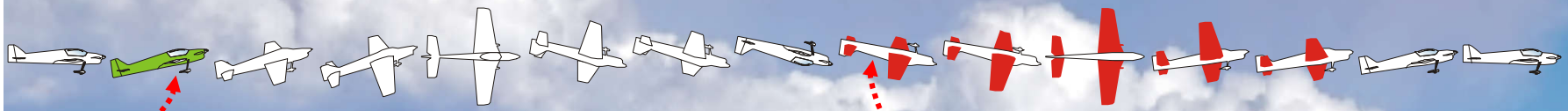
SNAP ROLLS

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

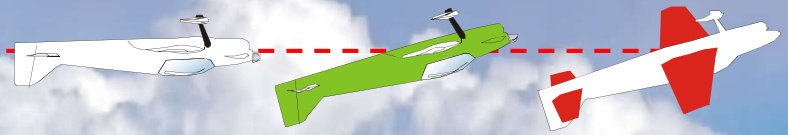
FLIGHT PATH (centre of gravity) must be level

Separation of fuselage attitude from flight path

SNAP ROLLS

NEGATIVE SNAP ROLL

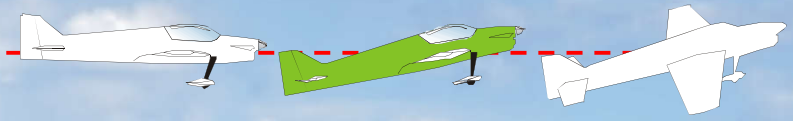
–



DOWN elevator

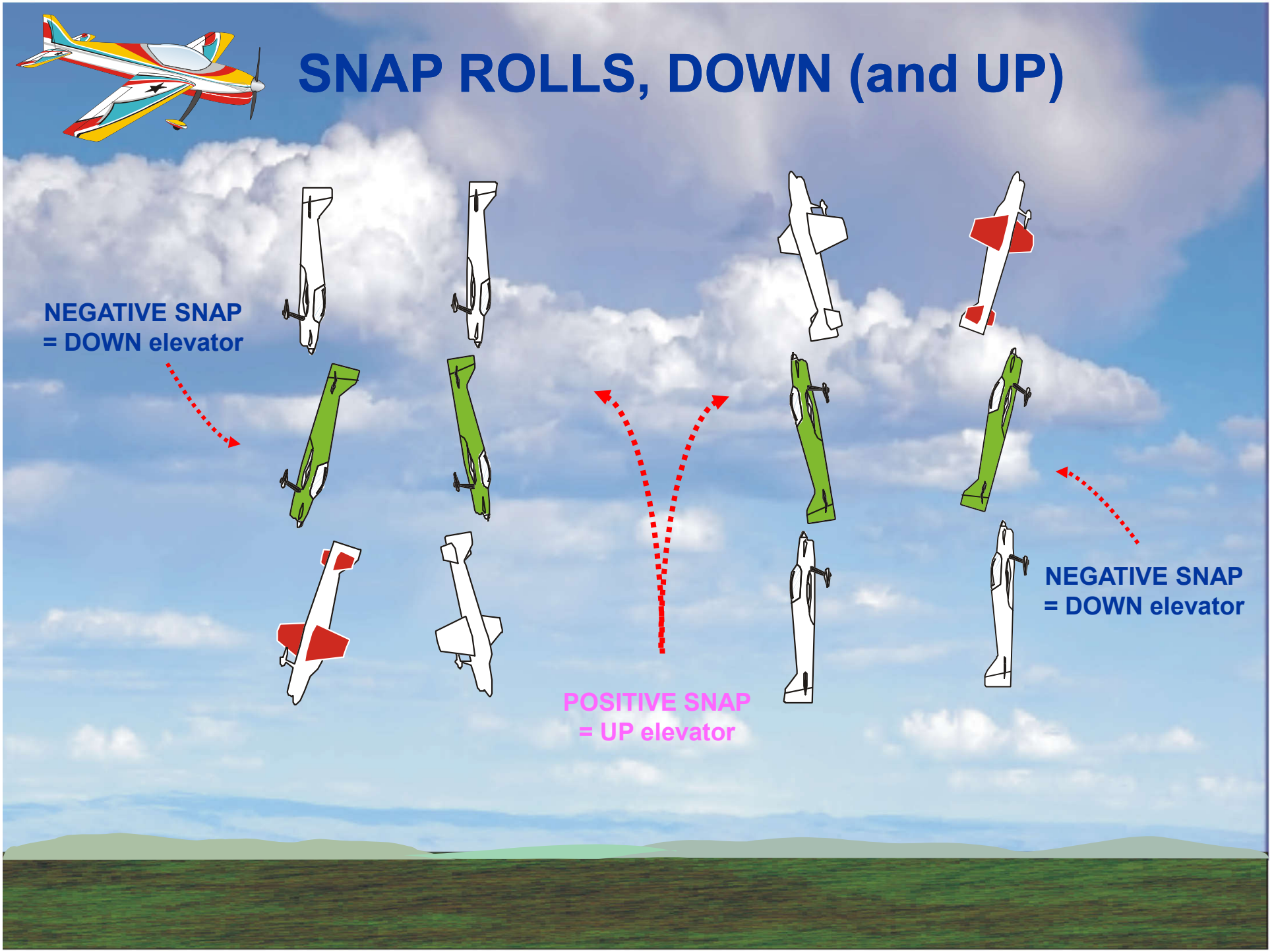
POSITIVE SNAP ROLL

+



UP elevator

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:

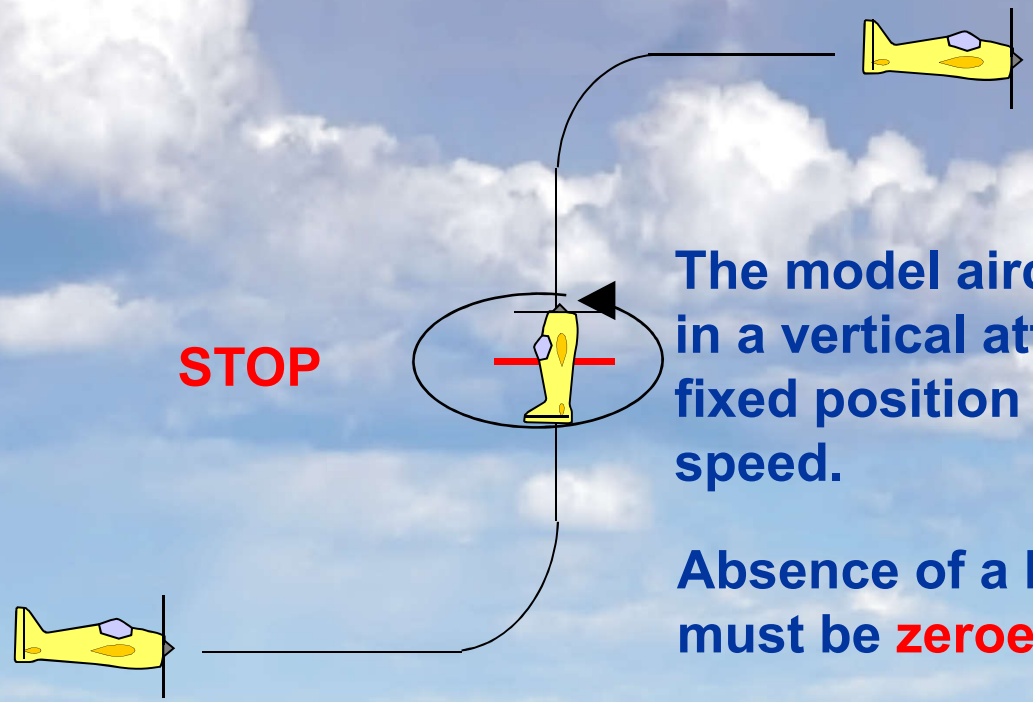
If it is not a BARREL ROLL... ✗

…and it's not an 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 and Part Circles

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.

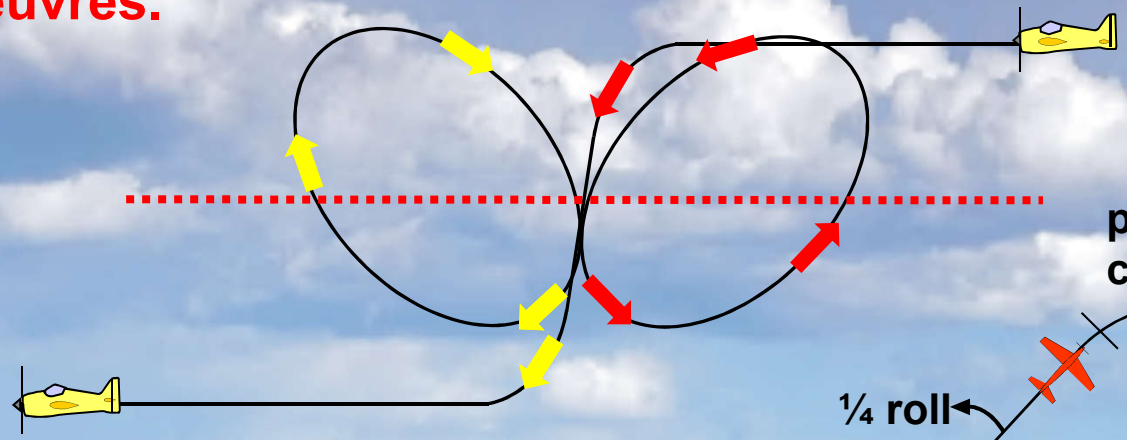
Each occurrence of a minor deviation in radius must be downgraded by 0.5 point, while more severe deviations may downgraded by 1, 1.5, 2 or more points for each occurrence.

Horizontal Circles and Part Circles

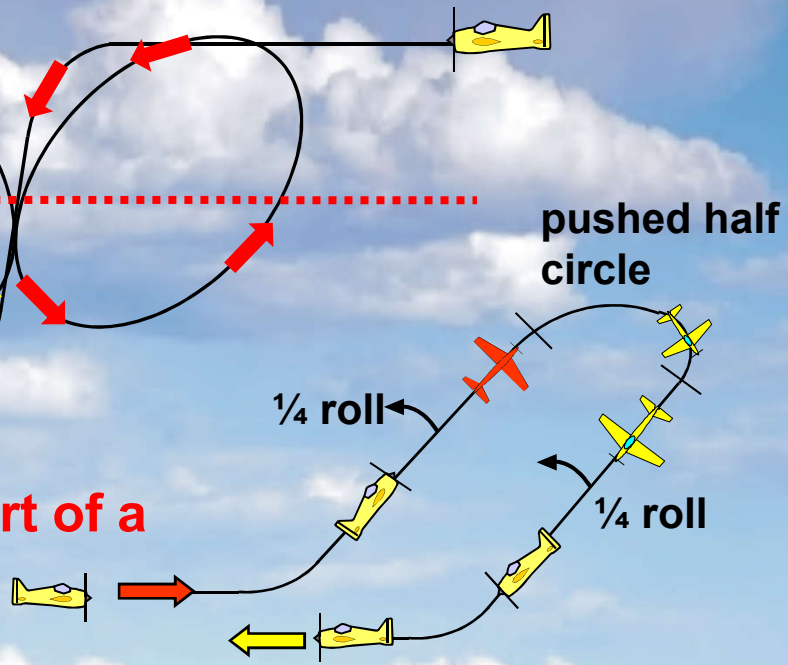
- Constant high or low altitude
- Circular flight path maintained
- Continuous rolling, at constant rate
- Rolls positioned correctly
- Any reversals to be immediate

45° Plane Circles and 45° Plane Part Circles

45° Plane circles are performed on a 45° plane and mostly used in centre manoeuvres.



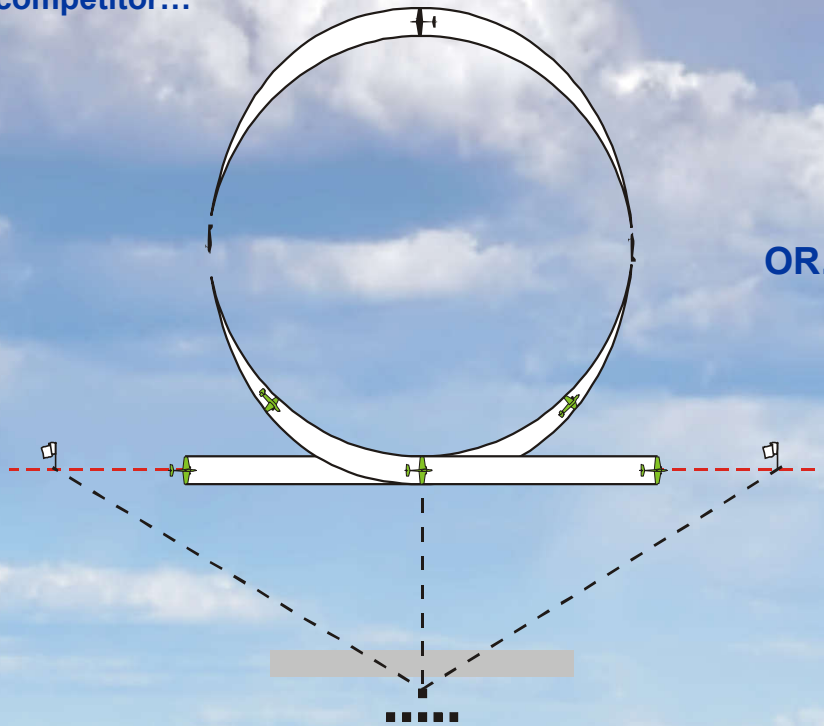
45° Plane Part Circles are mostly part of a manoeuvre.



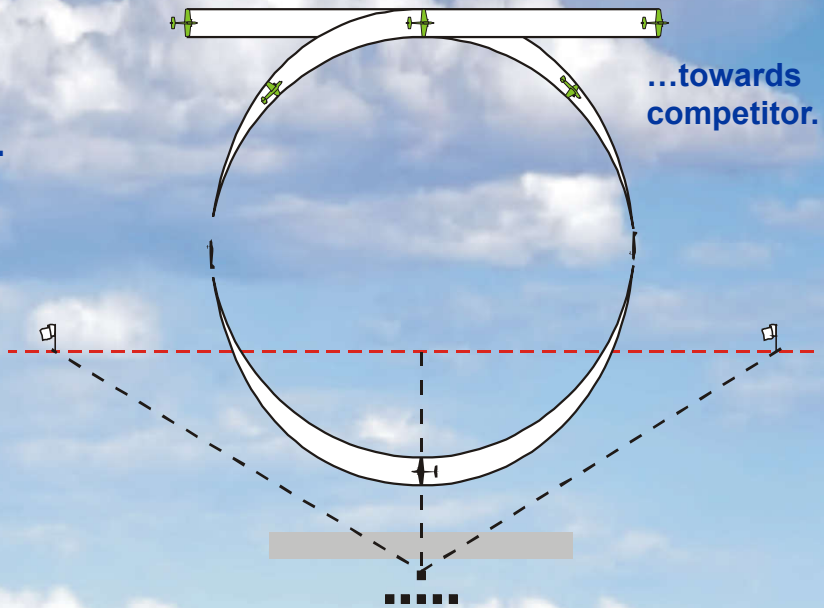
They are judged with same criteria as Horizontal Circles and Part Circles. As they are not horizontal they cannot be judged by constant altitude.

Rolling Circles

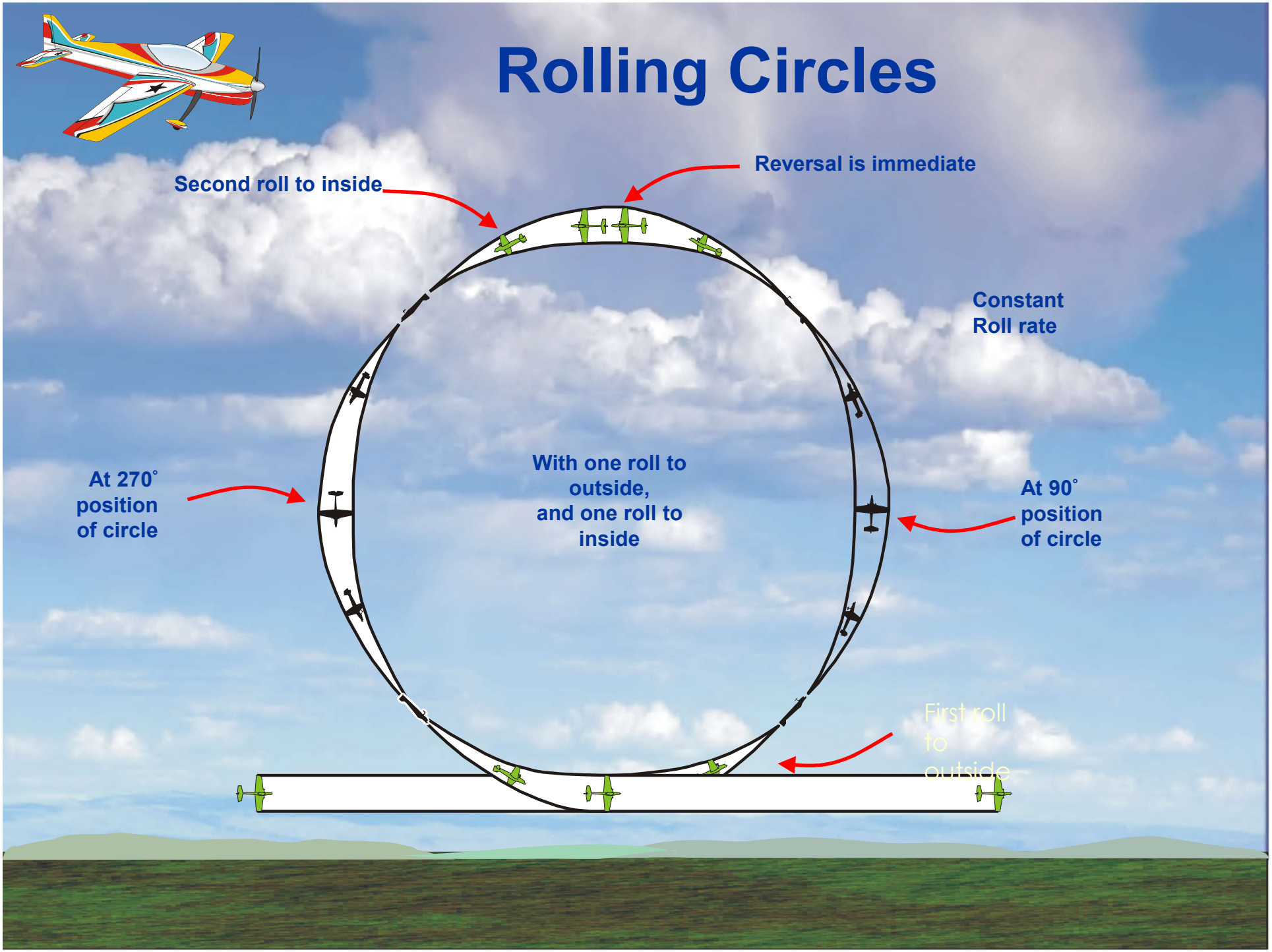
May be AWAY from competitor…



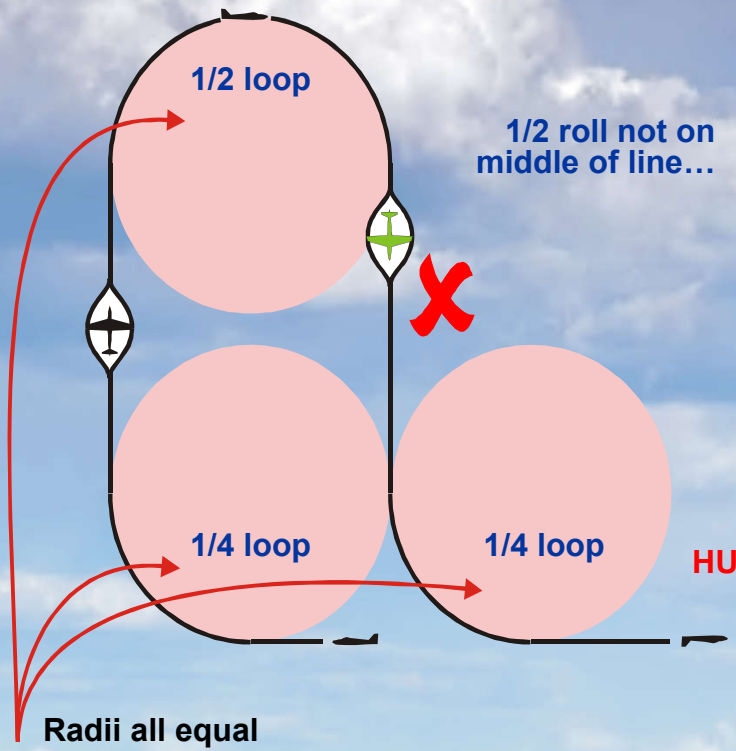
OR…

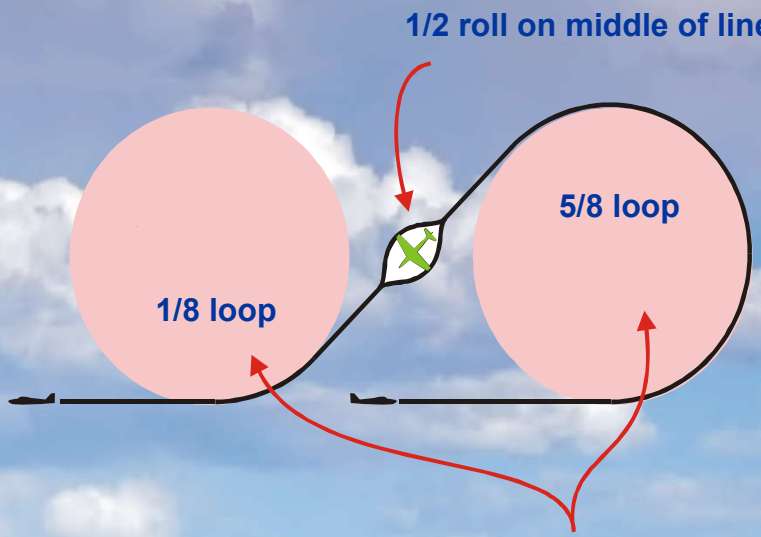


…towards competitor.


Rolling Circles
Reversal is immediate
Second roll to inside
Constant
Roll rate
At 270˚
position
of circle
With one roll to
outside,
and one roll to
inside
At 90˚
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

1/2 roll before completing 1/2 loop…

…use 1 point/15 degree downgrade!

SINGLE IMMELMANN

1/2 roll directly after 1/2 loop

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

Radii are equal

1/2 loop

1/2 loop

Double IMMELMANN

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

1/2 roll directly after 1/2 loop

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

Line/Loop/Roll/Horizontal Circle COMBINATIONS

SQUARE LOOP ON CORNER

All lines 45˚.
All lines equal length

1/4 loop

1/4 loop

Radii all equal

1/4 loop

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

1/8 loop

Radii equal

1/2 roll on middle of line

1/8 loop

45° DOWN

GOLF BALL

3/4 loop

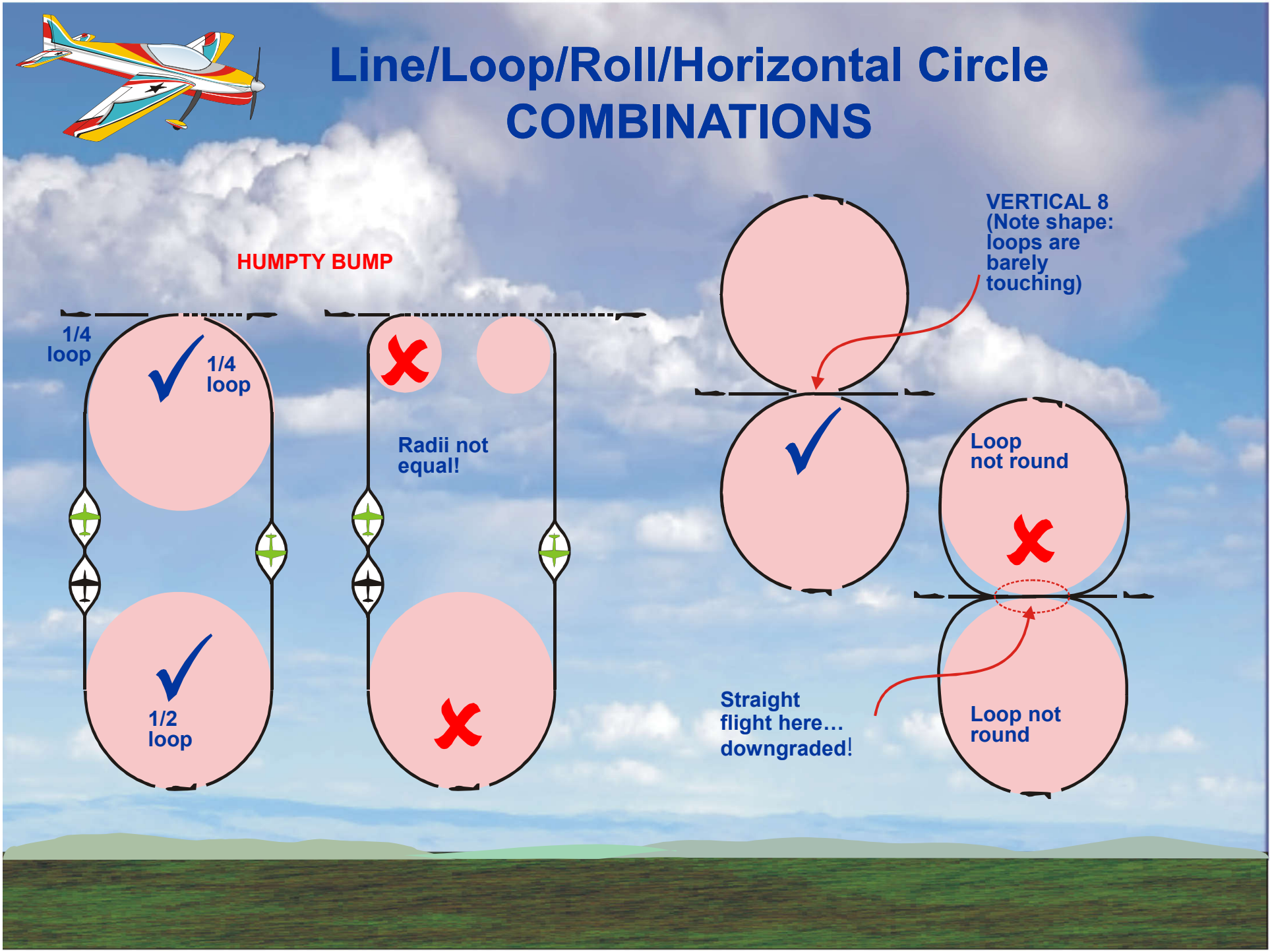
Radii all equal

1/8 loop

1/8 loop

Comet

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
1/4 loop
1/2 loop
Radii not equal!
VERTICAL 8 (Note shape: loops are barely touching)
Loop not round
Straight flight here… downgraded!
Loop not round

Line/Loop/Roll/Horizontal Circle COMBINATIONS

LOOPS WITH INTEGRATED ROLLS

Rolls or part rolls integrated with loop

90°

Loops must be ROUND!

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

15°

15°

STALL TURNS

Pivot on CG…
no downgrade!

Roll on middle of line...
no downgrade!

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

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

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

Pendulum
after
stall...
minus 1!

No line before roll…
minus 3 points!

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

Over 15⁰
off vertical…
minus 2 points!

Roll not on
middle...
minus 1 point!

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

STALL TURNS

"Skid" or "no stop" before reaching Stall position…

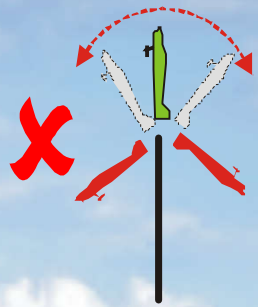
Minus 1 point!

Wing-over… ZERO!

Wing-over = 2 wing spans or more.

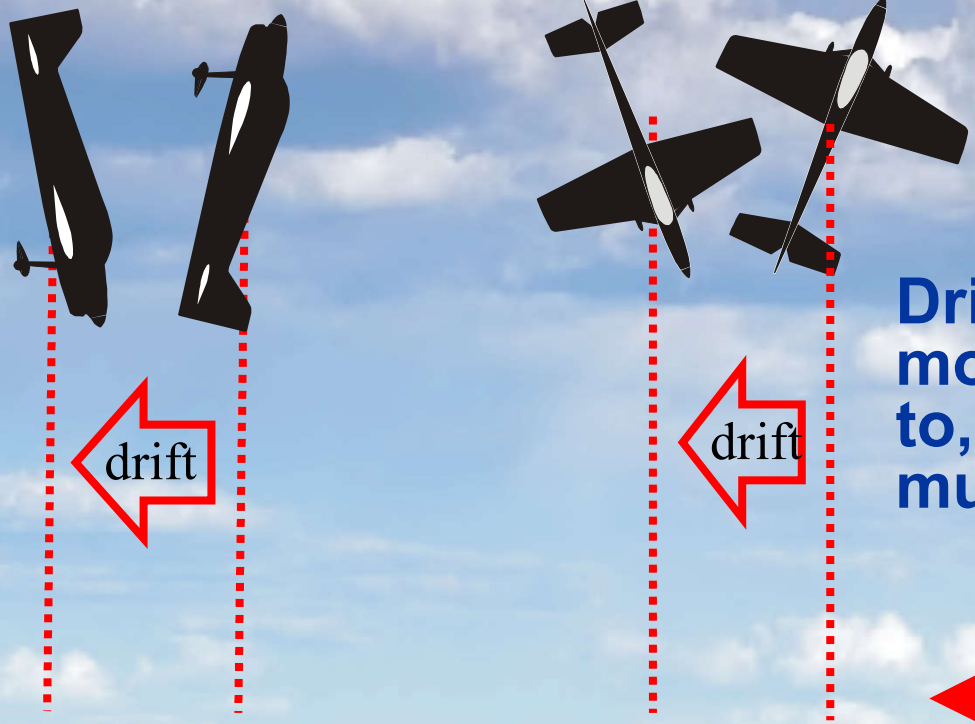
Torque-off… 1pt/15 degree downgrade

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.

WIND COMPENSATION
STALL TURNS



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

Direction of wind

SPINS

Level entry

Nose-up attitude increa-ses model aircraft is close to stall

Stall…
nose and wing drops…
rotation starts

Nose-up attitude

Model aircraft spins around CG

30° to 45°
…minus 3!

15° to 30°
…minus 2!

90° overspin
...minus 6!

Up to 15°
…minus 1!

STOP, with no over- or under-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.

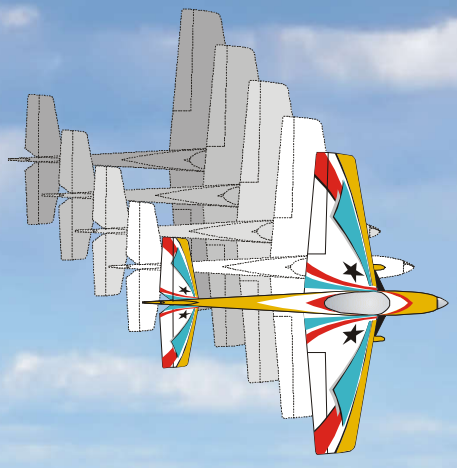
Vertical (wind corrected) downline after spin

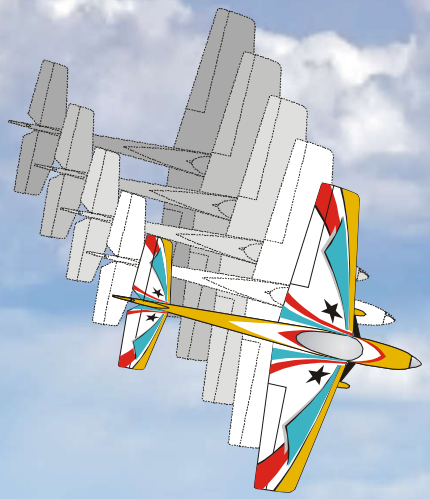
SPIN: DRIFT - YAWING

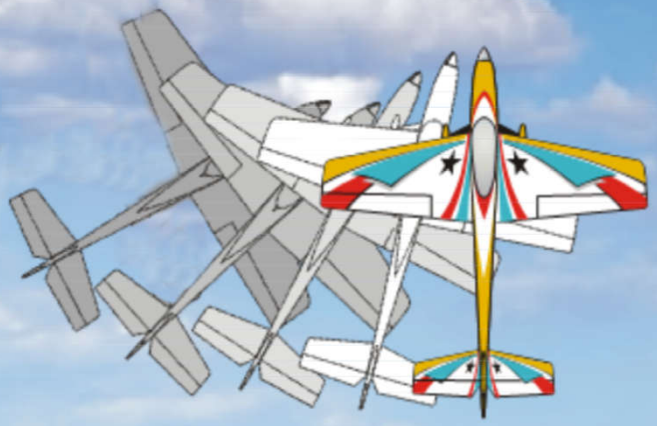
No penalty for wind compensation.
No penalty for drifting with wind close to stalled condition

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 drifting with wind close to stalled condition







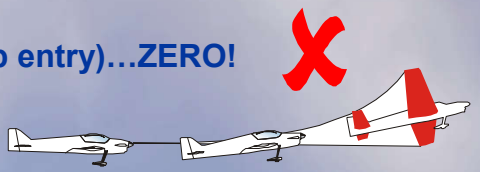
Direction of wind

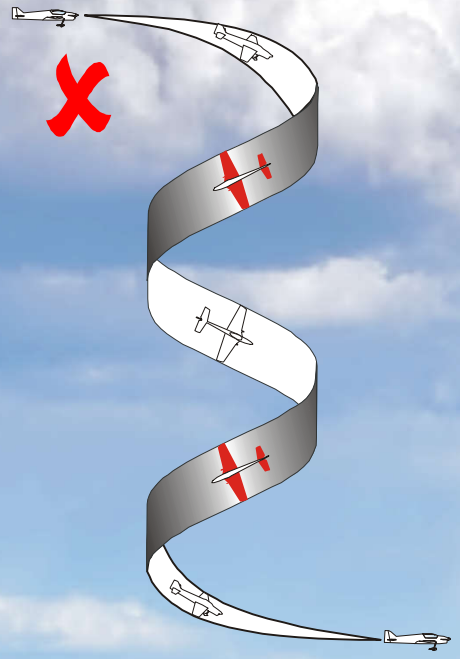
Direction of wind

Direction of flight

SPINS

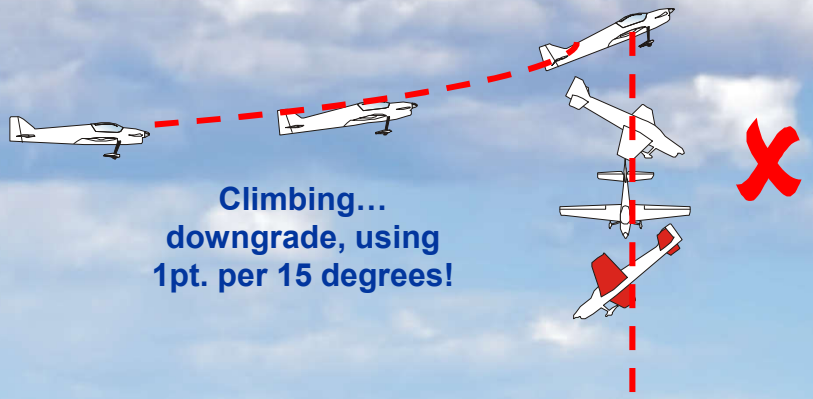
Wing lift (snap entry)…ZERO!





Spiral dive…scores ZERO!

Forced with
down-elevator…
minus 4 or 5!



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

Constant Flying Speed

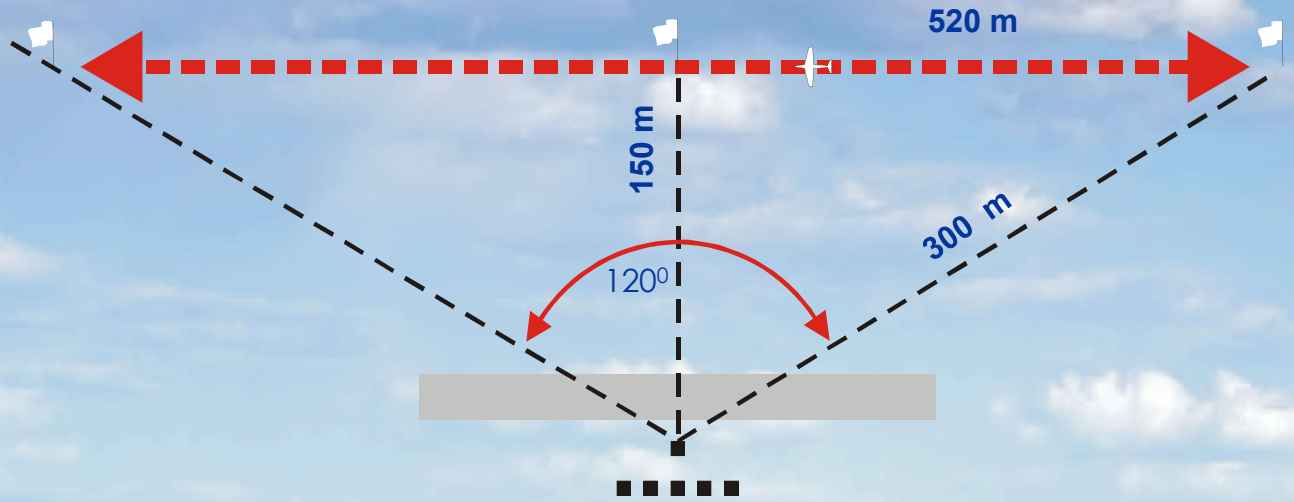
The model aircraft shall maintain a constant flight speed throughout the various manoeuvre components; for example, in climbing and descending sections.

For significant differences up to one point is subtracted.

LONGITUDINAL POSITIONING

Manoeuvres should be primarily performed along a line of flight approximately 150m

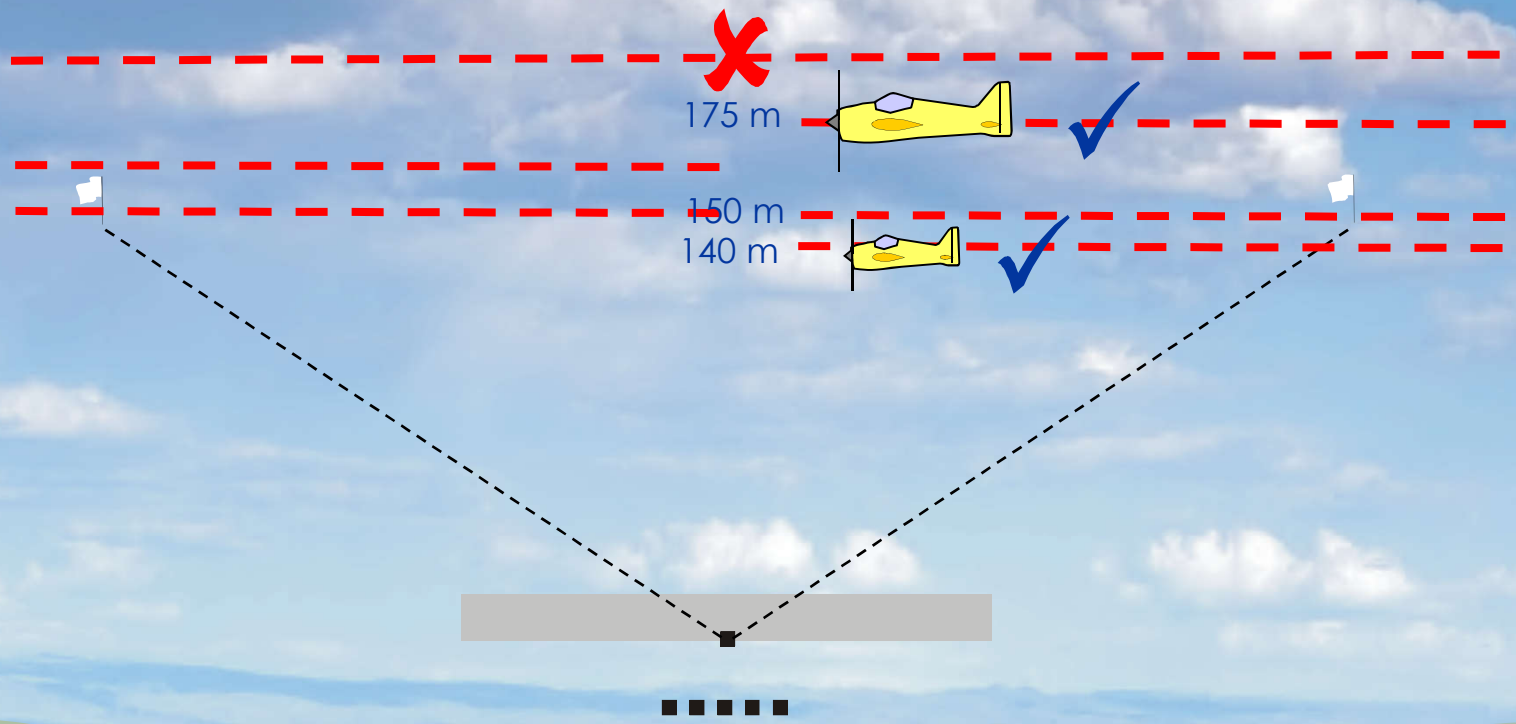
Exceptions to this rule are cross-box manoeuvres, 3D - manoeuvres, or manoeuvres in a stalled condition, as well as the horizontal circle manoeuvres which, of necessity, must deviate from the 150m distance of flight.

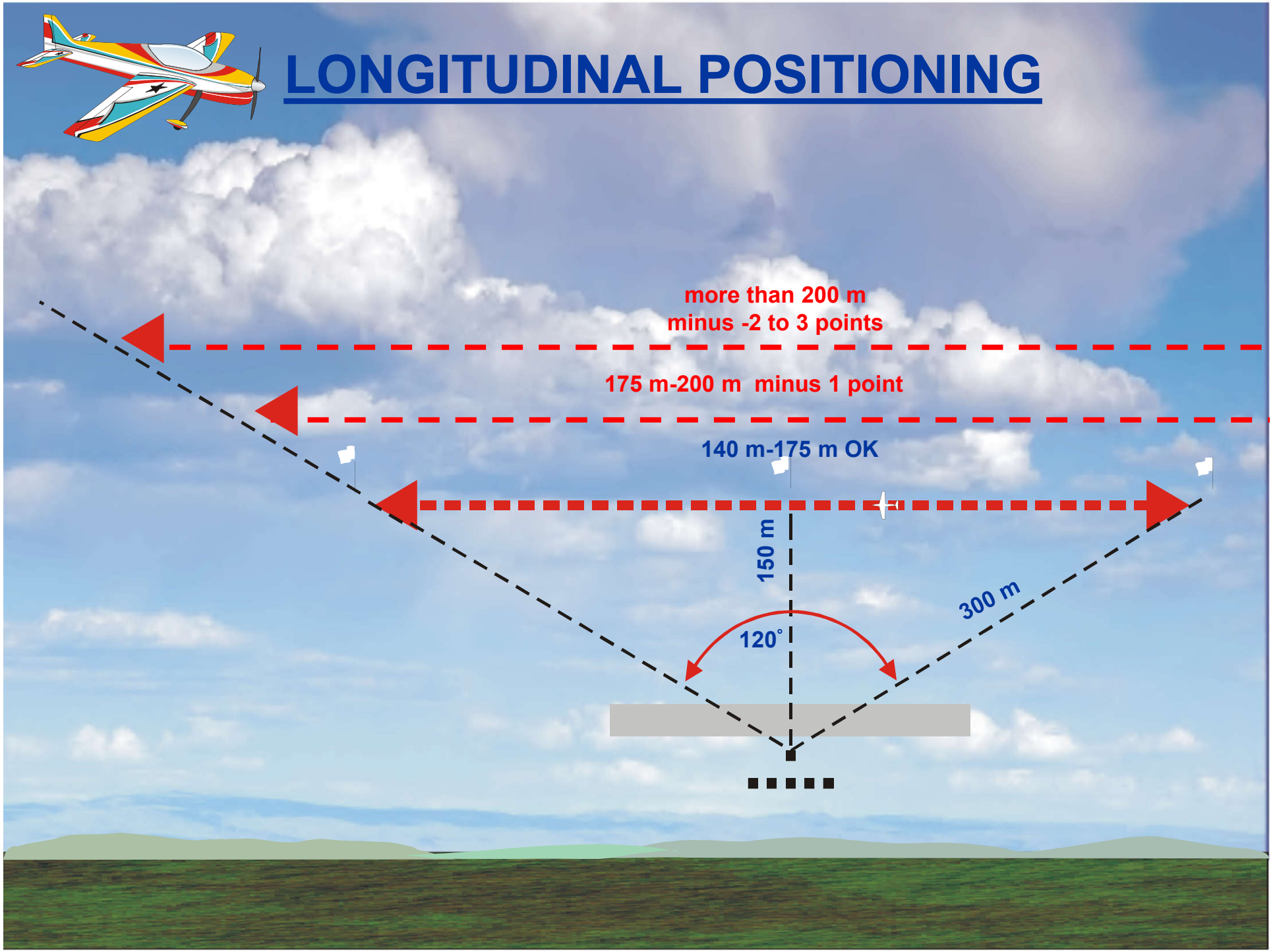


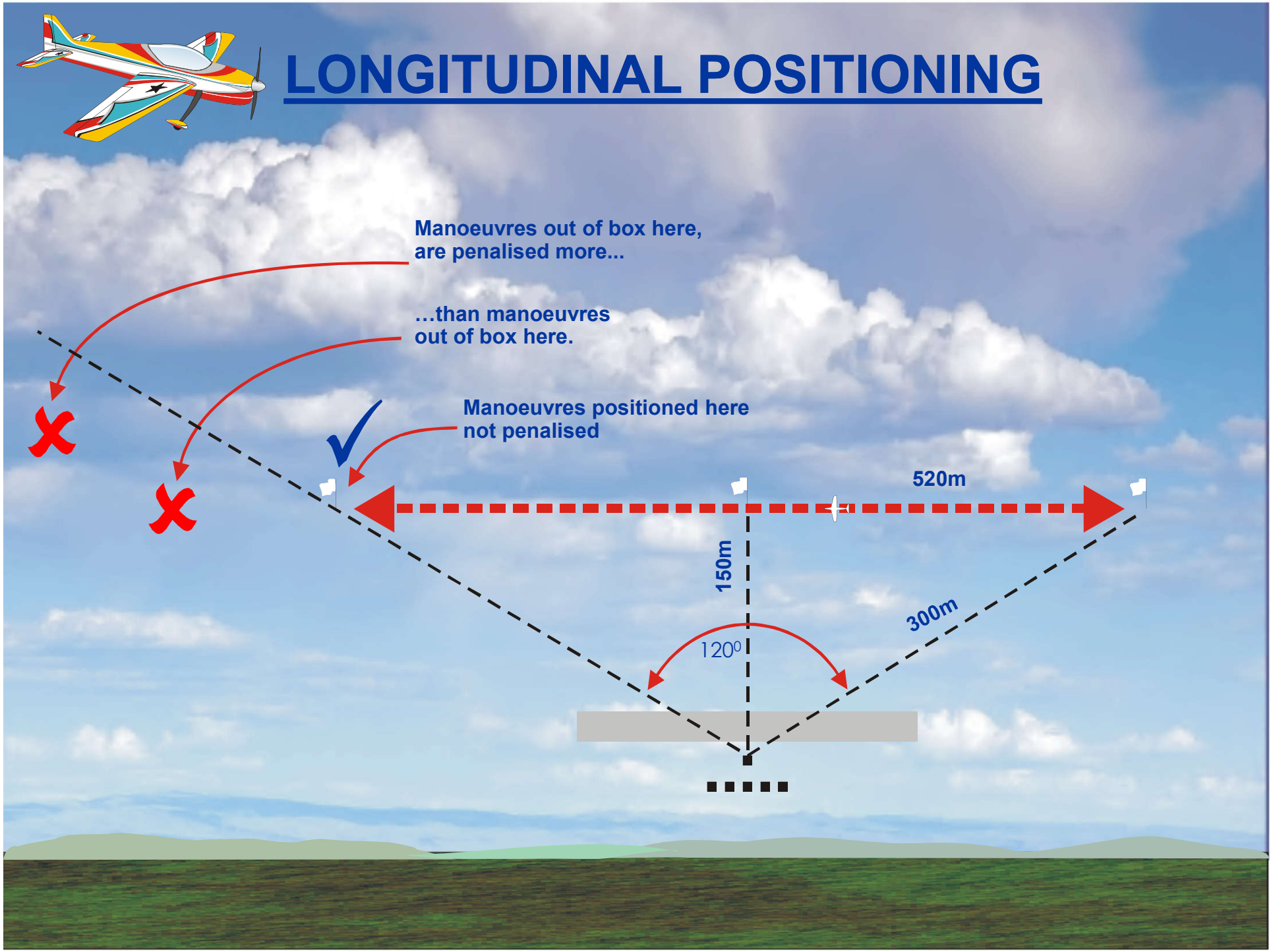
LONGITUDINAL POSITIONING

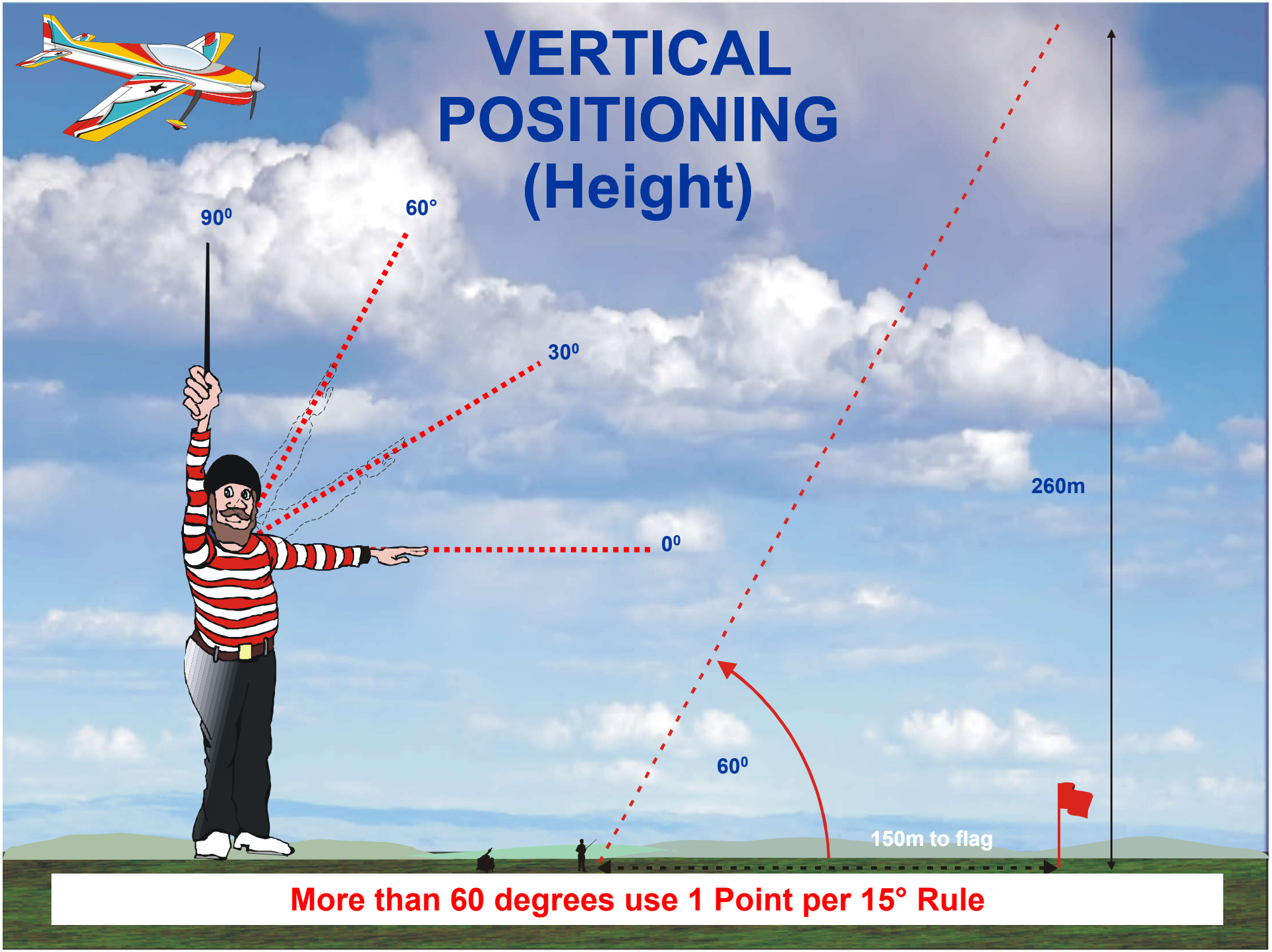
5B.10: "Manoeuvres on a line greater than 175 m MUST BE DOWNGRADED"

The main criterion is *visibility*!

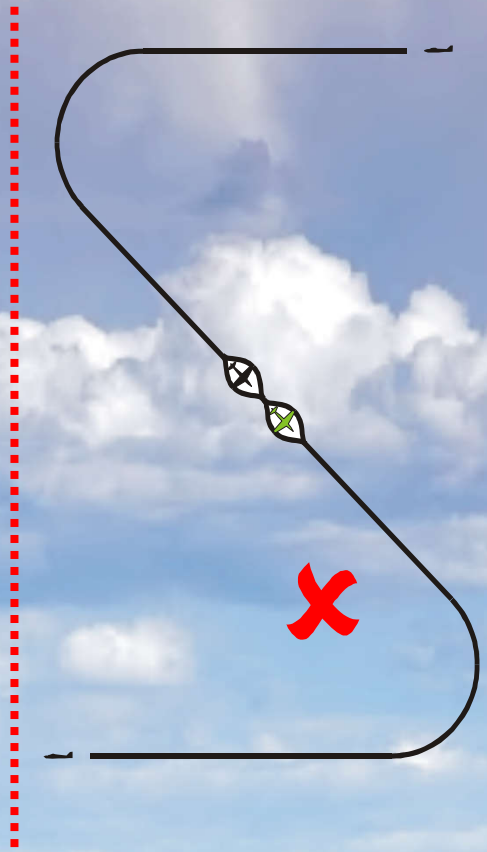



LONGITUDINAL POSITIONING
more than 200 m
minus -2 to 3 points
175 m-200 m minus 1 point
140 m-175 m OK
150 m
300 m
120°


LONGITUDINAL POSITIONING
Manoeuvres out of box here,
are penalised more...
…than manoeuvres
out of box here.
Manoeuvres positioned here
not penalised
520m
150m
300m
120⁰


VERTICAL
POSITIONING
(Height)
90⁰
60°
30⁰
0⁰
260m
60⁰
150m to flag
More than 60 degrees use 1 Point per 15° Rule

CENTRE POSITIONING



Off-centre positioning…
minus 3 or 4 points!
(for this example)

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

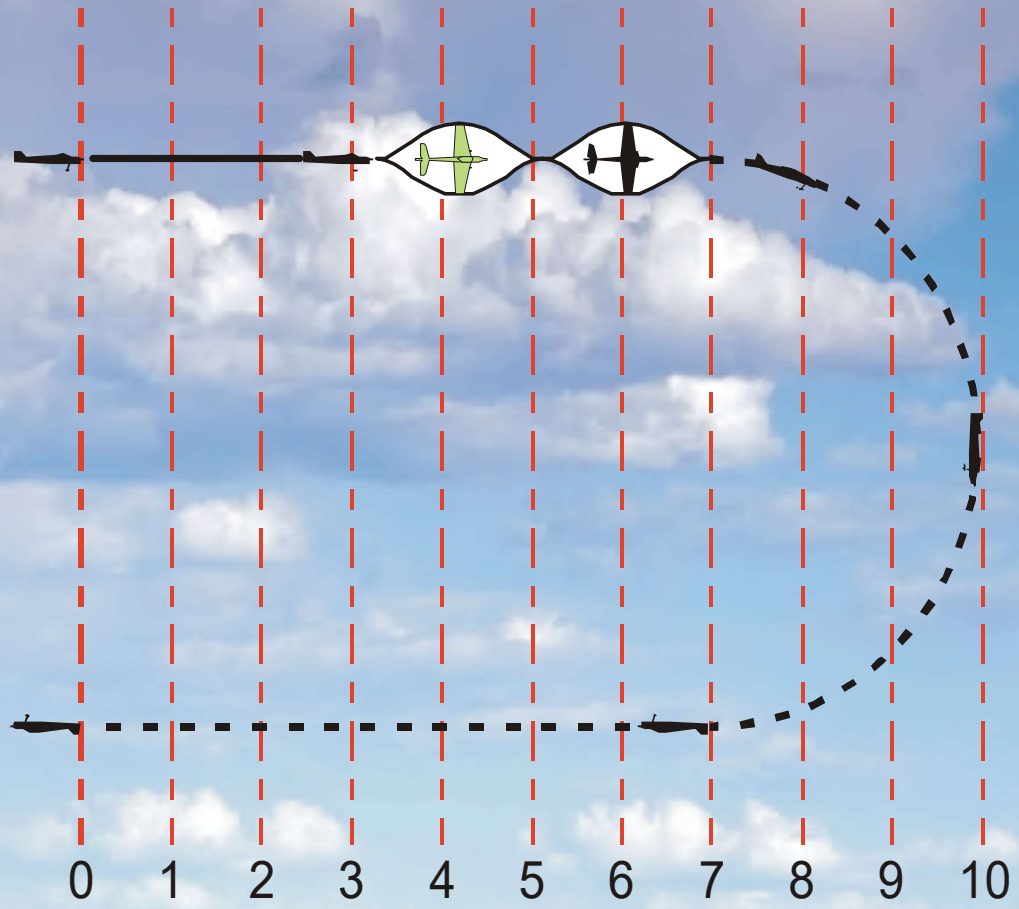
The size of a manoeuvre is scored by its matching size relative to the size of manoeuvring zone and the relative size of the other manoeuvres performed throughout the schedule

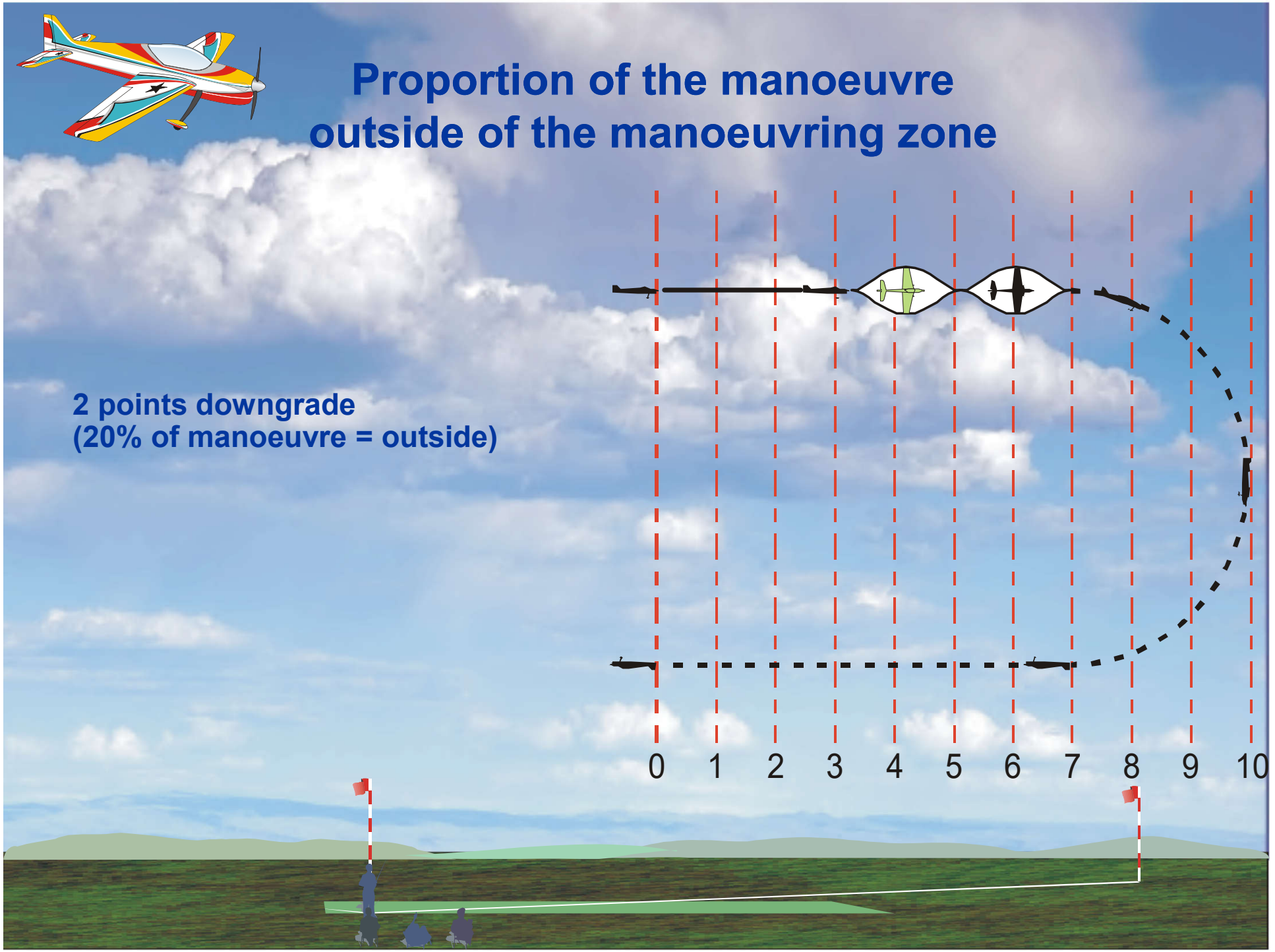
For mis-matching size up to 1 point downgrade.

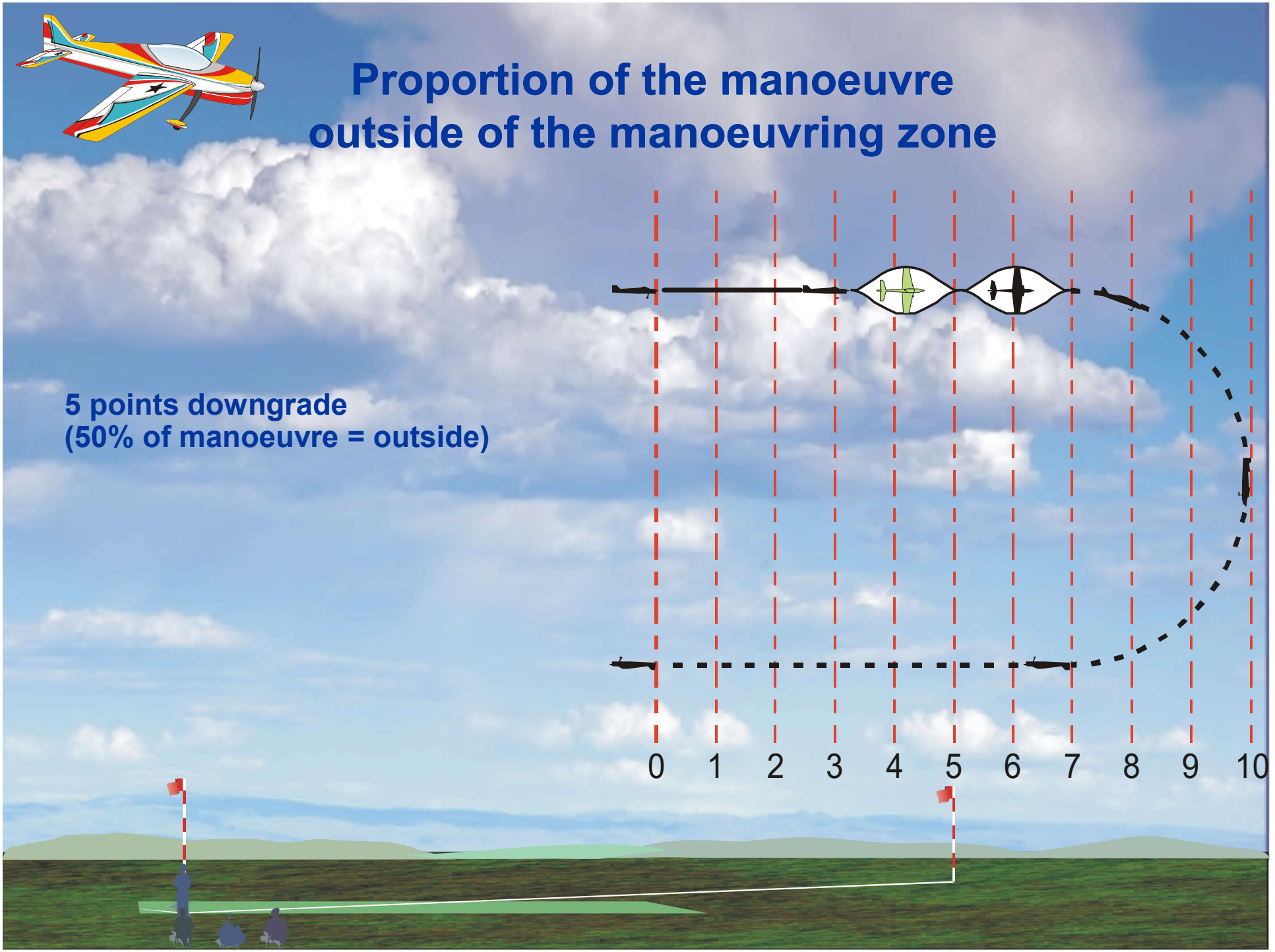

Proportion of the manoeuvre
outside of the manoeuvring zone
Box markers are indicators only.
Do not downgrade unnecessarily!

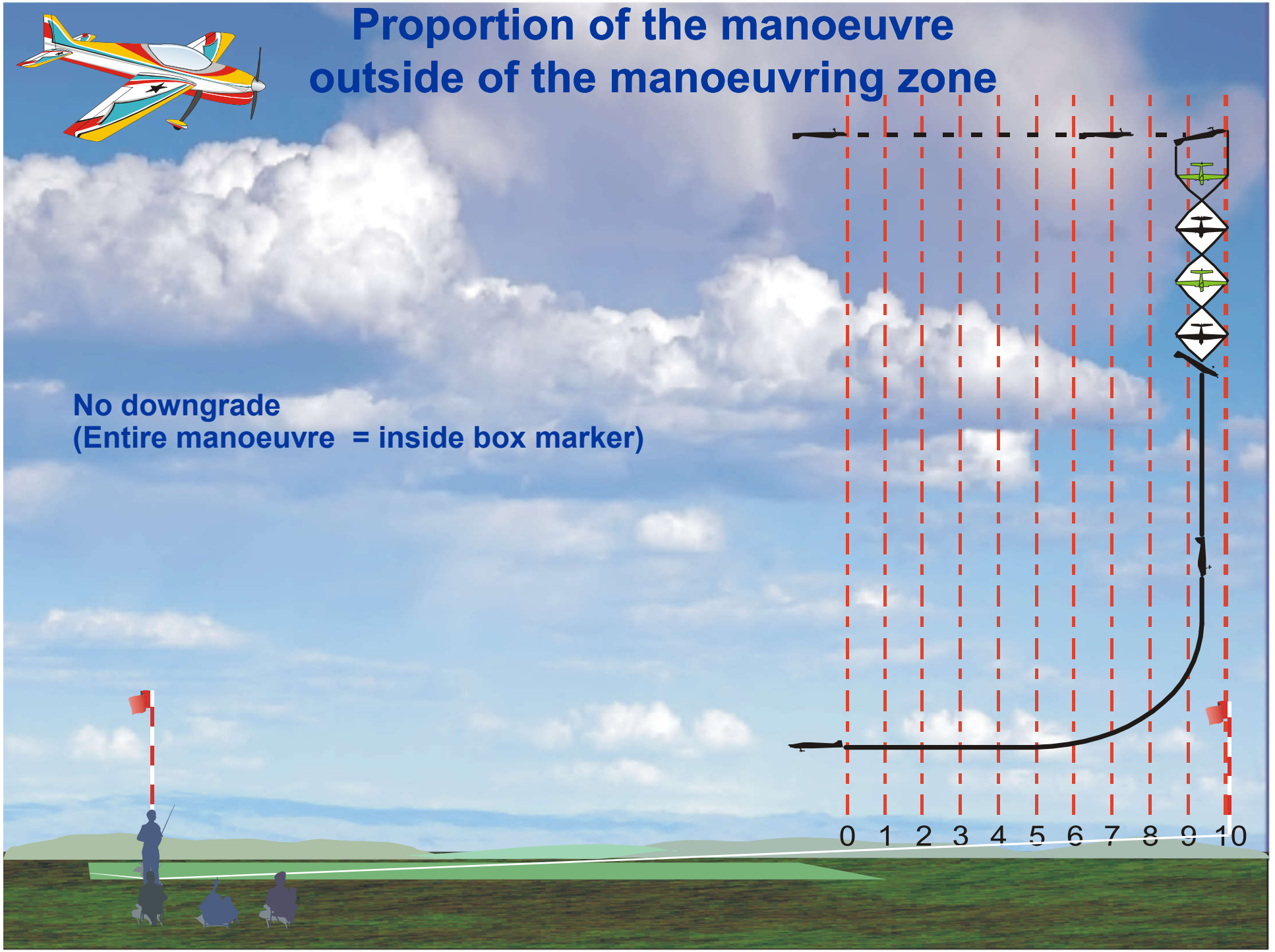
Proportion of the manoeuvre outside of the manoeuvring zone

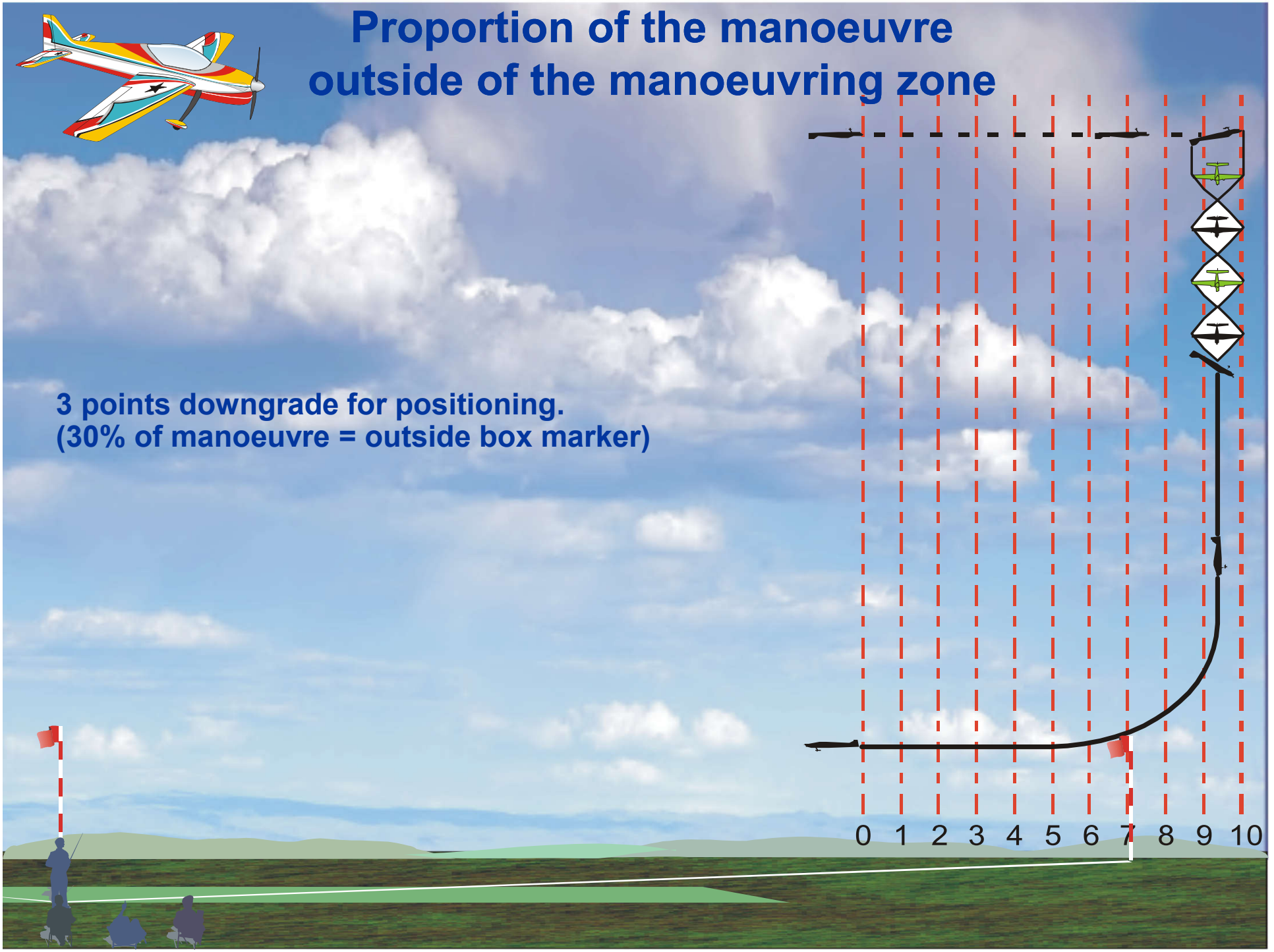
No downgrade (positioning only) (Entire manoeuvre = inside box marker)




Proportion of the manoeuvre
outside of the manoeuvring zone
2 points downgrade
(20% of manoeuvre = outside)
0 1 2 3 4 5 6 7 8 9 10


Proportion of the manoeuvre
outside of the manoeuvring zone
5 points downgrade
(50% of manoeuvre = outside)
0 1 2 3 4 5 6 7 8 9 10


Proportion of the manoeuvre
outside of the manoeuvring zone
No downgrade
(Entire manoeuvre = inside box marker)
0 1 2 3 4 5 6 7 8 9 10


Proportion of the manoeuvre
outside of the manoeuvring zone
3 points downgrade for positioning.
(30% of manoeuvre = outside box marker)
0 1 2 3 4 5 6 7 8 9 10

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?

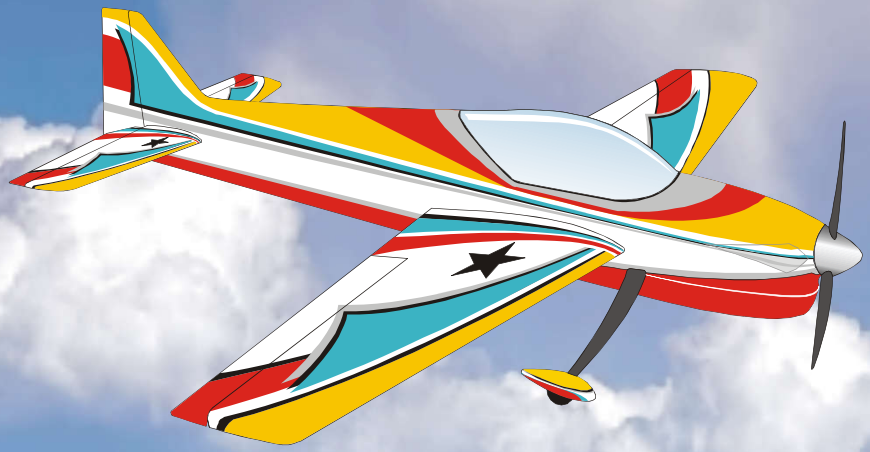
- The pilot should do as good as a job as possible to hide errors from the judges

- 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 to Bob Skinner who initiated this presentation.