Precision Aerobatics Judging Questions – with Answers Explained Set C

Andrew Palmer

With thanks to Russell Edwards and Peter Uhlig

What Will We Cover?

About myself, my interest in judging and F3A rules
Where to find information on judging
The manoeuvre execution guide and objective judging
NZ Expert Schedule Walk (Fly) Through
Tonight's ten questions
Tools to help with judging (and flight training!)
Any questions

But first, lets get ready with Poll Everywhere

Its anonymous and free!

Poll Everywhere

Please remember!

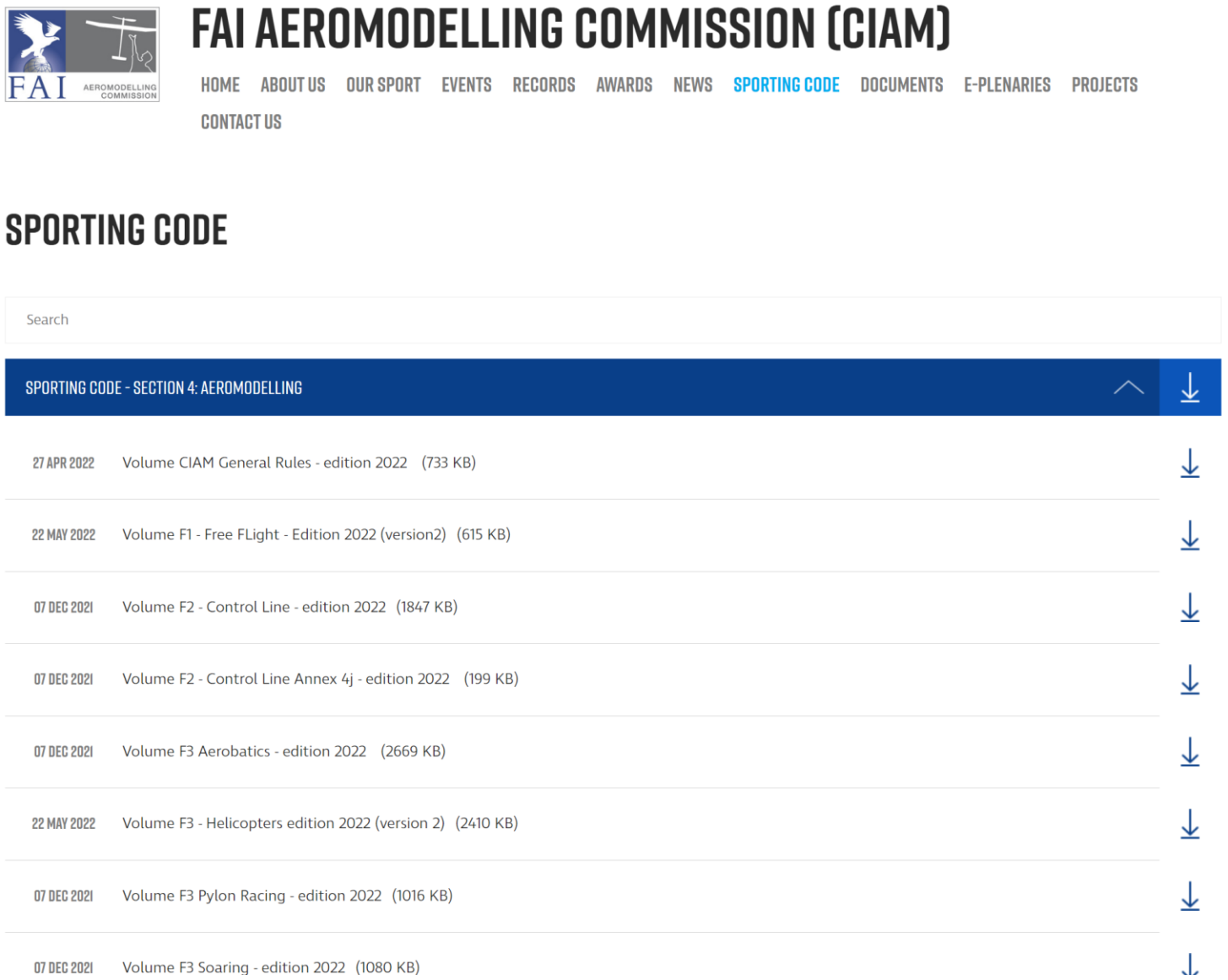
- The rule book is not perfect
- It does not have all the answers (but almost)
- I don’t have all the answers
- But I will try and be a good navigator!

- We all hope to fly well, be judged fairly and judge fairly ourselves

(And IMAC is judged differently)

About Myself

Where to find Judging Information?



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?

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

Judging is based on the trajectory of the aircraft's centre of gravity rather than its attitude. Manoeuvres must be wind corrected except where the aircraft is in a stalled condition (Spins, Stalls and Snaps).

Criteria for judging:

1. Type of defect
2. Severity of defect
3. The number of times any one defect occurs, as well as the total number of defects.
4. Positioning of manoeuvre and size relative to other manoeuvres in the flight

Basic rule is to deduct 1 point for 15 degrees variation from defined manoeuvre geometry, but 0.5 points only for half of this. Lines should be judged more harshly than deviations in yaw or roll.

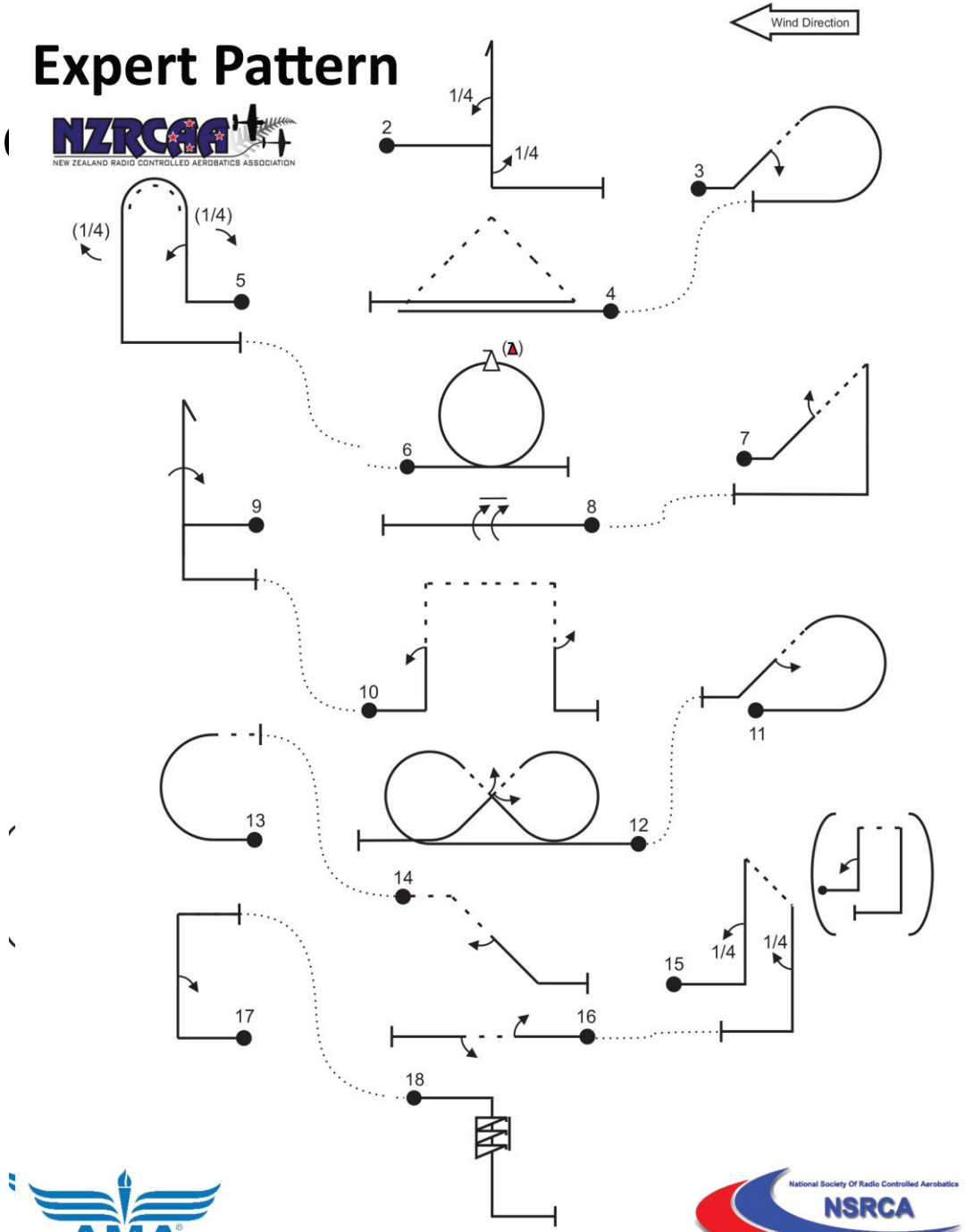
Defect	Downgrade
For significant differences in Constant Flying Speed	0.5 - 1
Sizing different relative to other manoeuvres in the flight	0.5 - 1
Positioning - *Appropriate distance out should be based on visibility of aircraft*	
Manoeuvre not centred (per 15 degrees)	0.5 - 4
More than 175m out (visibility is the criterion)	1
Greater than 200m out	2 - 3
Outside 60 degree markers, further out is worse (based on % out of box)	1 - 10
Lines	
Length of lines not graded	No deduction
Manoeuvre doesn't start and end with a horizontal line	1 per manoeuvre
Mis-relationship between lines	0.5 or more
Rolls not centred on lines (except Split S and Immelmann)	0.5 - 2
No line before/after roll (except Split S and Immelmann)	3
Loops	
Radius (Compare each radius that was just flown to the last radius flown) (e.g. All loops or part loops within a manoeuvre must have the same radius)	0.5 – 2 or more for each occurrence
Segmentation (Every segmentation must be down graded)	0.5 or more
Departure from vertical plane	0.5 or more
Part loops must not be too tight or too loose (Too tight or too loose must be downgraded)	0.5 - 1
Turn-arounds are positioning manoeuvres. Entry/exit altitude can be different heights	No deduction
Rolls	
Variation in roll rate	0.5 or more
Slowing down / speeding up at end of roll	1 per 15 degrees
Start or stop not crisp (Each occurrence)	0.5 or more
Not centred on lines (except Split S and Immelmann)	0.5 - 2
No line before/after roll (except Split S and Immelmann)	3

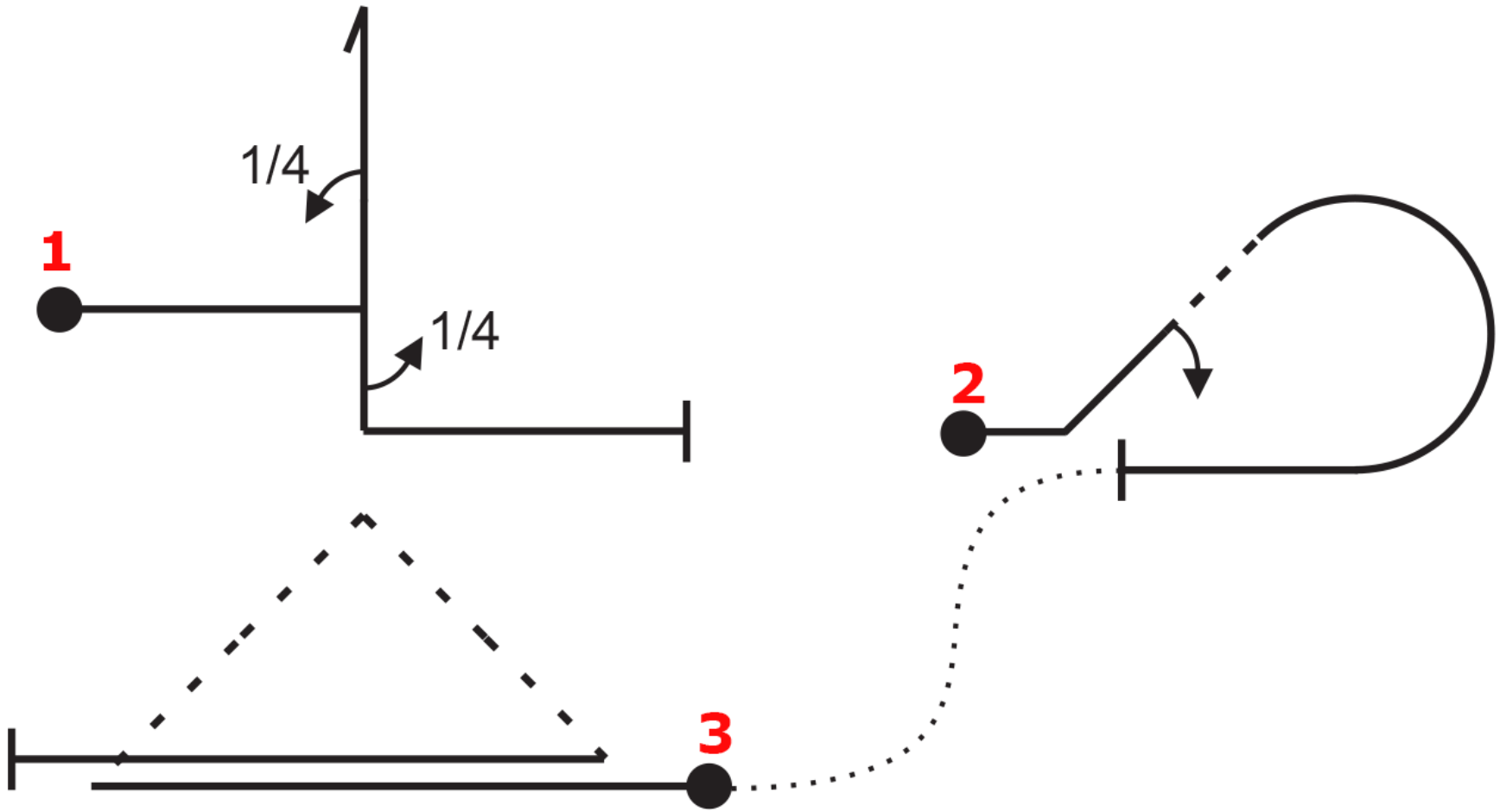
Change in pause length within point rolls	0.5 or more per occurrence
Missed or extra point in point roll(s)	1 per 15 degrees
Roll or part-roll in wrong direction	Zero scored
Roll/Loop Combinations	
For Immelmann & Split S, roll not immediately before/after loop or part loop	0.5 - 2
For Immelmann, roll starts before loop or part loop completed	1 per 15 degrees
On Cuban 8's or half Cubans, rolls must be centred on lines	0.5 - 3
Humpty Bumps must have consistent radii in all part loops	0.5 - 3
Integrated rolls or part rolls not smooth and continuous and correctly integrated	1 per 15 degrees
Snap Rolls - *Use same basic judging criteria as axial rolls above. If it's not an axial or barrel roll, it's a snap roll*	
Attitude (positive or negative) at pilot's discretion	No deduction
Stall/break from line of flight not observed and barrel rolls	Severe (5+)
Axial roll disguised as a snap	Severe (5+)
Aircraft un-stalls during snap	1 per 15 degrees
Spins - *Nose up attitude, nose drops as aircraft stalls. Simultaneously, wing drops in direction of spin*	
Gain in altitude prior to spin	1 per 15 degrees
Severe yawing/weathercocking when near stalled	1 per 15 degrees
Drift when stalled or near stalled (not outside aerobatic zone)	No deduction
No stall, snap rolled, or spiral-dived into spin	Zero scored
Slides into spin	1 per 15 degrees
Forcing spin in opposite direction on initial rotation	Severe (5+)
Forcing spin from high angle of attack with down or up elevator	4 - 5
Conditions (e.g., no wind) may mean aircraft does not completely stop	No deduction
Rotation errors judged in same manner as rolls	1 per 15 degrees
Reversal of rotation not immediate (e.g., becomes un-stalled)	Severe (5+)
Roll rate in reversal significant (slight difference ok)	1
Unloading spin (e.g., finishing spin with ailerons)	1 per 15 degrees
Specific attitude of aircraft during spin not judged as long as it remains stalled	No deduction
No visible vertical line following rotation(s)	1

Stall Turns	
Pivot up to ½ wingspan	1
Pivot up to 1 wingspan	2 - 3
Pivot >1½ wingspans	4 - 5
Pivot >2 wingspans or flops over	Zero scored
Torques off	1 per 15 degrees
Pendulum movement after pivot	1
Skid before reaching stall turn (early rudder)	1
Drift when stalled or near stalled (not outside aerobatic zone)	No deduction
Part loops on entry/exit not constant and equal radius	0.5 - 3

Rolling Circles - *Mainly about maintaining consistent circular flight path, altitude, roll rate and roll integration (Apply same rules as per rolls)*	
150m distance requirement not applied. Deduct where >350m	1 - 3
Deviations in geometry	1 per 15 degrees
Either performed towards or away from judges	No deduction
Roll or part roll in wrong direction	Zero scored

NZ Expert Schedul

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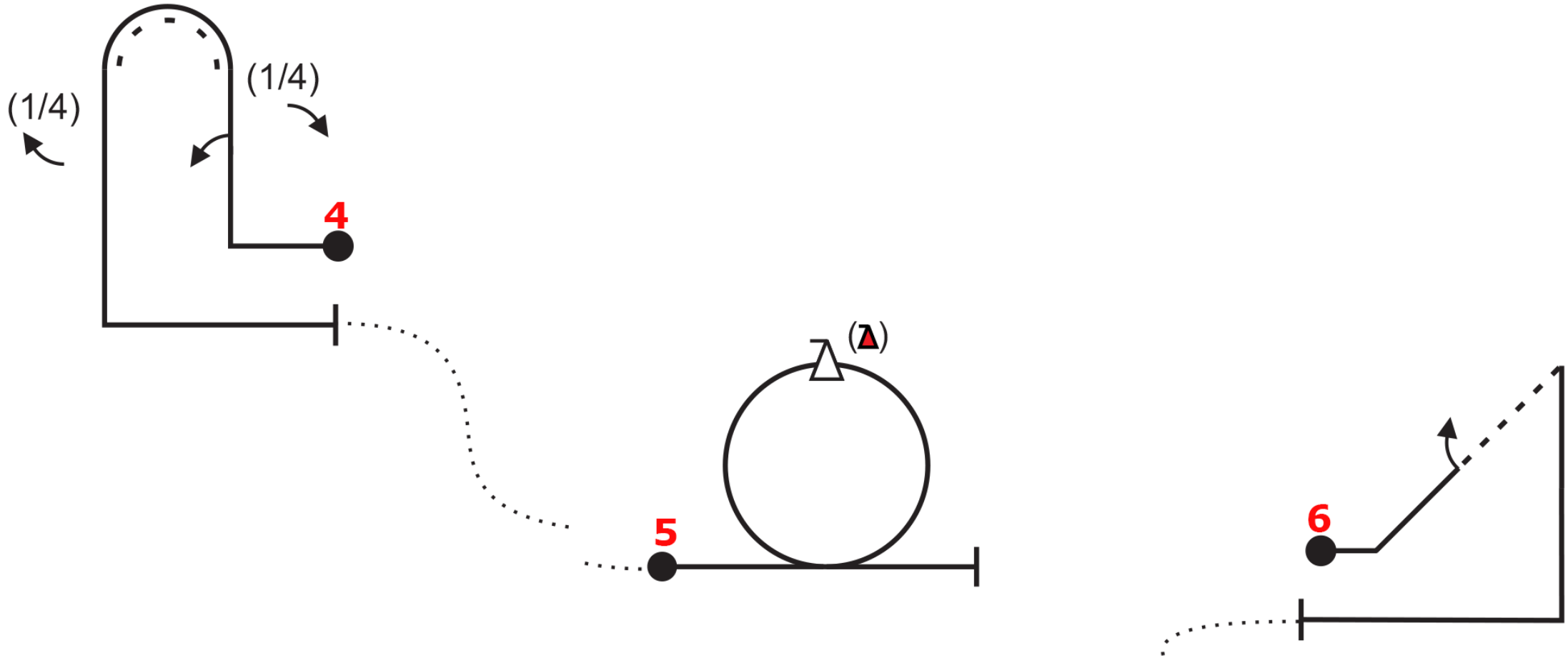
1
1/4
2
3


(1/4)
(1/4)
4
(1)
5
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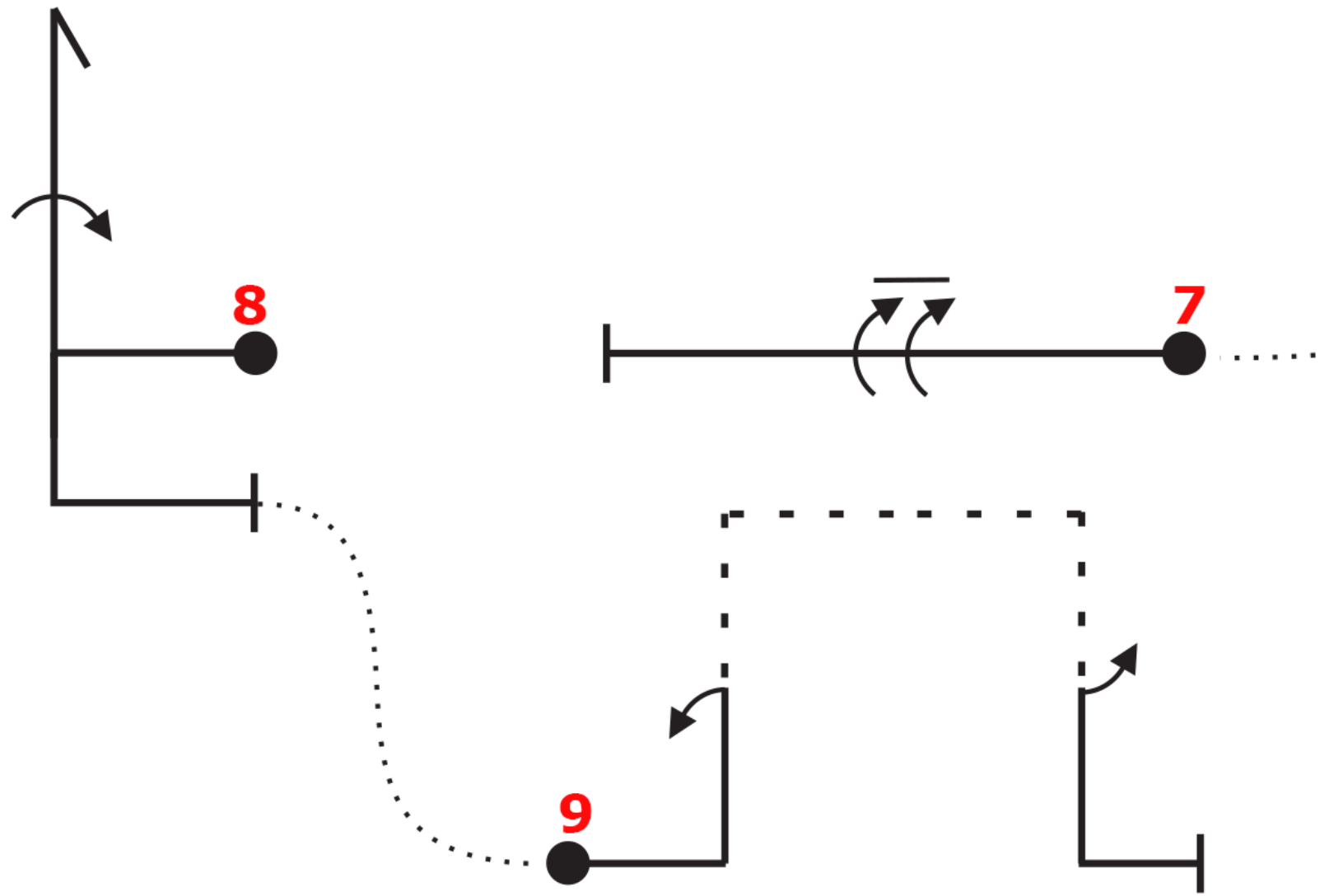
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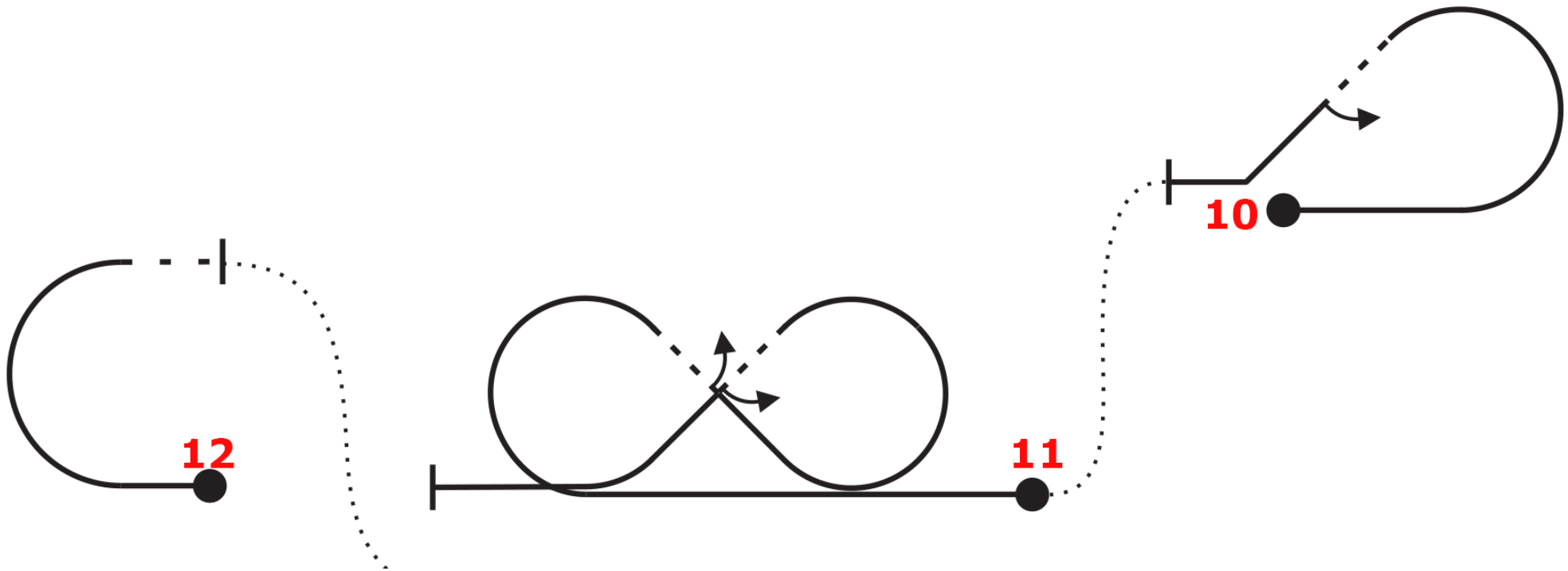
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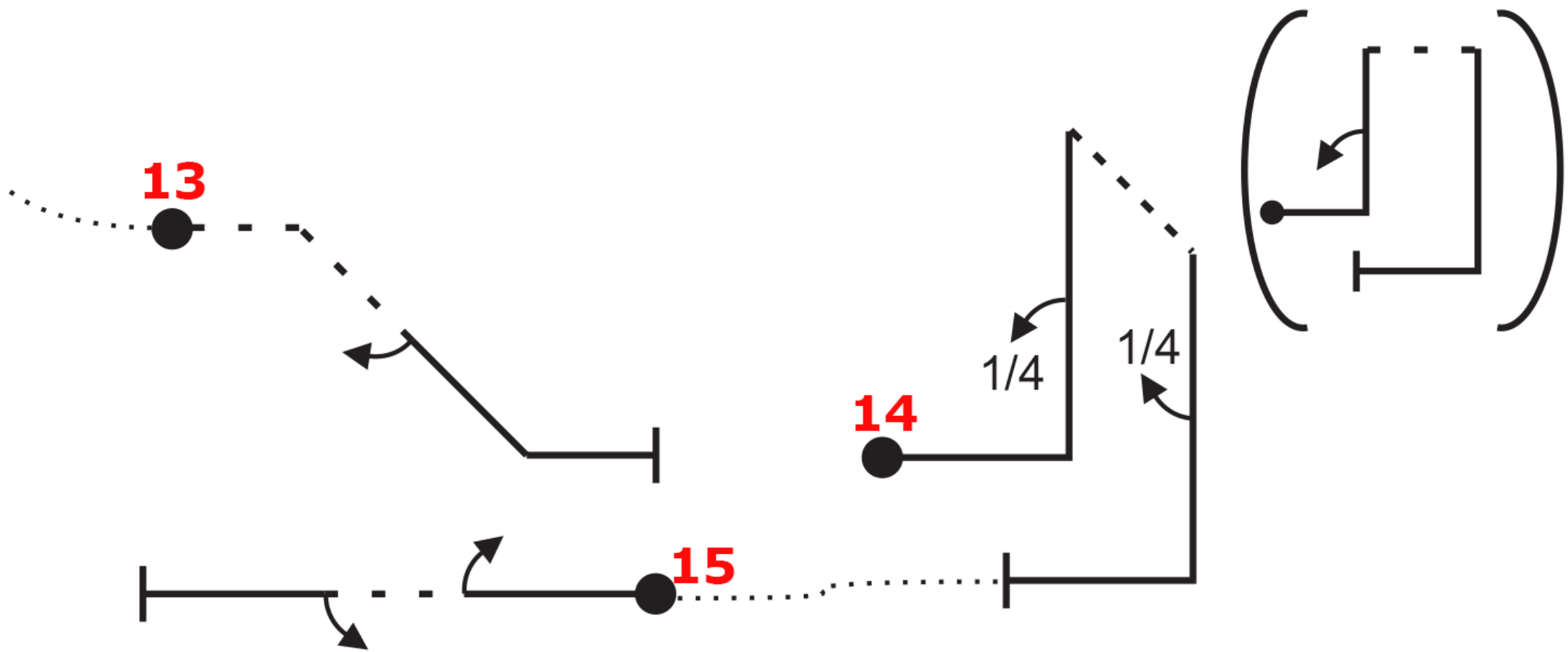
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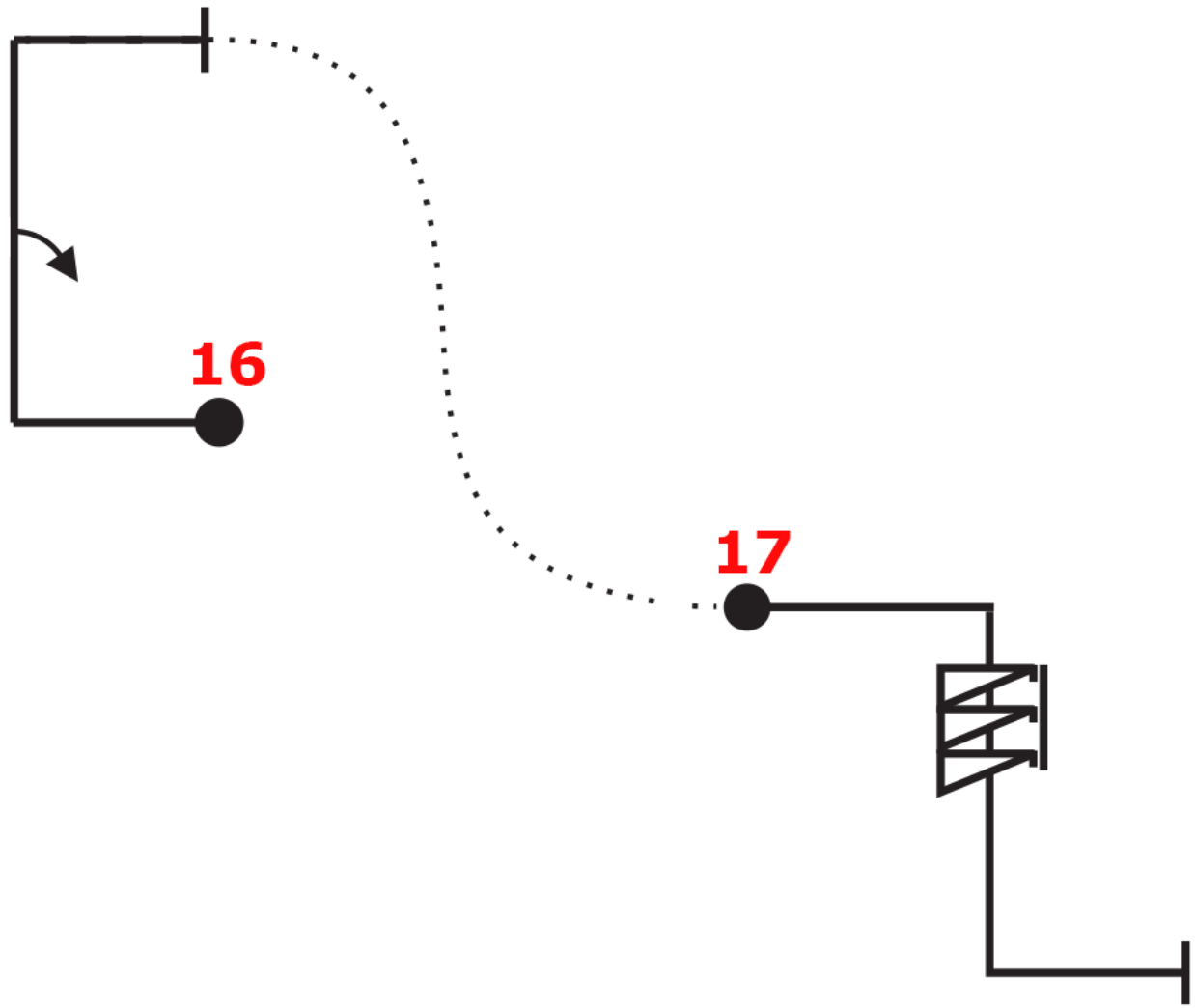
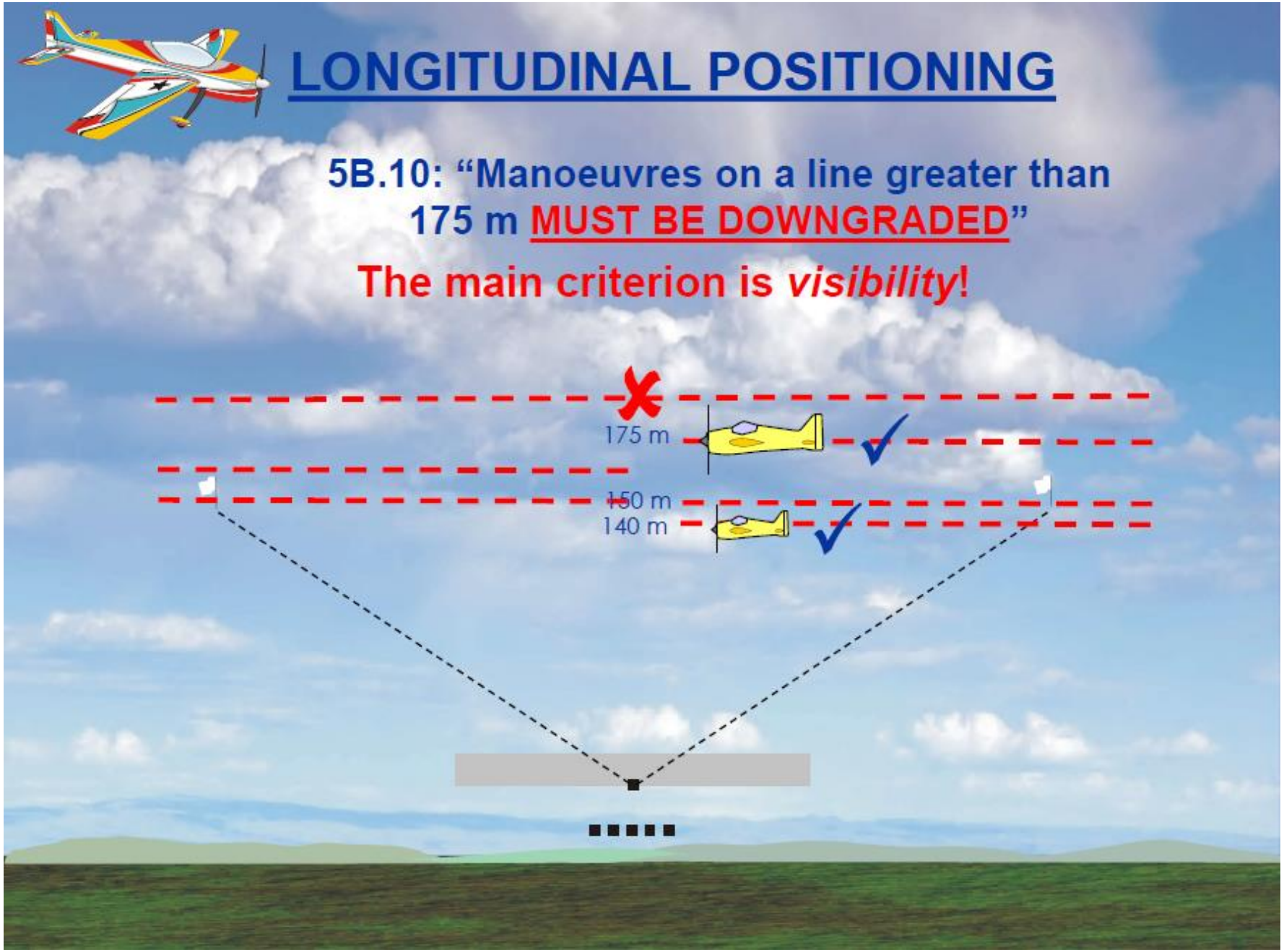
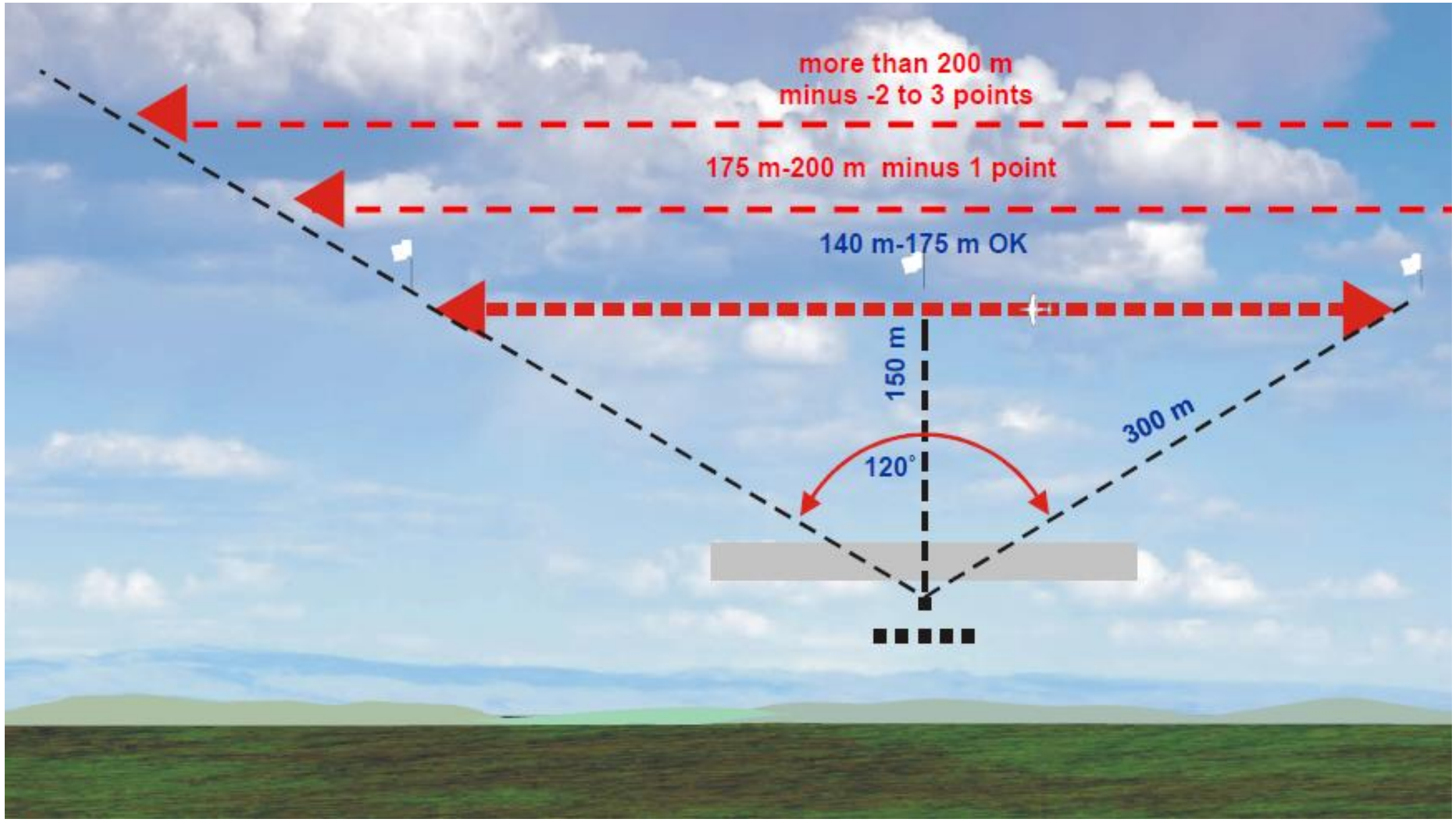

16
17

1. Flying so far out as to make evaluation of a manoeuvre difficult should result in a downgrade of:

0 points ☐	4-5 points ☐
1 point ☐	Severe downgrade (more than 5 points) ☐
2 points ☐	Zero the manoeuvre ☐
3 points ☐	

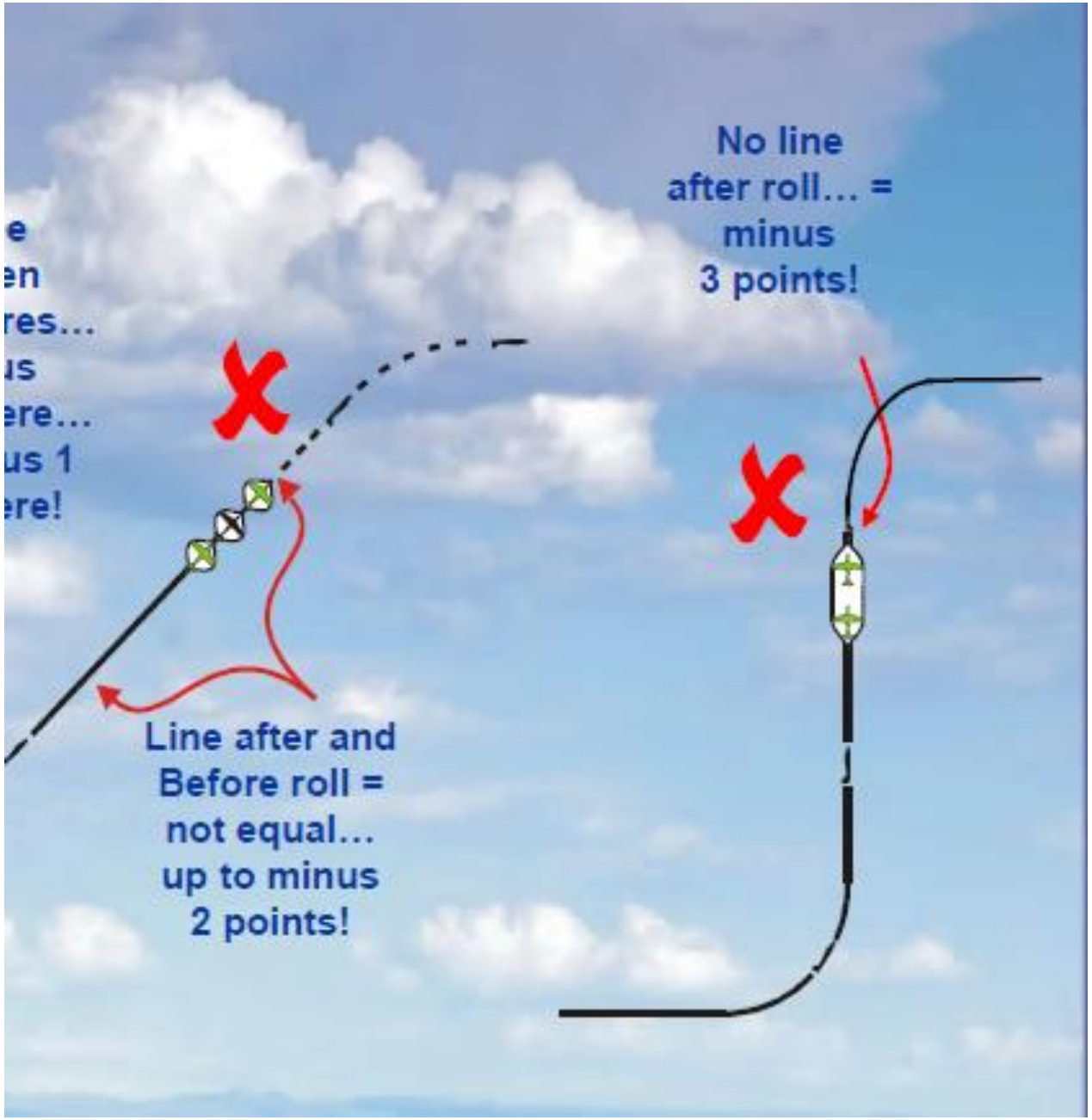

LONGITUDINAL POSITIONING
5B.10: “Manoeuvres on a line greater than 175 m MUST BE DOWNGRADED”
The main criterion is visibility!
175 m
150 m
140 m

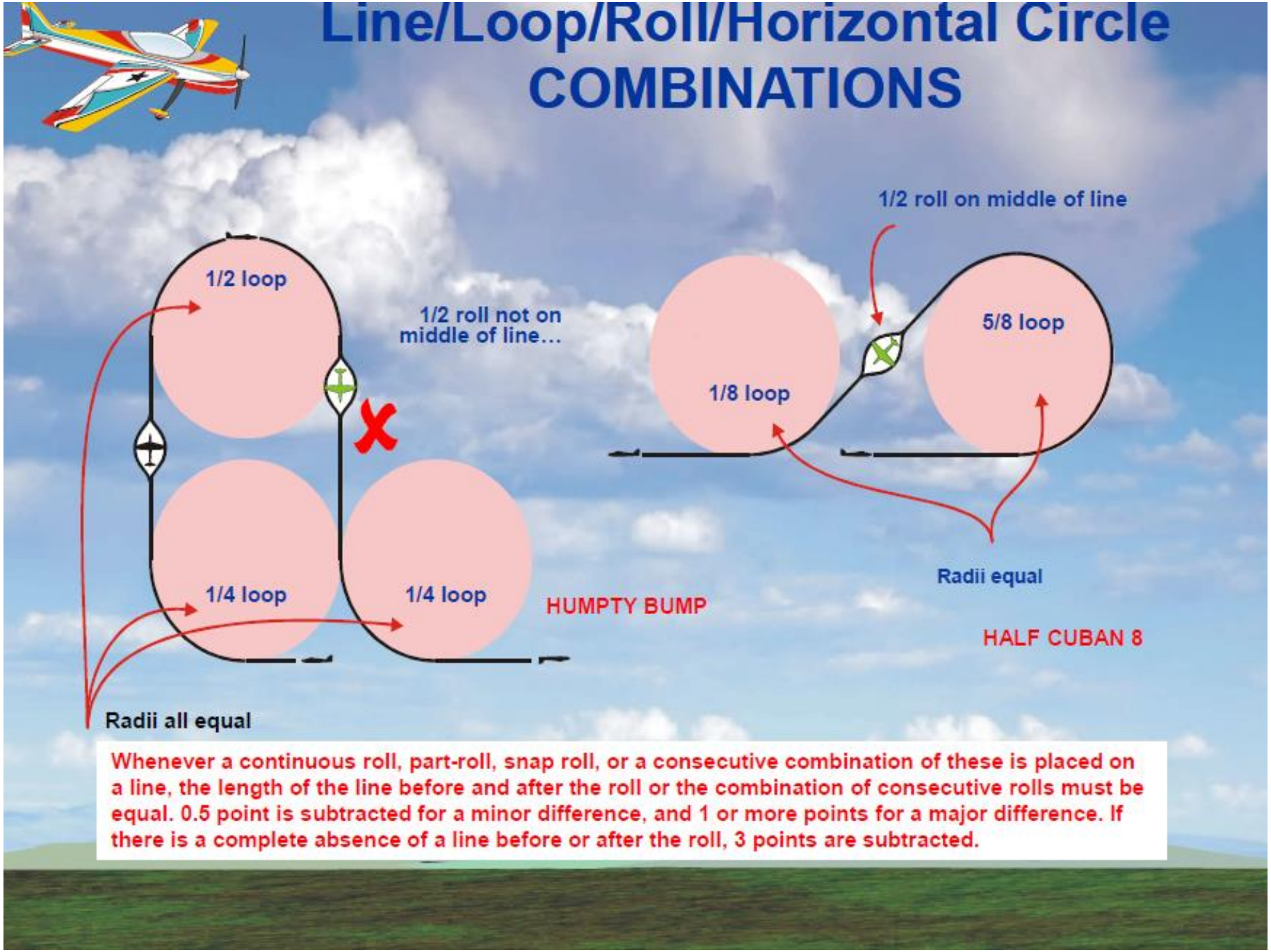

more than 200 m
minus -2 to 3 points
175 m-200 m minus 1 point
140 m-175 m OK
150 m
300 m
120°

5B.10 - Flying so far out as to make evaluation of a manoeuvre difficult should be severely downgraded.

2. For centre Cuban eight manoeuvres, rolls, part-rolls or point rolls on the 45 degree line should be placed: (Note: Check all correct answers)

- At the end of the line ☐
- On the centre of the manoeuvring area ☐
- On the centre of the line ☐
- At the end of the line ☐


e
en
res...
us
ere...
us 1
ere!
No line
after roll... =
minus
3 points!
Line after and
Before roll =
not equal...
up to minus
2 points!


Line/Loop/Roll/Horizontal Circle
COMBINATIONS
1/2 loop
1/2 roll not on middle of line…
1/4 loop
1/4 loop
HUMPTY BUMP
Radii all equal
1/2 roll on middle of line
1/8 loop
5/8 loop
Radii equal
HALF CUBAN 8
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.

5B.8.10 - 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.
5B.10 - 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.

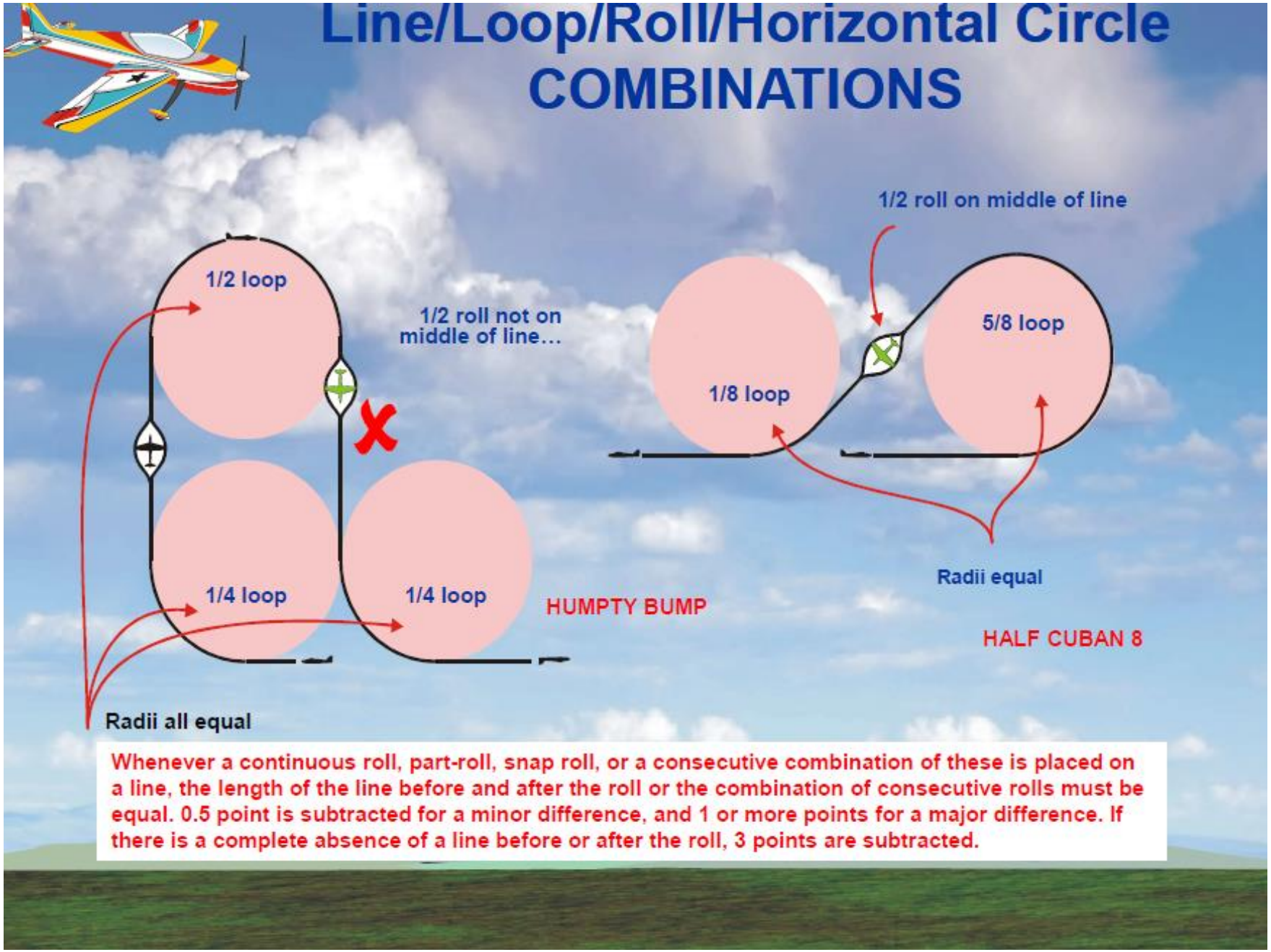
3. For Cuban eight and half Cuban eight manoeuvres, rolls, part-rolls or point rolls on the 45 degree line should be placed:

At the beginning of the line ☐

On the centre of the line ☐

At the end of the line ☐

Line/Loop/Roll/Horizontal Circle COMBINATIONS



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5B.8.10 - Whenever a continuous roll, part-roll, snap roll, or a consecutive combination of thes is placed on a line, the length of the line before and after the roll or the combination of consecutive rolls must be equal.

4. For Stall Turns, a radius of pivot of _____ is considered a wing-over and a zero must be given.

- One wingspan or more ☐
- One and a half wingspans or more ☐
- Two wingspans or more ☐
- Three wingspans or more ☐
- Five wingspans or more ☐

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.

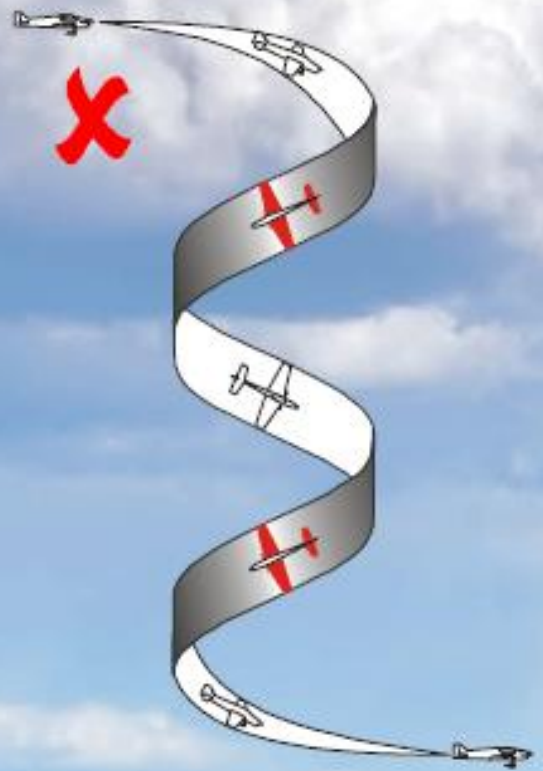
5B.8.11 - A radius of pivot of 2 wingspans or more is considered a wing-over and a zero must be given.

5. Forcing a spin from a high angle of attack with elevator results in what downgrade?

0 points ☐	**4-5 points ☐**
1 point ☐	Severe downgrade (more than 5 points) ☐
2-3 points ☐	Zero the manoeuvre ☐

SPINS

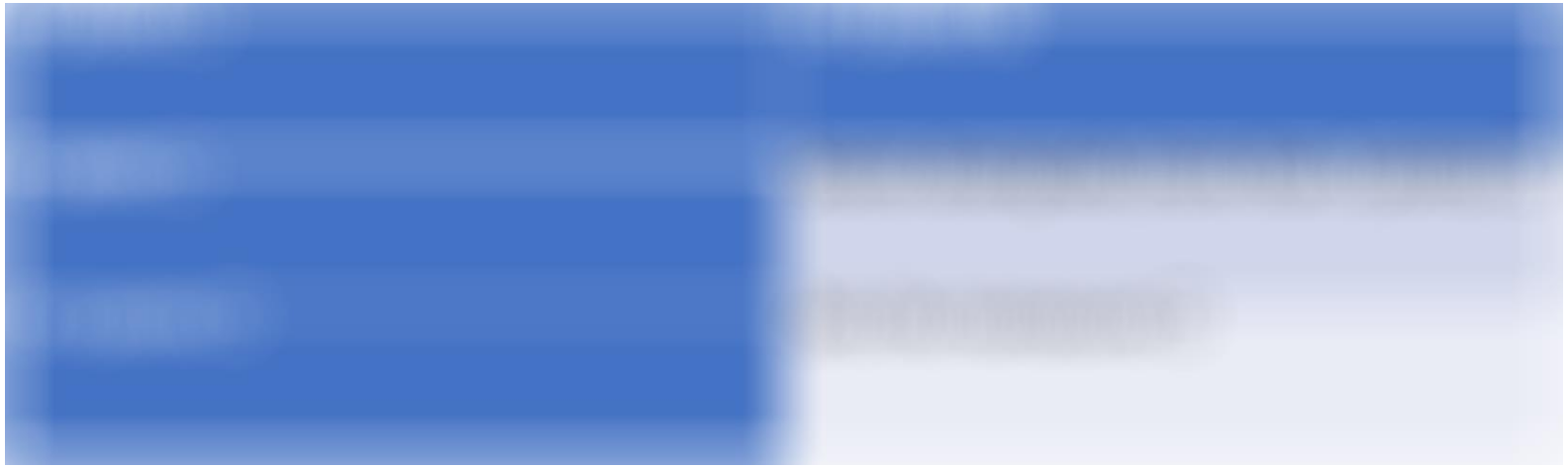
Wing lift (snap entry)…ZERO!



Spiral dive…scores ZERO!

Forced with
down-elevator…
minus 4 or 5!

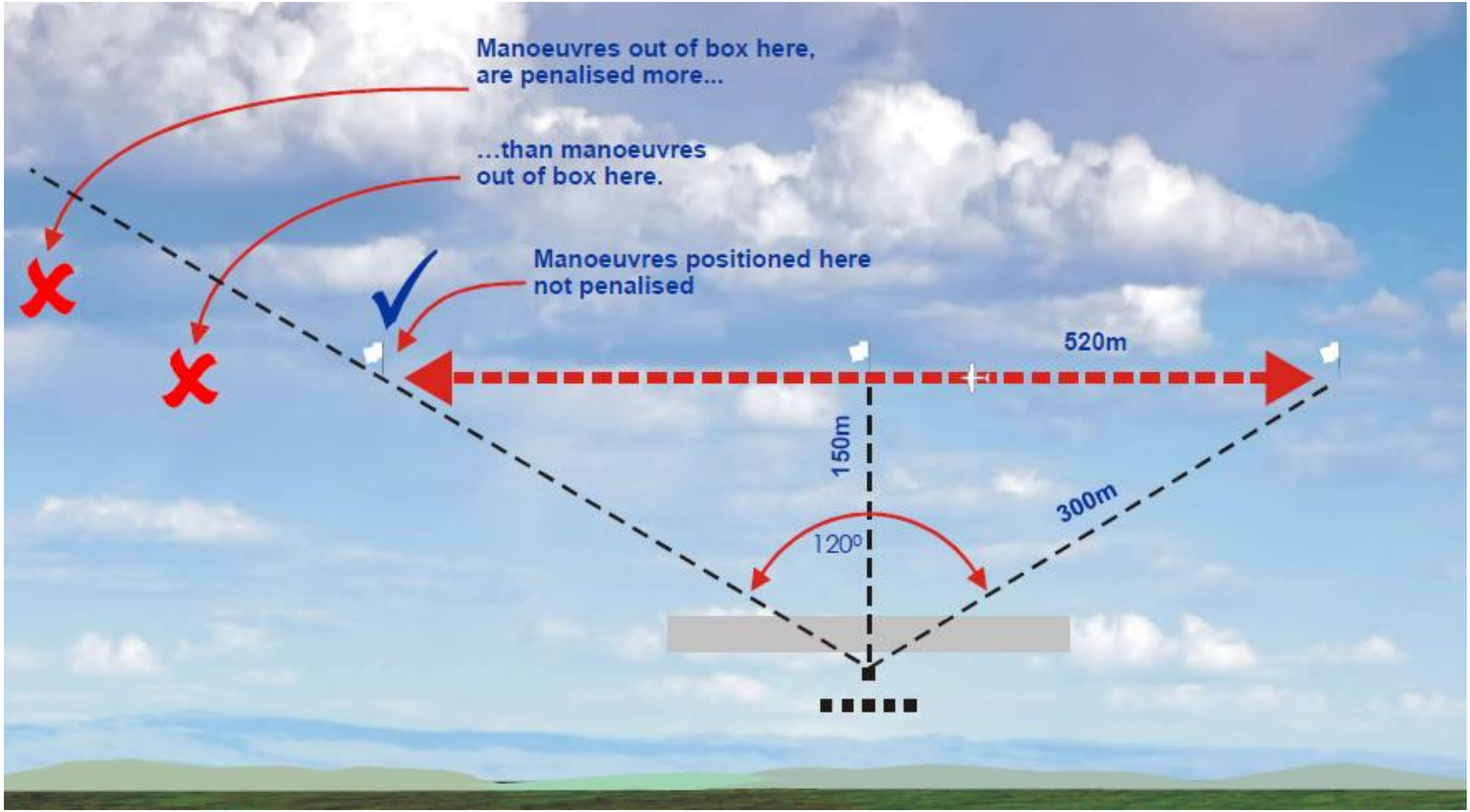
Climbing…
downgrade, using
1pt. per 15 degrees!



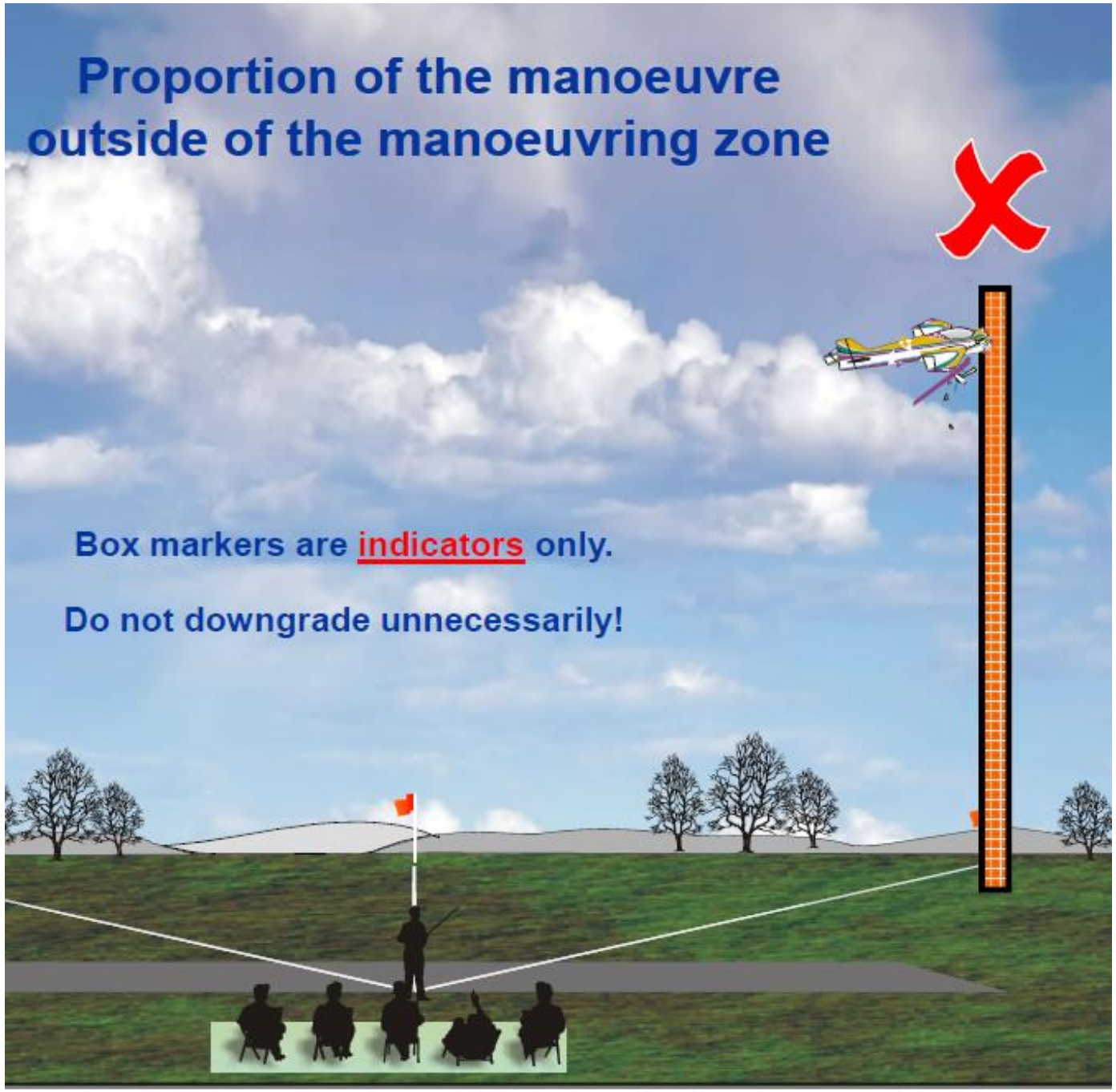
5B.8.12 - Forcing the model aircraft to spin from a high angle of attack with down (or up) elevator, should be downgraded by 4 or 5 points.

6. If an entire manoeuvre including entry and exit is flown out of the manoeuvring zone (the 'box'), what downgrade should be applied?

0 points (ignore the infringement) ☐	**5 points ☐**
1 point ☐	Severe downgrade (more than 5 points) ☐
3 points ☐	Zero the manoeuvre ☐

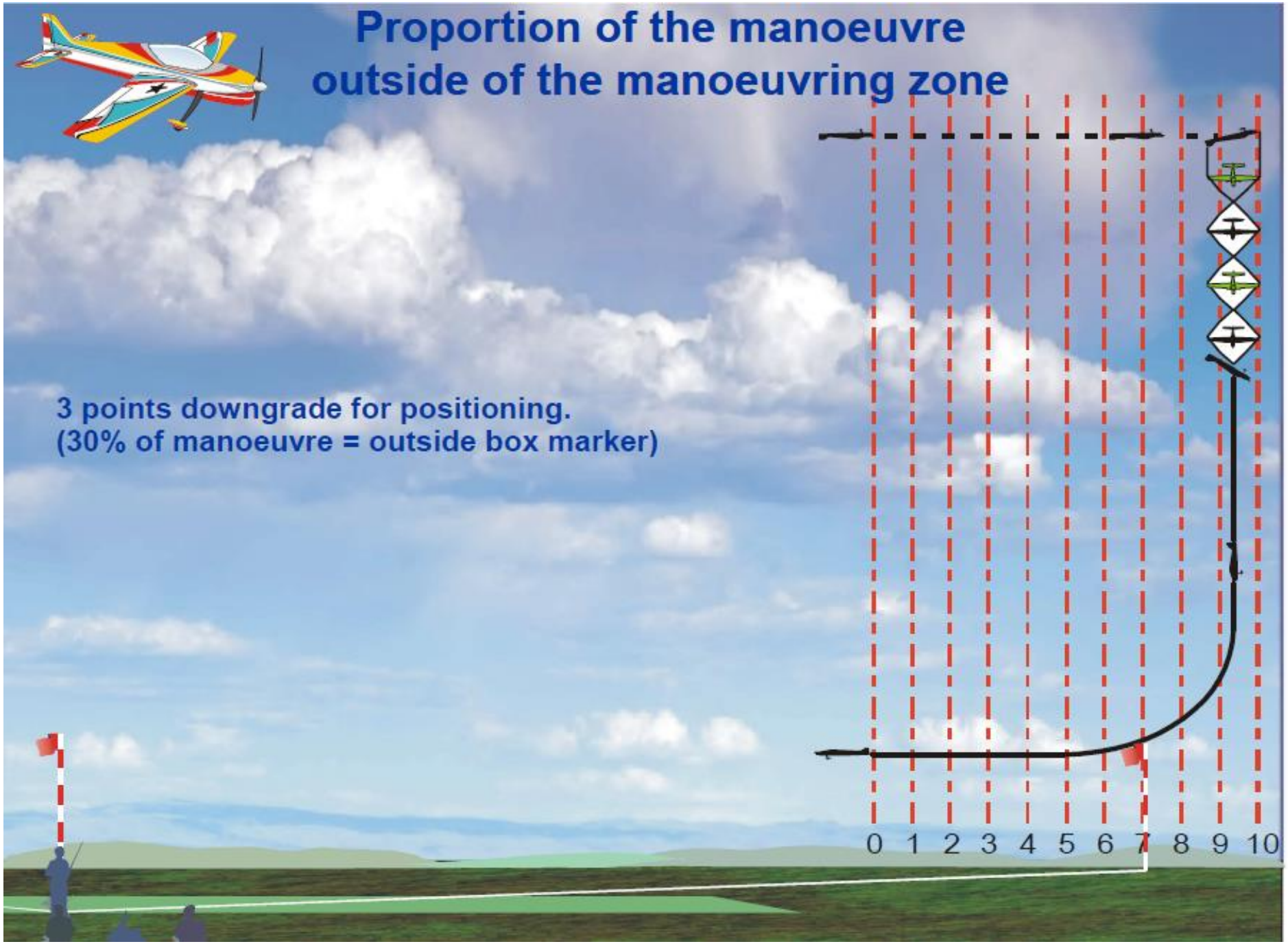

Manoeuvres out of box here,
are penalised more...
...than manoeuvres
out of box here.
Manoeuvres positioned here
not penalised
520m
150m
300m
120º

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

5B.12 - If an entire manoeuvre including entry and exit is flown out of the manoeuvring zone, it consequently must be zeroed.

7. If any part of the model is jettisoned (eg: dropped) during flight: (Note: Check all correct answers)

- The score will be zero only for the manoeuvre during which it occurred ☐
- Scoring will cease from the point the model part was dropped ☐
- The entire flight will receive a zero score ☐
- The competitor must be instructed to land their model aircraft immediately ☐

5.1.12 b) - If any part of the model aircraft is jettisoned during the flight, scoring will cease at that point and the competitor must be instructed by the flight line director to immediately land his model aircraft.

8. If the radius of a Stall Turn exceeds one and a half wingspans, but less than two wingspans, what downgrade is applied?

0 points ☐	4-5 points ☐
1 point ☐	Severe downgrade (more than 5 points) ☐
2-3 points ☐	Zero the manoeuvre (wing over) ☐

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.

5B.8.11 - if the radius exceeds one and a half wingspans, the manoeuvre must be downgraded 4 to 5 points. A radius of pivot of 2 wingspans or more is considered a wing-over and a zero must be given.

9. If the rudder is applied before a Stall Turn, causing a 'skid', or the model does not stop before a Stall Turn, what downgrade is applied?

0 points ☐	3 points ☐
1 point ☐	Zero the manoeuvre ☐
2 points ☐	

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

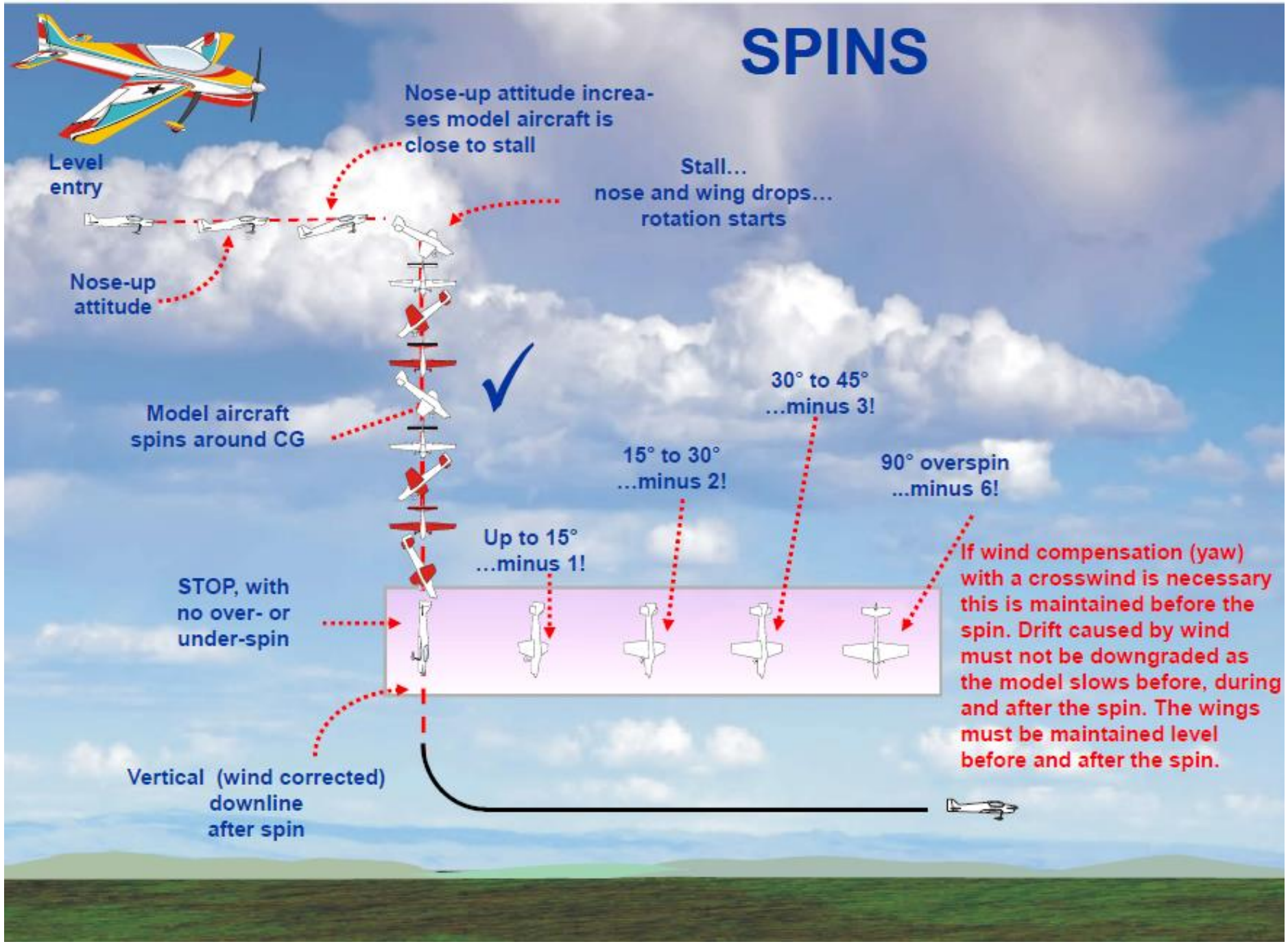
Flop forwards, or backwards... ZERO!

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

5B.8.11 - If the model aircraft should 'skid' or not stop before reaching the stall turn (early application of rudder), the manoeuvre is downgraded by 1 point.

10. In order for a model to spin, the model:

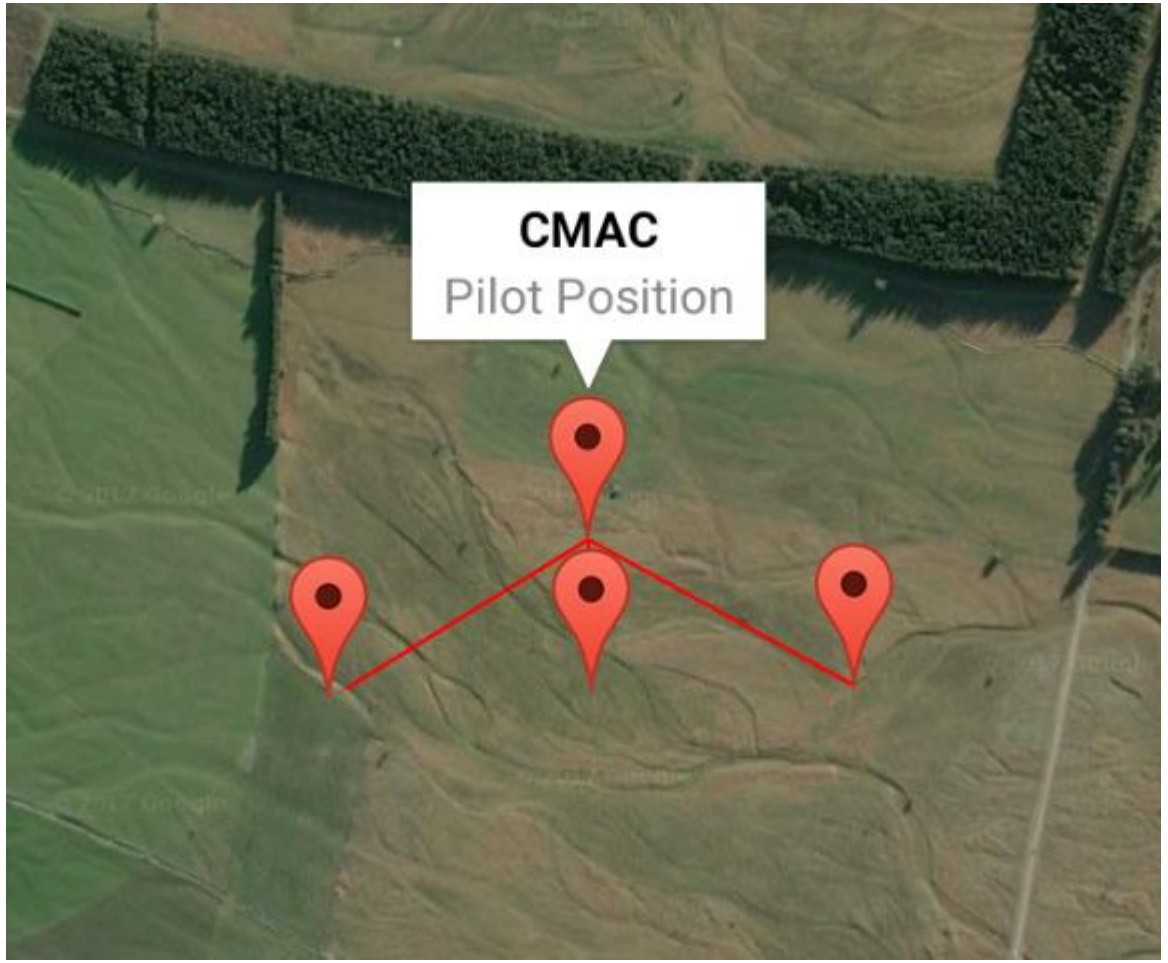
Must be snap-rolled into the spin ☐	Must have a high angle of attack ☐
Must come to a complete stop ☐	
Must be stalled ☐	


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

5B.8.12 - In order to spin, the model aircraft must be stalled.

What Tools are out there to Help with Judging (and Flight Training)?

F3A Zone Pro (iOS and Android)



F3A ZONE PRO

ANDROID APP ON Google play

Download on the App Store

F3A Zone Pro on Android also lets you easily walk out to the flight line (in a safe position) and see who is flying at 150-165m (and who is not!) – this is great for gaining an appreciation of where we should be flying.

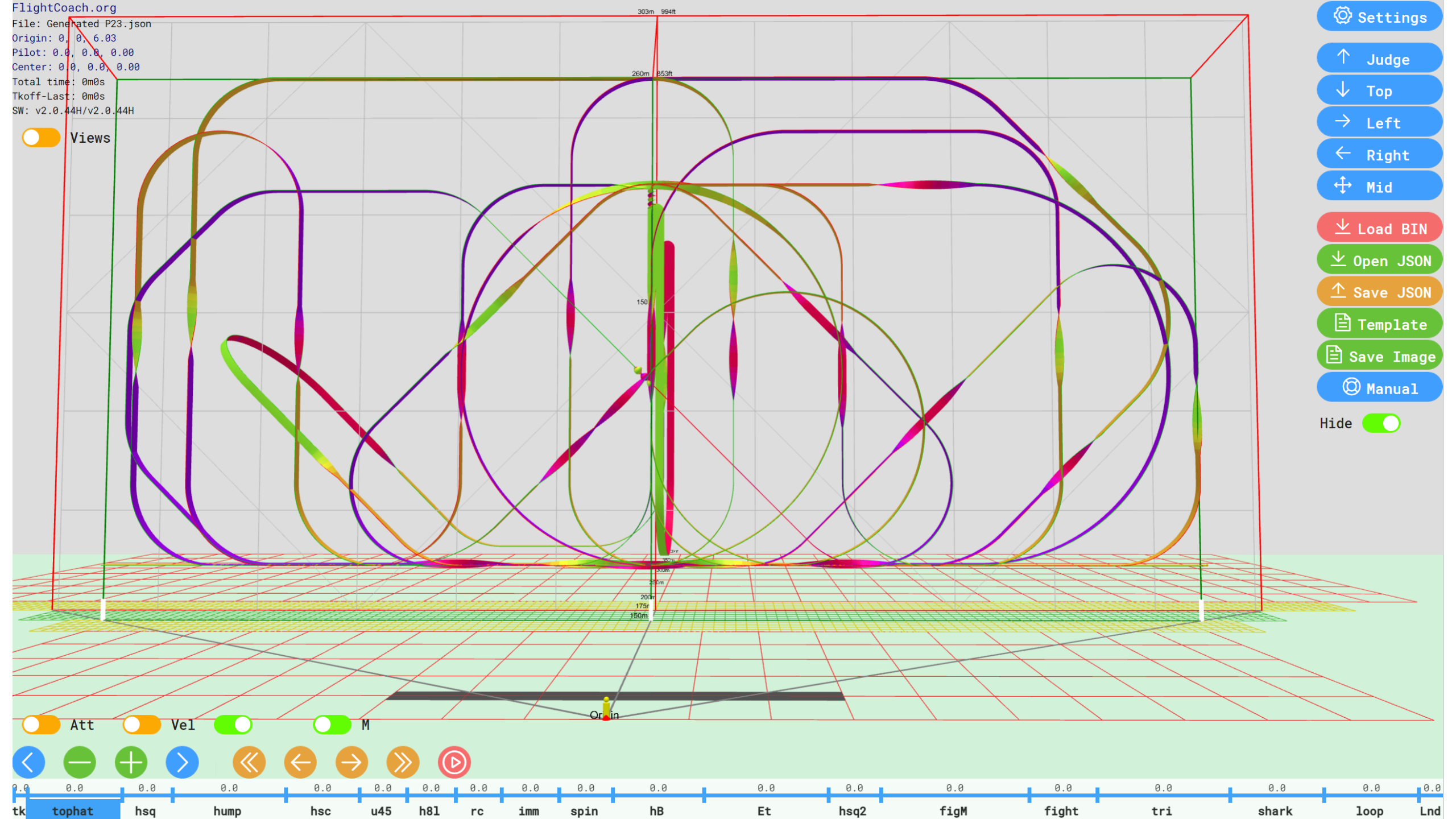
Flight Coach

Your Radio Control Flight Geometry Companion

Home

The Flight Coach Project develops data driven tools for precision aerobatic pilots and judges with the aim of making the sport more objective. The project was started by a group of keen F3A and IMAC competitors, but the work is also applicable to other RC and full size aerobatic disciplines.

Most of our work involves installing inexpensive GPS and attitude tracking hardware in the aircraft, then post processing the data on the ground to provide feedback. All the Flight Coach project outputs are free to use (see specific license details in Instructions/Software).


FlightCoach.org
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Pilot: 0.0, 0.0, 0.00
Center: 0.0, 0.0, 0.00
Total time: 0m0s
Tkoff-Last: 0m0s
SW: v2.0.44H/v2.0.44H
Views
303m 994ft
260m 853ft
150
Settings
Judge
Top
Left
Right
Mid
Load BIN
Open JSON
Save JSON
Template
Save Image
Manual
Hide
Att
Vel
M
tk
tophat
hsq
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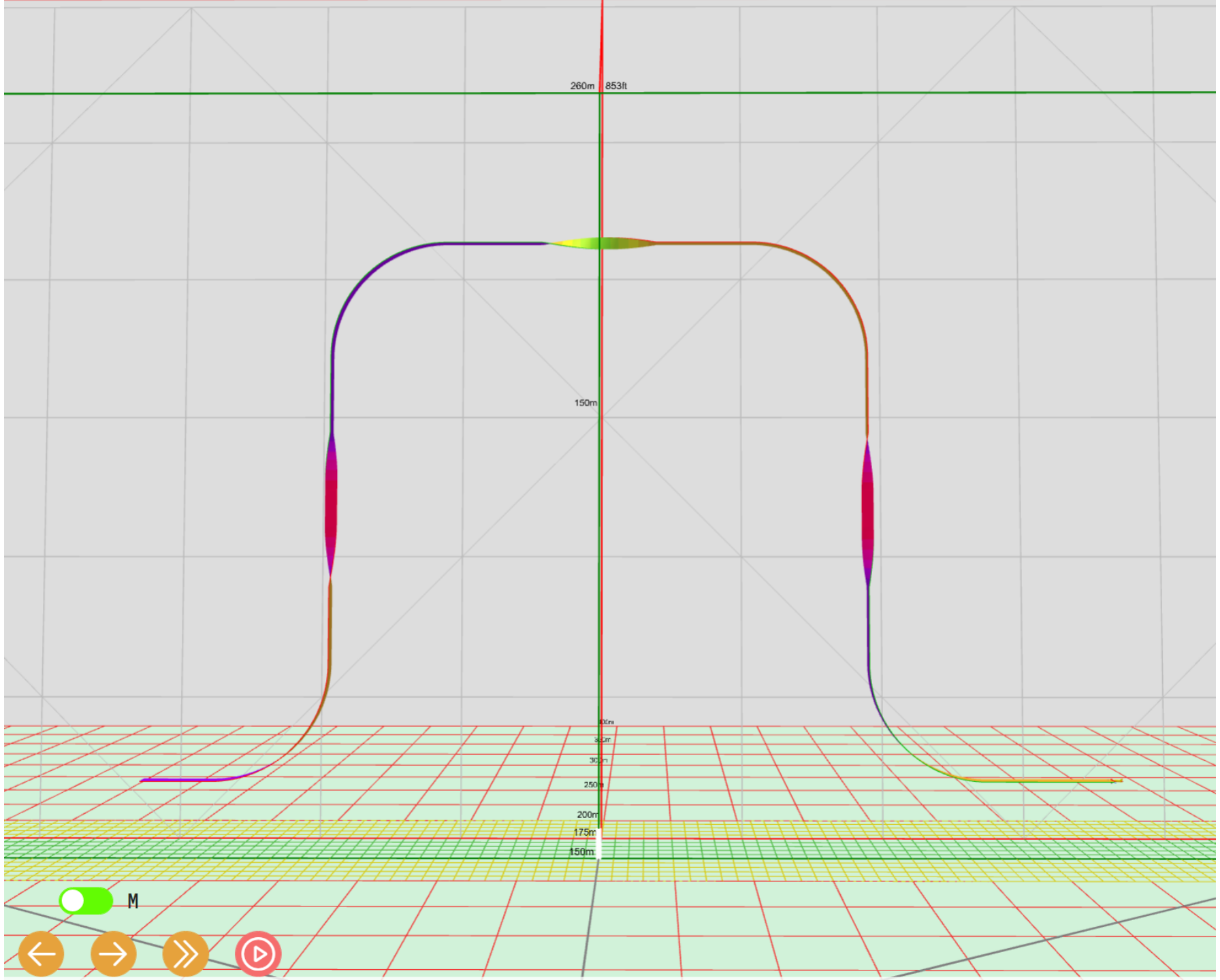
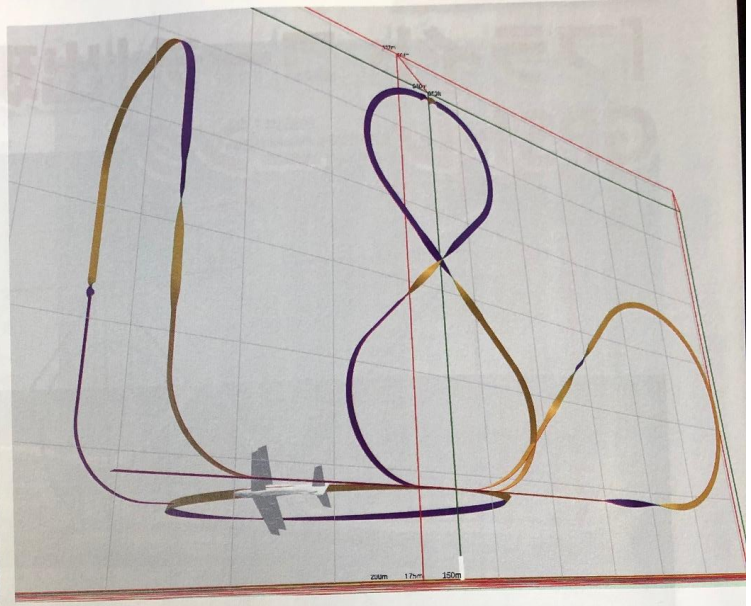
hsq2
figM
fight
tri
shark
loop
Lnd


260m 853ft
150m
250m
200m
175m
150m
M



「フライト コーチ」開発者からのメッセージ

オーストラリアを代表するF3Aフライヤーや技術者が中心となって開発した、飛行軌跡の3D可視化技術と、それを司るアプリケーションの名称が「フライト コーチ」です。今回、その開発チームより本誌にメッセージが届きました。彼らのサイトへのアクセスは自由とのことなので、ぜひチャレンジしてみてください。

https://www.flightcoach.org

https://www.flightcoach.org/template-flights/

●日本のフライヤーに向けて●

F3Aの飛行は難しく、正確かつ優雅に飛行することはさらに困難です。吉岡さん、成家さん、秋葉さん、鈴木さん、八田さん、音田さん(そして、もちろんもっと多くの!)のような日本の偉大なF3Aパイロットに秘訣をたずねたら、きっと「コーチや指導者からの評価やアドバイスに従って、何千回もフライトしましょう」という共通する返事が聞かれそうです。しかし、指導者なしで自分の飛行を正確に評価できますか? または、あなたとあなたの指導者が飛行について意見が一致しない場合はどうなりますか? 私たちが開発したシステムは、低コストで簡単に入手できるハードウェアを使用し、パイロットが飛行場での練習中、または帰宅後快適な自宅で飛行の出来映えを客観的に評価するためのツールを提供します。

Flight Coachは、英国のIMACおよびF3Aのトップパイロットであるthomas Davidのアイデアから始まりました。GPS、安価なマルチローター飛行制御ボード、そして独自のコンピューター分析ツールを融合すれば、指導の支援に有用な飛行分析ができないか? 答えは確かにイエスでした! もちろん、そのようなプロジェクトの実現は複雑で容易ではありません。オーストラリアのF3Aパイロットであるartur Uzieblo は、幅広い知識とプログラミングスキルを持って参加しました。 Andrew Palmer(ニュージーランドF3Aパイロット)はアイデアを整理し、ハードウェア・システムを開発しました。Russell Edwards(オーストラリアのF3Aパイロット)はシステムテストに寄与し、プロッターのマニュアルを作成しました。

中心となるのは、GPSベースの測位を拡張した慣性航法システムです。高度なセンサーフュージョン・アルゴリズムにより毎秒15〜25ポイントのスムーズで正確な飛行経路と姿勢のログを提供します。これは一般的なGPSのみのシステムでの姿勢情報なしで1秒あたり1〜2点だけのものとは比べ物になりません。データはmicroSDカードに記録されます。そして、無料で使用できるWebブラウザベースのFlight Coachソフトウェアが、飛行後の分析を提供します。フライト コーチ・システムはF3Aの難しさを取り除くことはできませんが、機体の飛行経路に関する客観的なデータを提供し、飛行後の分析を可能にすることで、貴重なトレーニングの支援を提供します。

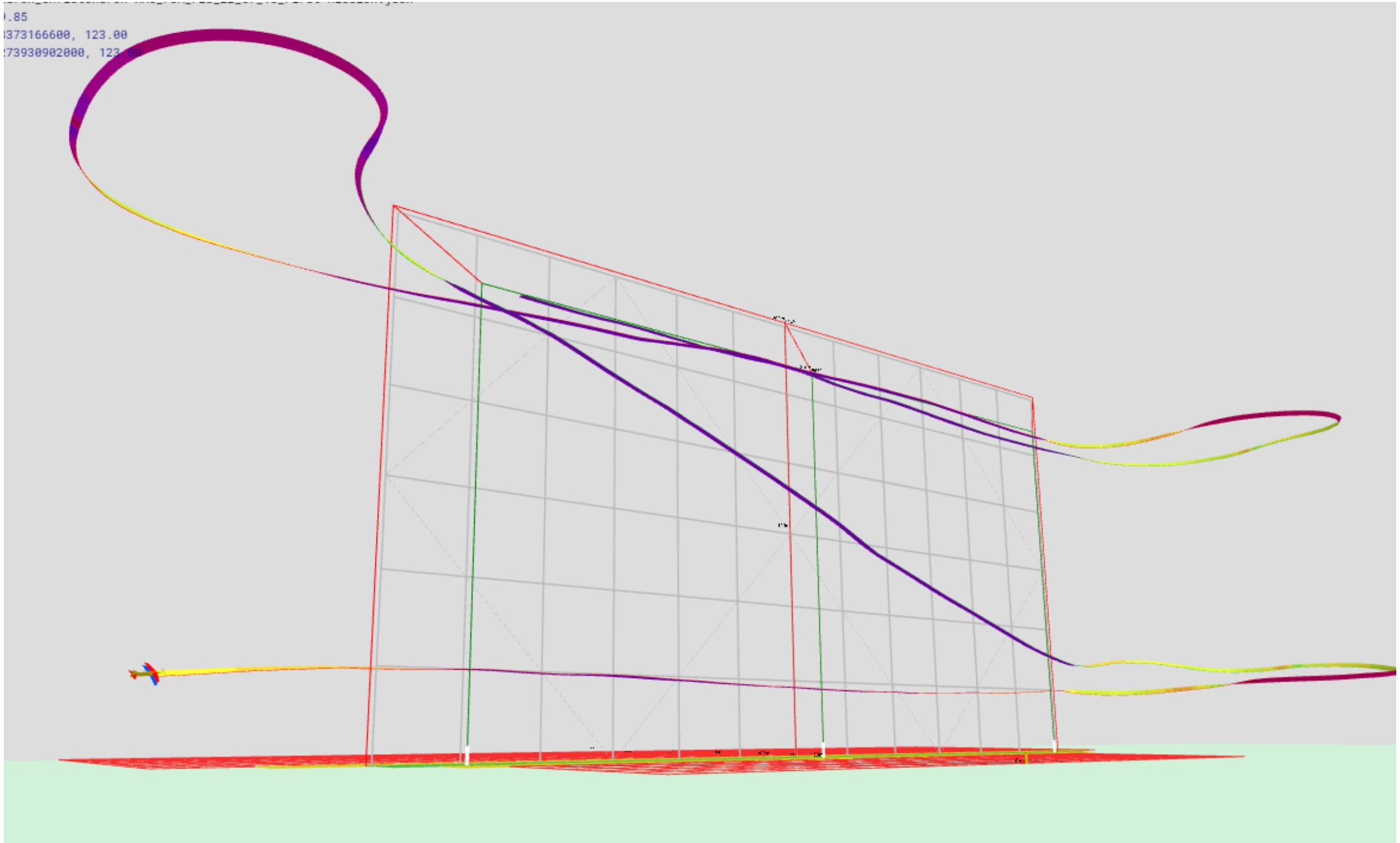
実はハードウェアは、ログに膨大な数のパラメーターを記録しています。現在、Flight Coachはそのうちのいくつかのみを使用しています。これは将来のバージョンで拡張され、パイロットがより多くの情報を利用できるようになる可能性もあります。機体位置での風向、迎え角と横滑り、対気と対地速度、G力などの推定を含める可能性があります。

日本の皆さんがフライト コーチ・システムを体験できることを願っています。練習に時間と労力を費やせば、それだけ飛行の改善に役立つと確信しています。

Andrew Palmer (訳/佐々木 哲)

Ardupilot Autonomous Aerobatics Project

https://www.youtube.com/watch?v=MmUDC3A7Ntk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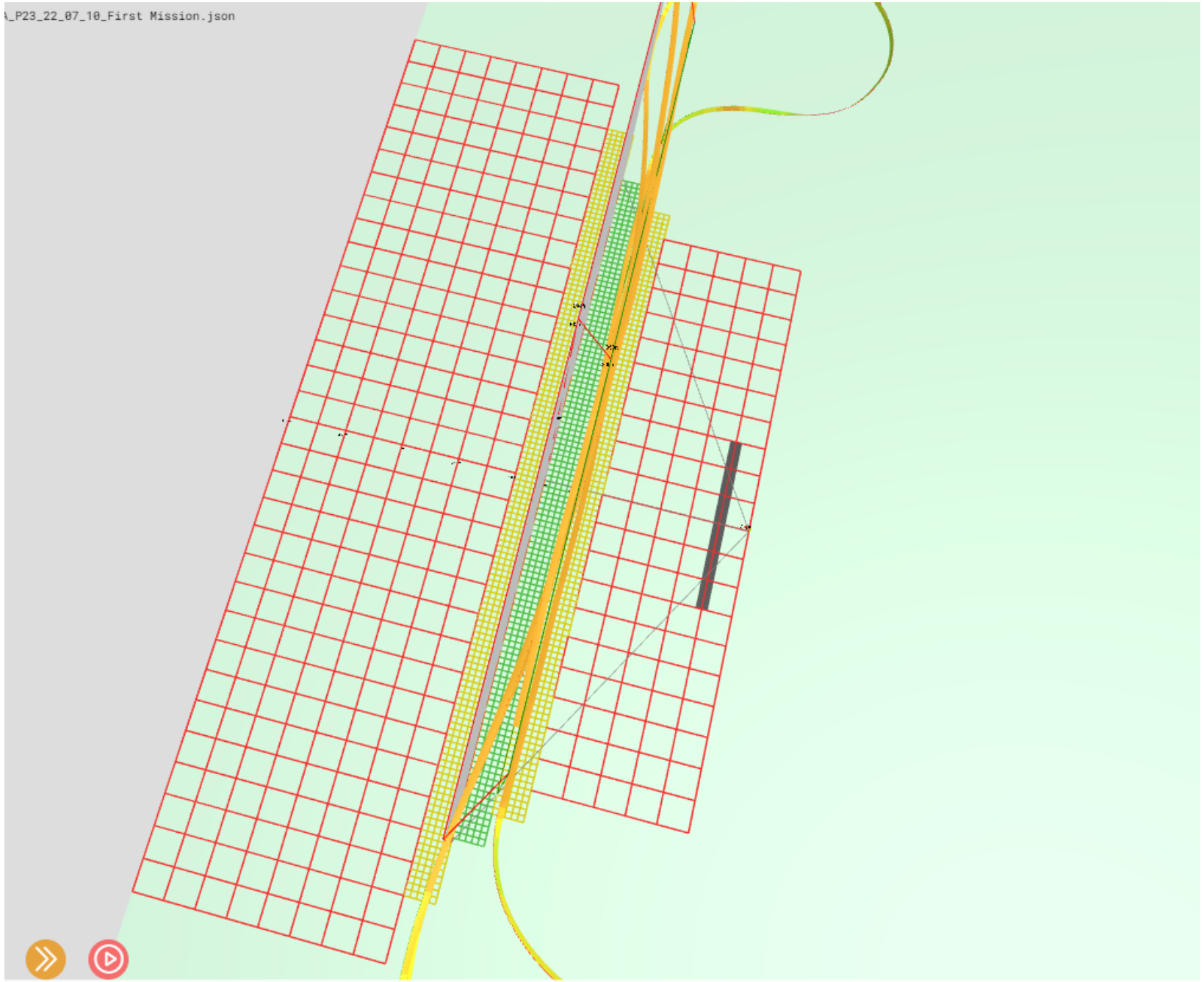
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ROLL
TRAINER
By Knife Edge Software
START


Roll
1/4
Score
No Attempts
START OVER
SHOW DETAILS
How much error do you see?
0
5
10
15
20
25
30
35
40
45

Next time

- I still have 2 x sets of 10 questions to go!
- Walk through some manoeuvres – from a flying and judging perspective
- Electronic score entry systems

Any Questions?