

# Precision Aerobatics Judging Questions – with Answers Explained Set D

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 Masters Schedule Questions

NZ Classic Schedule Questions

Electronic Scoring Systems

Tonight's ten questions

Tools to help with judging (and flight training!)

Any questions

# 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)

# But first, lets get ready with Poll Everywhere

Respond at [Pollev.com/andrewpalmer714](https://Pollev.com/andrewpalmer714)



Its anonymous and free!



# About Myself



# Where to find Judging Information?



## FAI AEROMODELLING COMMISSION (CIAM)

[HOME](#) [ABOUT US](#) [OUR SPORT](#) [EVENTS](#) [RECORDS](#) [AWARDS](#) [NEWS](#) [SPORTING CODE](#) [DOCUMENTS](#) [E-PLENARIES](#) [PROJECTS](#)  
[CONTACT US](#)

### SPORTING CODE

#### SPORTING CODE - SECTION 4: AEROMODELLING



27 APR 2022    Volume CIAM General Rules - edition 2022    (733 KB)



22 MAY 2022    Volume F1 - Free FLight - Edition 2022 (version2)    (615 KB)



07 DEC 2021    Volume F2 - Control Line - edition 2022    (1847 KB)



07 DEC 2021    Volume F2 - Control Line Annex 4j - edition 2022    (199 KB)



07 DEC 2021    Volume F3 Aerobatics - edition 2022    (2669 KB)



22 MAY 2022    Volume F3 - Helicopters edition 2022 (version 2)    (2410 KB)



07 DEC 2021    Volume F3 Pylon Racing - edition 2022    (1016 KB)



07 DEC 2021    Volume F3 Soaring - edition 2022    (1080 KB)





## 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
<b>Positioning</b> - <i>Appropriate distance out should be based on visibility of aircraft</i>	
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
<b>Lines</b>	
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
<b>Loops</b>	
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
<b>Rolls</b>	
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**

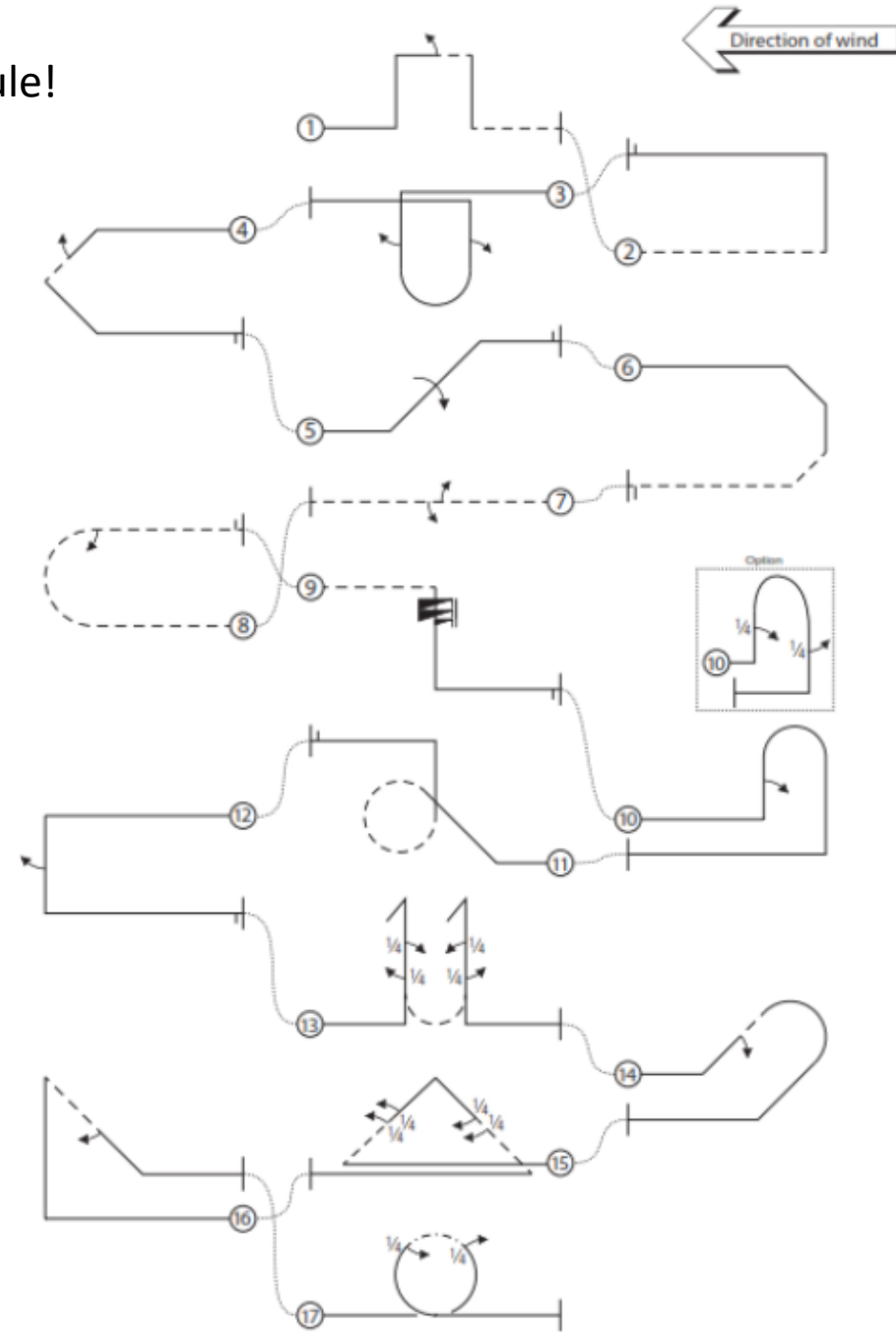
Pivot up to ½ wingspan	1
Pivot up to 1 wingspan	2 - 3
Pivot >1½ wingspans	4 - 5
Pivot >2 wingspans or flops over	Zero scored
Torques off	1 per 15 degrees
Pendulum movement after pivot	1
Skid before reaching stall turn (early rudder)	1
Drift when stalled or near stalled (not outside aerobatic zone)	No 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

# ADVANCED SCHEDULE A-23 (2021-2023)

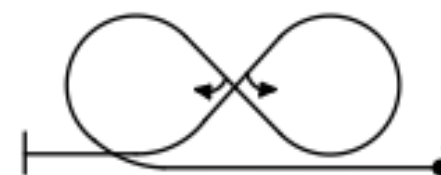
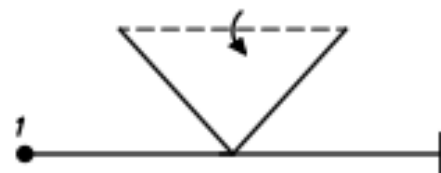
NZ Masters Schedule!



# Classic Pattern Schedule 2022

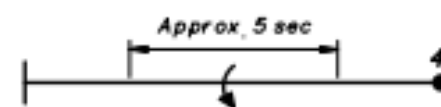
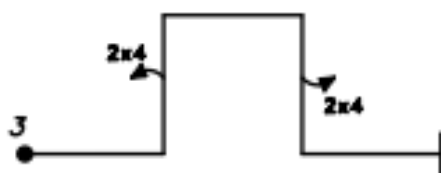


TRIANGLE  
LOOP



CUBAN  
EIGHT

TOP  
HAT

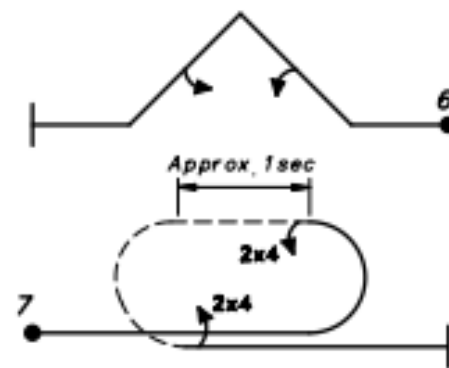


SLOW  
ROLL

TWO  
OUTSIDE  
LOOPS

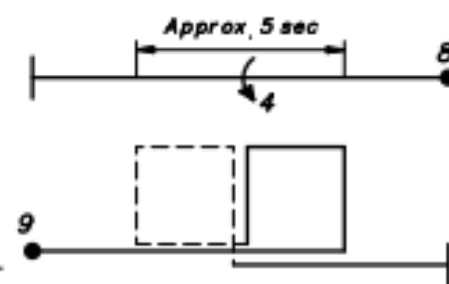


DOUBLE  
IMMELMAN



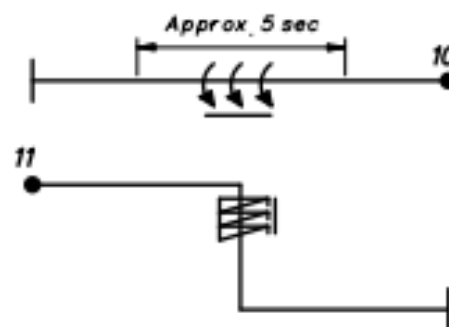
COBRA  
ROLL

SQUARE  
HORIZONTAL  
EIGHT



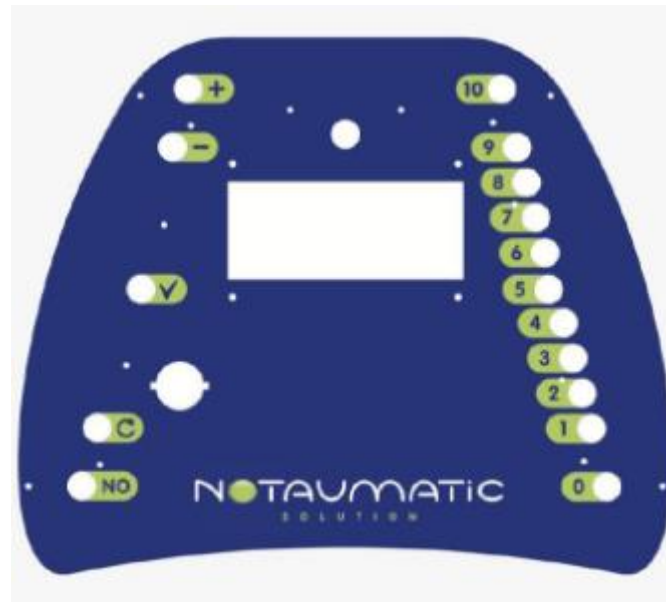
FOUR  
POINT  
ROLL

THREE  
TURN  
SPIN



THREE  
HORIZONTAL  
ROLLS

# Electronic Scoring Systems





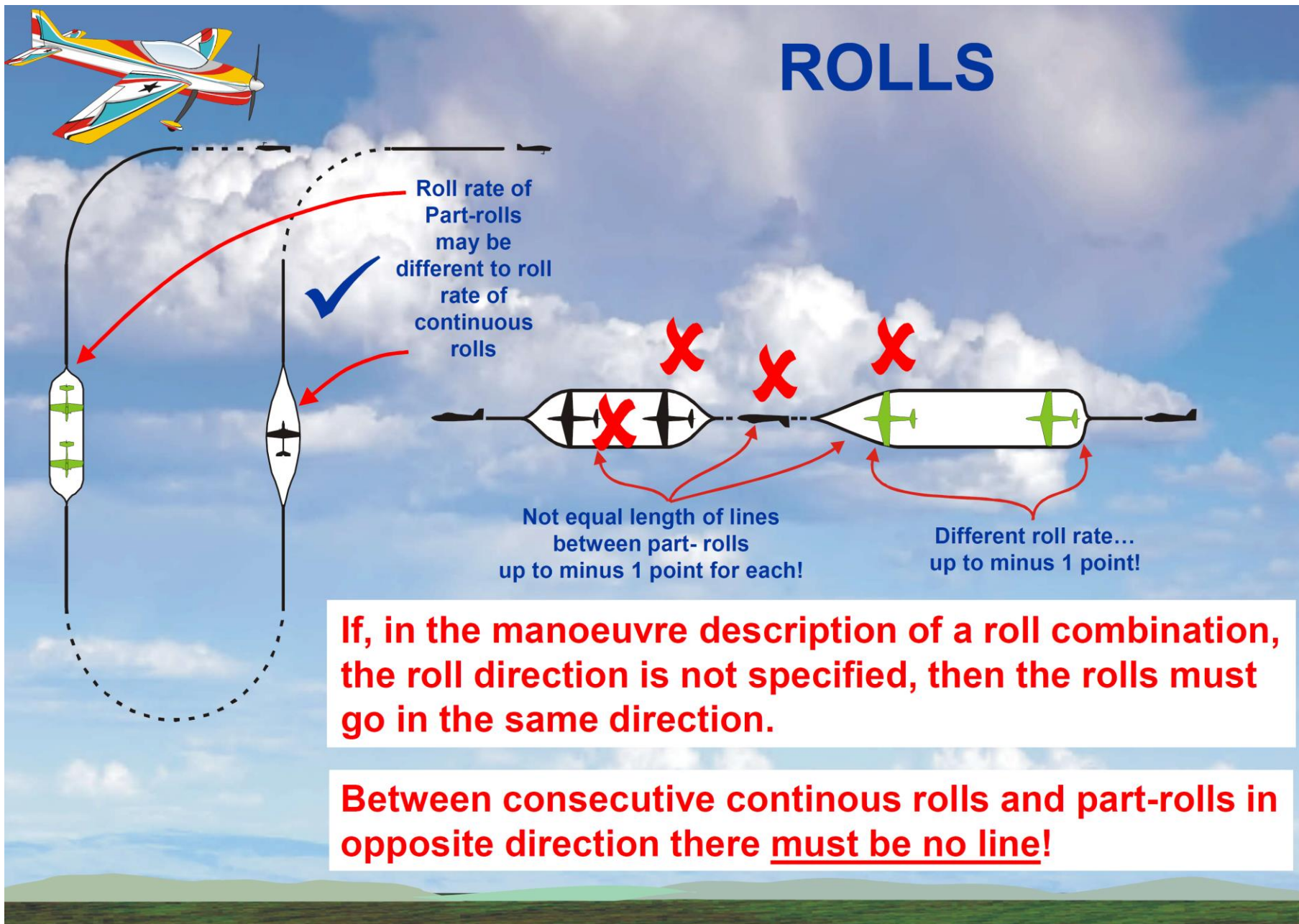
1. In rolling manoeuvres that require opposite direction rolls, (part rolls or continuous rolls) there must be \_\_\_\_\_ line between consecutive rolls.

A short ☐

A long ☐

No ☐

# ROLLS





5B.8.5 e) - Between consecutive continuous rolls or part-rolls in opposite direction there must be no line.

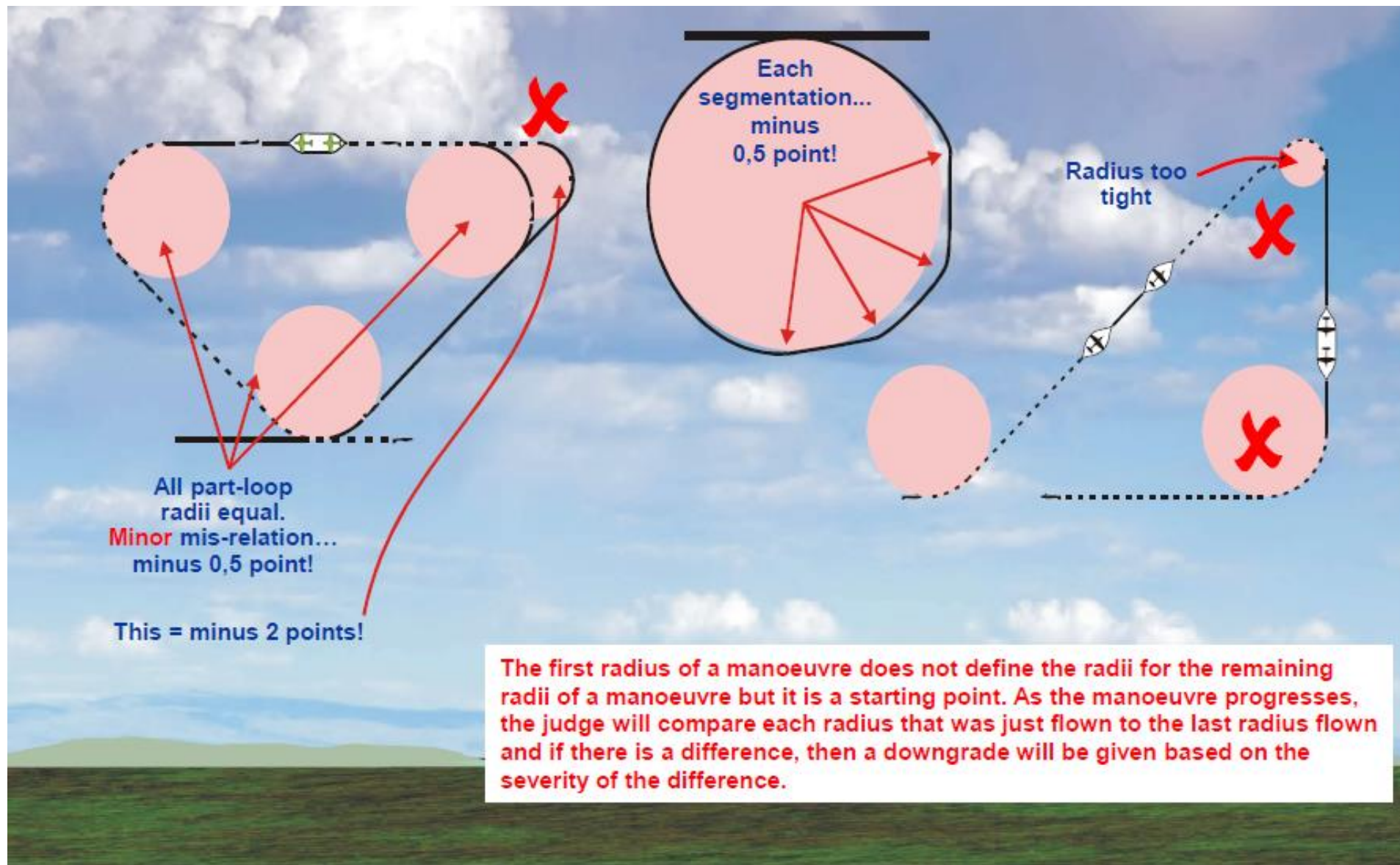
2. Loops and part-loops within a manoeuvre should all have the same radii:

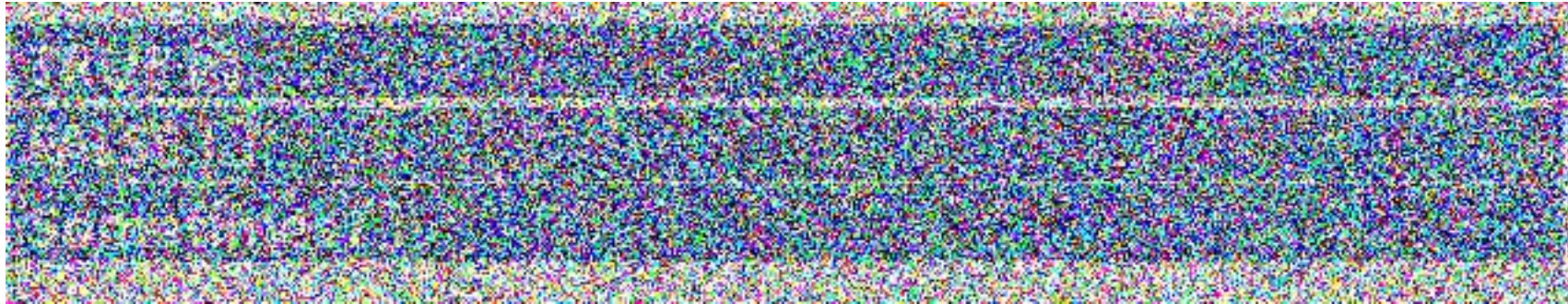
TRUE ☐

FALSE ☐

Sometimes ☐







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5B.8.4 - Loops and part-loops within one manoeuvre must have the same radius



3. Loops should be flown in the vertical plane and not drift closer or further from the judges. What downgrade should be applied for a minor drift closer or further from the judges?

0 points <input type="checkbox"/>	2 points <input type="checkbox"/>
0.5 point <input type="checkbox"/>	Zero the manoeuvre <input type="checkbox"/>
1 points <input type="checkbox"/>	



# Judging ACCURACY

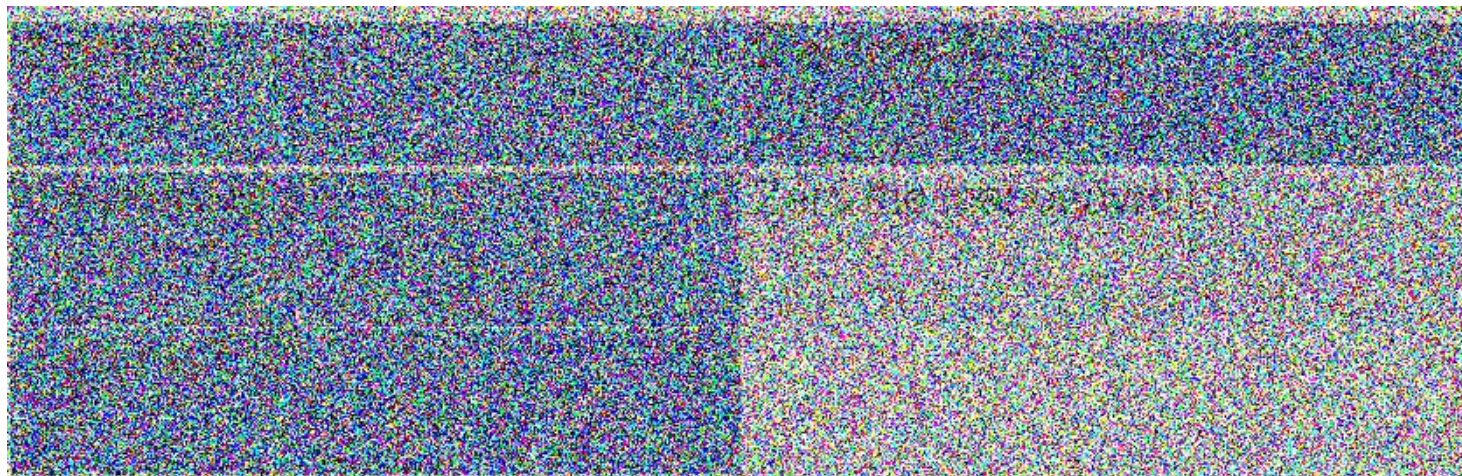
Downgrade by **up to 1** point for a minor defect

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



5B.8.4 - If the loop is not performed entirely in the vertical plane ie it drifts closer or further from the judges, minor drift must be downgraded by 0.5 point, while more severe drift must be downgraded more.

## 4. Manoeuvres with more than one loop or part-loop must have:

The same radius ☐

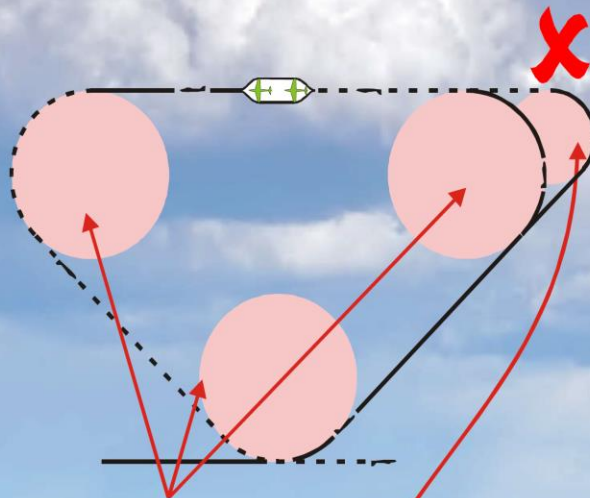
Same radius for part-loops only ☐

Different radius for part-loops ☐



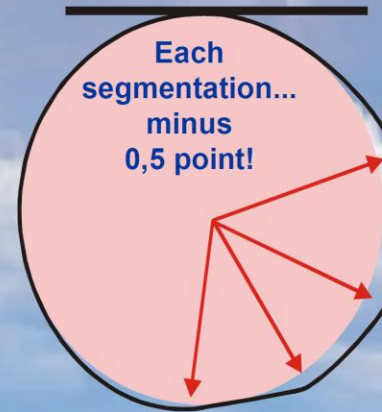


# LOOPS

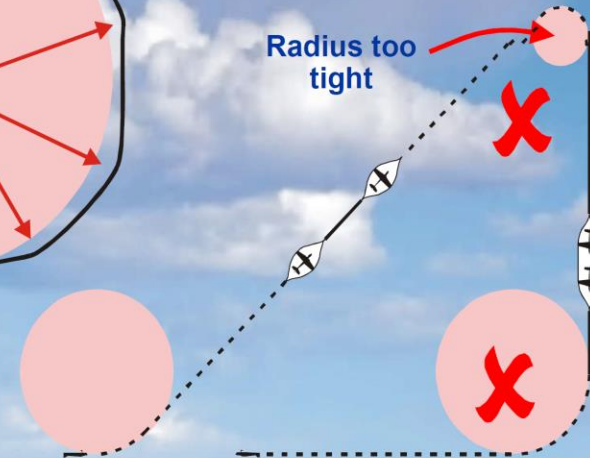


All part-loop  
radii equal.  
**Minor** mis-relation...  
minus 0,5 point!

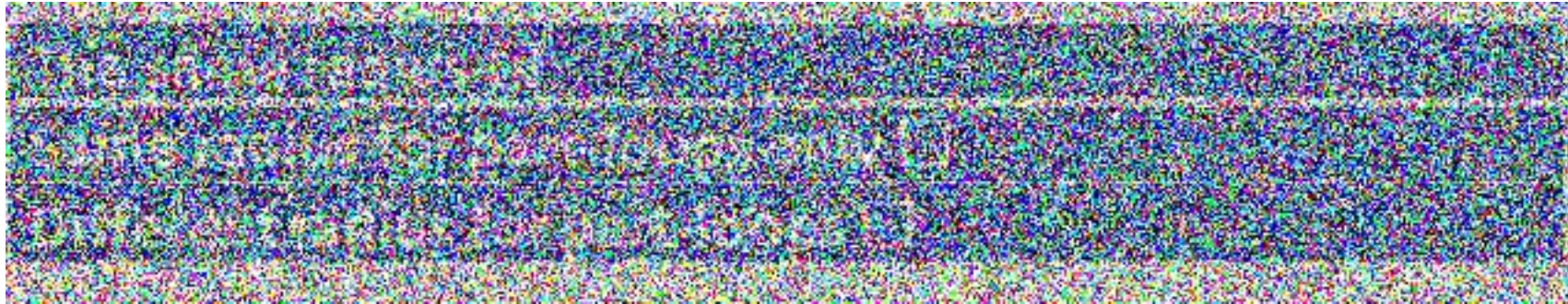
This = minus 2 points!



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.



5B.8.4 - Loops and part-loops within one manoeuvre must have the same radius



5. One point should be subtracted for each approximate \_\_\_\_\_ degrees of deviation from defined manoeuvre geometry.

5 degrees <input type="checkbox"/>	30 degrees <input type="checkbox"/>
10 degrees <input type="checkbox"/>	45 degrees <input type="checkbox"/>
15 degrees <input type="checkbox"/>	90 degrees <input type="checkbox"/>



# 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



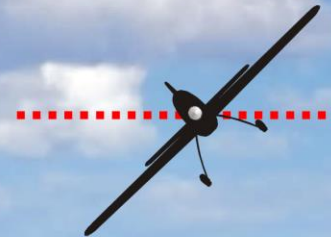
Approximate 15°  
deviation =  
1 point downgrade



Approximate 30°  
deviation =  
2 points downgrade



Approximate 45°  
deviation =  
3 points downgrade





# 1 POINT PER 15° DEVIATION

Perfect geometry =  
No downgrade

Approximate 15°  
deviation =  
1 point downgrade

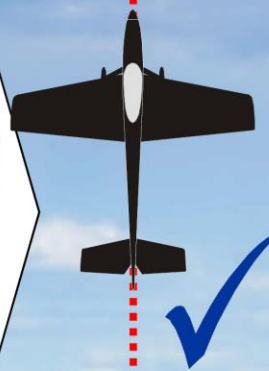
Approximate 30°  
deviation =  
2 point's downgrade

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° 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.**



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5B.8.2 - 1 point must be subtracted for each approximate 15 degrees deviation, but 0.5 points only for half of this.

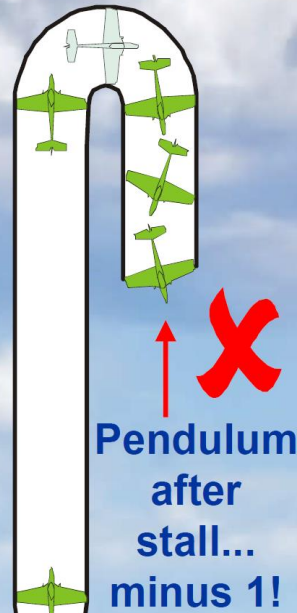
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6. Pendulum movement after a 180 degree Stall Turn has been described by some judges in the past as 'an indication of a true stall'. What downgrade must be applied for pendulum movement?

0 points <input type="checkbox"/>	3 points <input type="checkbox"/>
1 point <input type="checkbox"/>	Zero the manoeuvre <input type="checkbox"/>
2 points <input type="checkbox"/>	



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



No line before roll...  
minus 3 points!



5B.8.11 - If the model aircraft shows a pendulum movement after the pivot, the manoeuvre is downgraded by 1 point.

7. Scoring for the remainder of the flight will immediately cease: (Note: Check all correct answers)

At the point of any item being jettisoned (eg: dropped) from the model ☐

After the expiration of the 8-minute time limit ☐

If any part of a manoeuvre crosses the safety line ☐



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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.

5.1.11 m) - With the expiry of the 8-minute flying time, the scoring will cease

5B.10 - If any part of a manoeuvre is performed beyond the safety line, the manoeuvre will be zeroed. Repeated infringements of the safety line may result in the competitor being asked by the flight line director to terminate the flight

8. Should a visible line between the half loop and the half roll in an Immelmann Turn and a Split-S result in a downgrade?

Yes ☐

No ☐

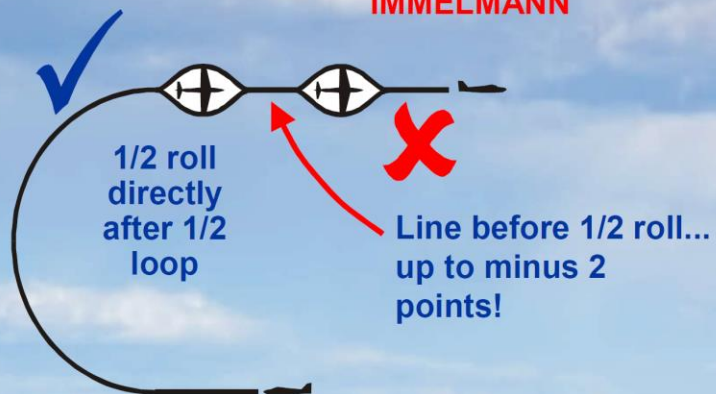
Only if the line is longer than 20m ☐

Only for Immelman Turns, no downgrade for Split-S  
☐





# Line/Loop/Roll/Horizontal Circle COMBINATIONS



Radii are equal

**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!

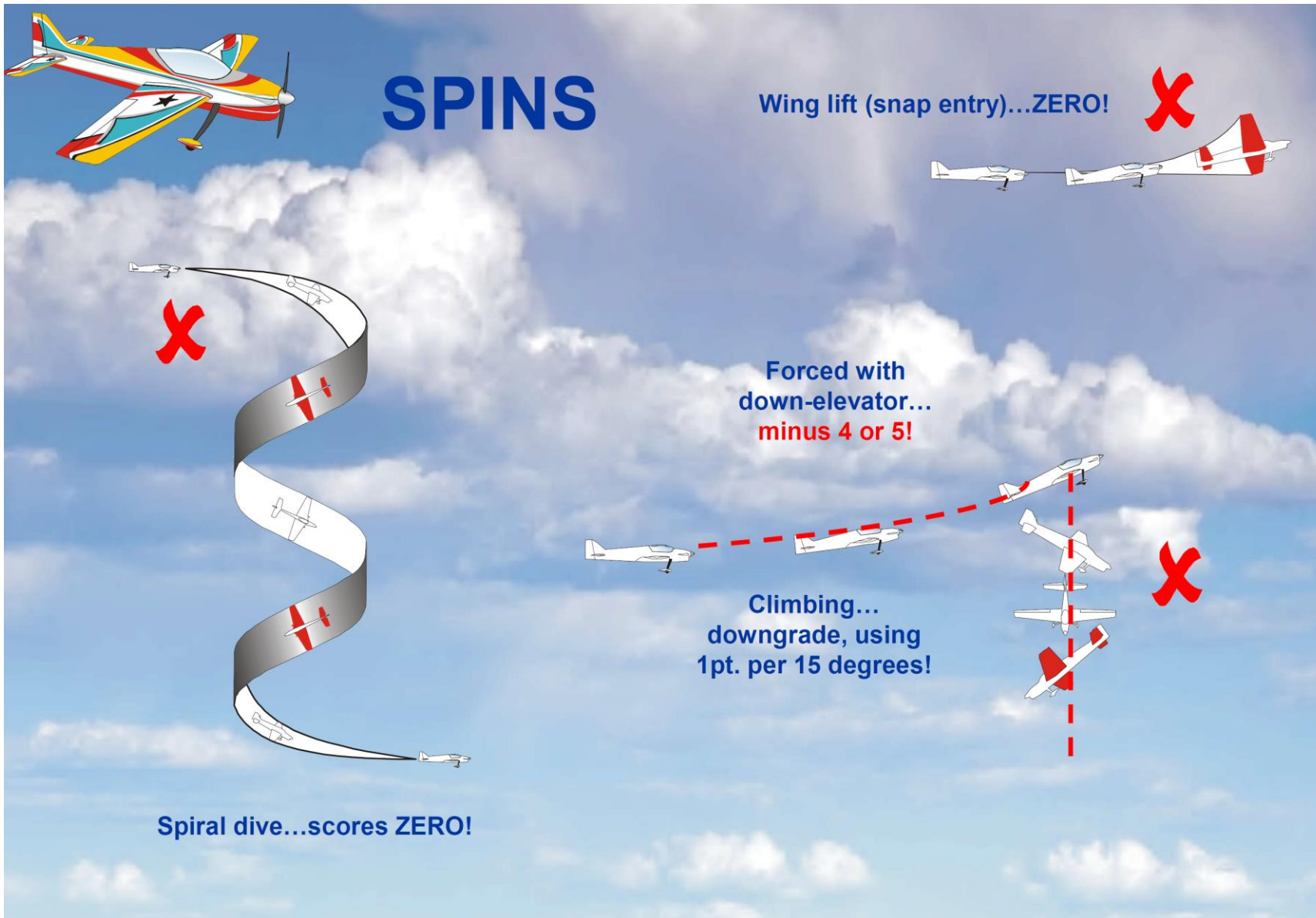




5B.8.10 - ...all Immelman Turn and Split-S manoeuvres ... rolls are always performed immediately before or after (the) part-loop... A visible line in-between the two components or rolls and not completely before or after the part-loop, must downgrade the manoeuvre. Up to 2 point downgrade per the Manoeuvre Execution Guide (images/judging/manexguide-2022-final.pdf) - Page 63

9. The downgrade for a model that is not stalled, or is snap-rolled, into a spin is:

0 points <input type="checkbox"/>	4-5 points <input type="checkbox"/>
1 point <input type="checkbox"/>	Severe downgrade (more than 5 points) <input type="checkbox"/>
2-3 points <input type="checkbox"/>	Zero the manoeuvre <input type="checkbox"/>



# SPINS

Wing lift (snap entry)...ZERO!

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

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

Spiral dive...scores ZERO!





5B.8.12 - If the model aircraft does not stall or if the model aircraft is snap-rolled or spiral-dived into the spin, the manoeuvre is zeroed.

10. The flight path (track) of a model is:

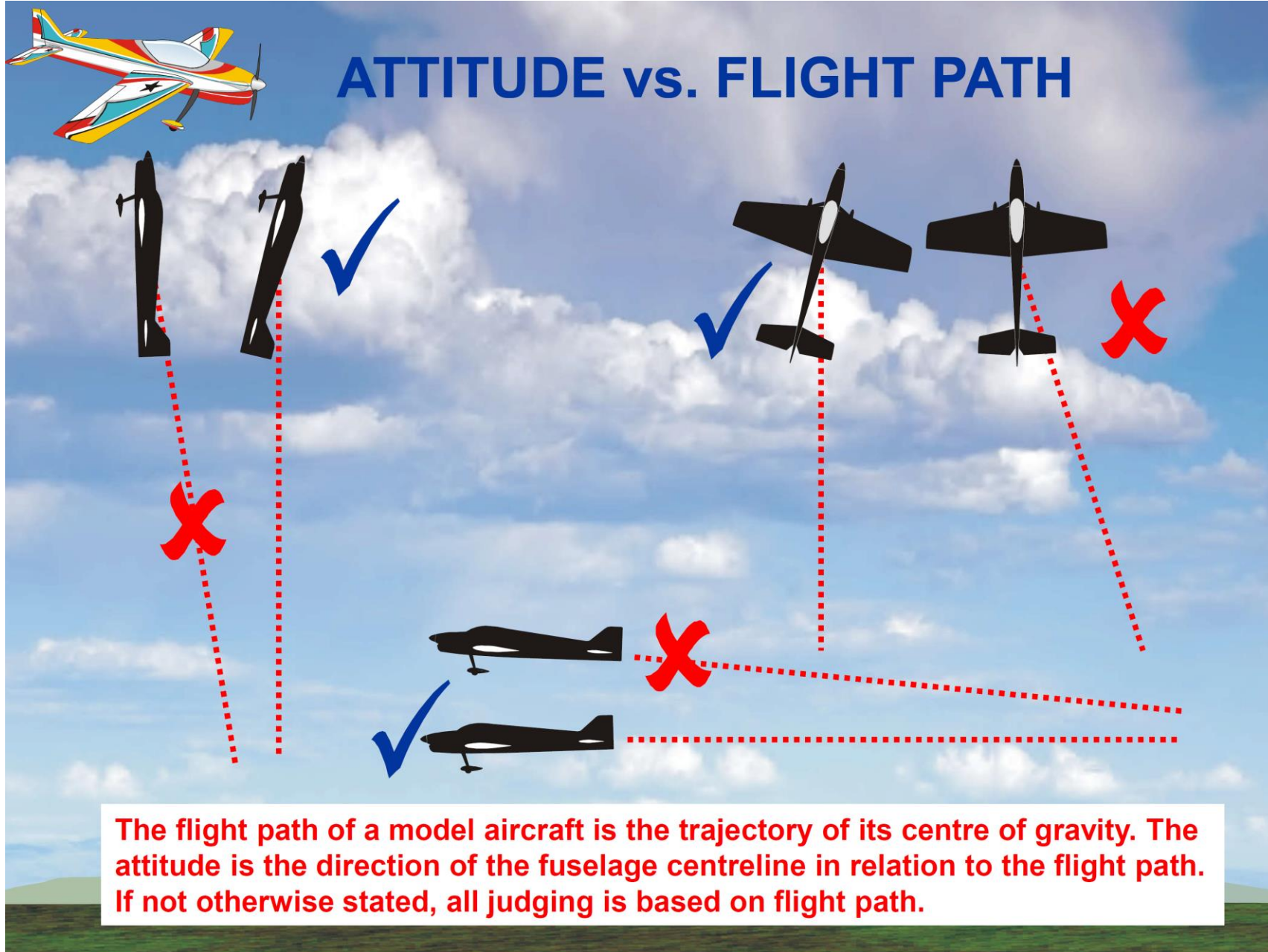
Its heading ☐

The direction of the fuselage centerline (attitude)  
☐

The trajectory of its center of gravity ☐



## ATTITUDE vs. FLIGHT PATH





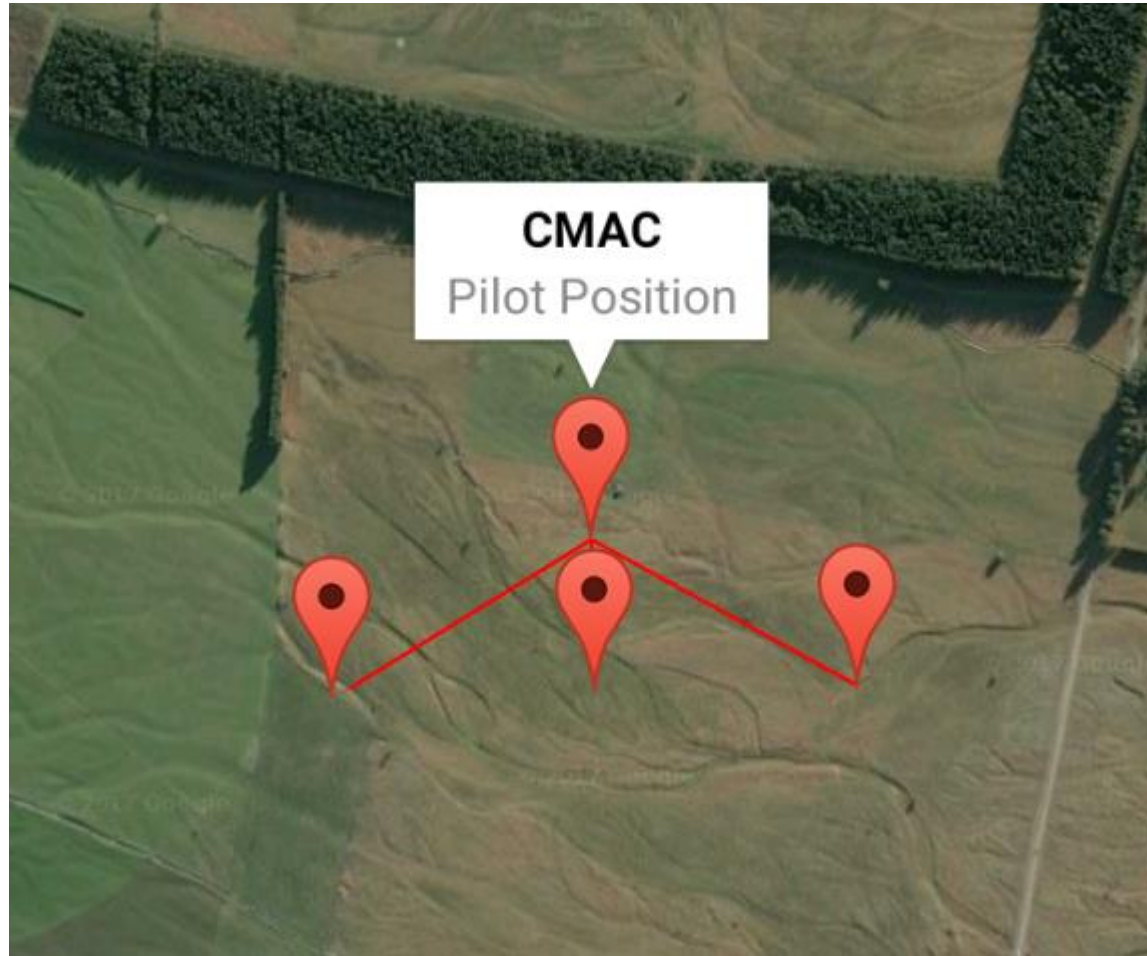
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5B.6. - The flight path of a model aircraft is the trajectory of its centre of gravity. The attitude is the direction of the fuselage centre-line in relation to the flight path.  
If not otherwise stated, all judging is based on flight path.

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

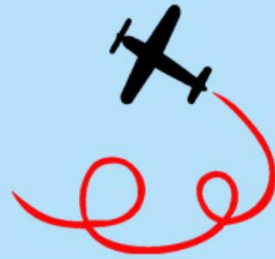


# F3A Zone Pro (iOS and Android)



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

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### 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).

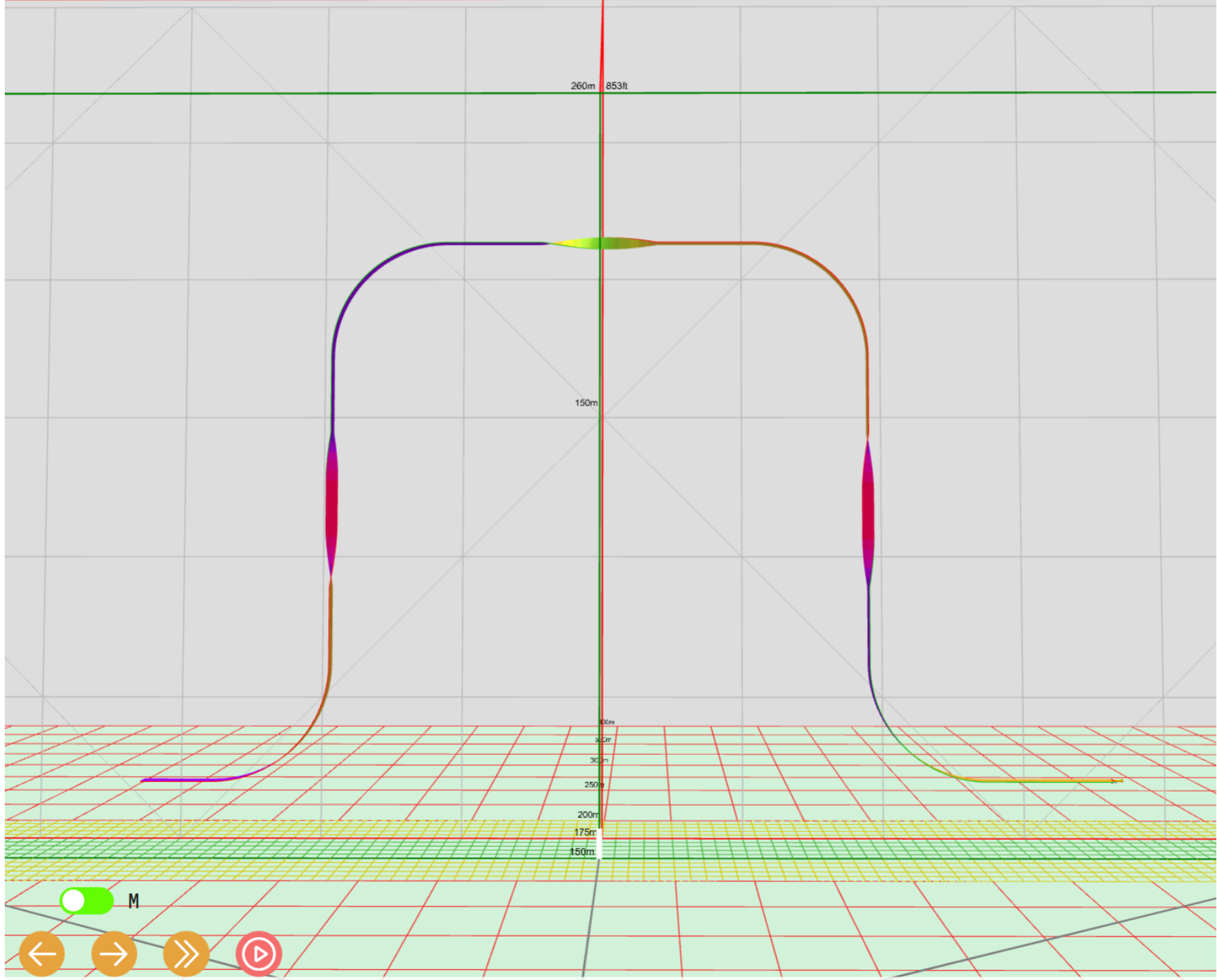


 Views

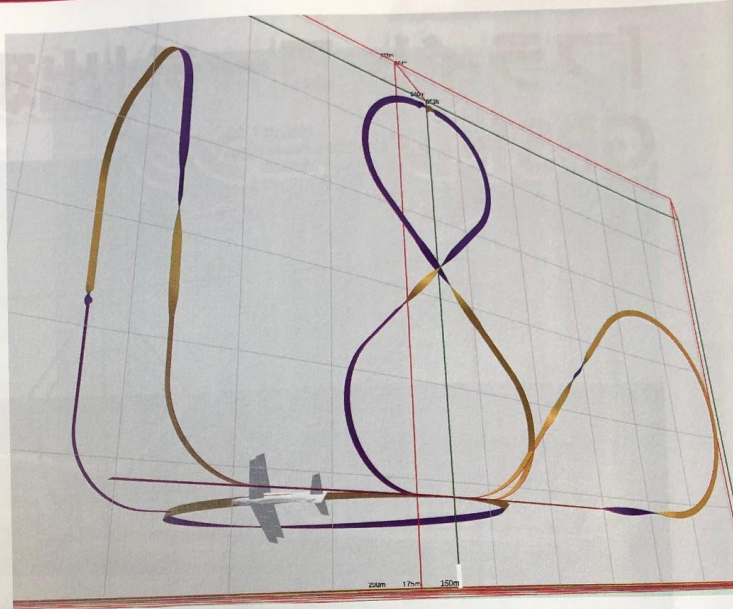
Manual

Hide ☒

Att Vel 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を従って、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>

YouTube <sup>NZ</sup>

Search

## ArduPilot Aerobatics

The aerobatic 'box'



- 150m out from origin
- 60 degrees either side of centre
- 60 degrees high

- Can we fly this path autonomously?

(not with current code)

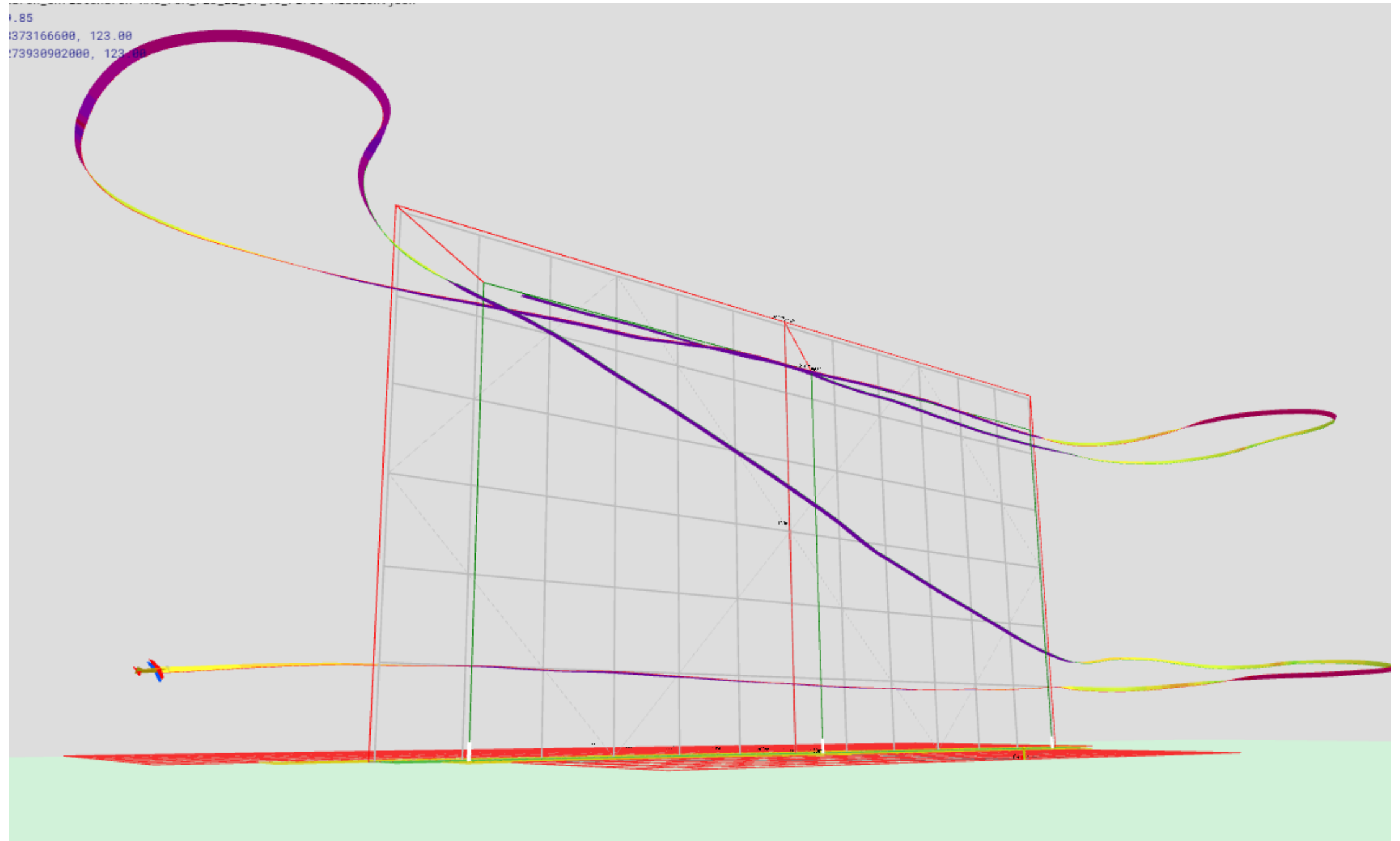
ARDUPILOT  
Versatile, Trusted, Open

Andrew Palm...

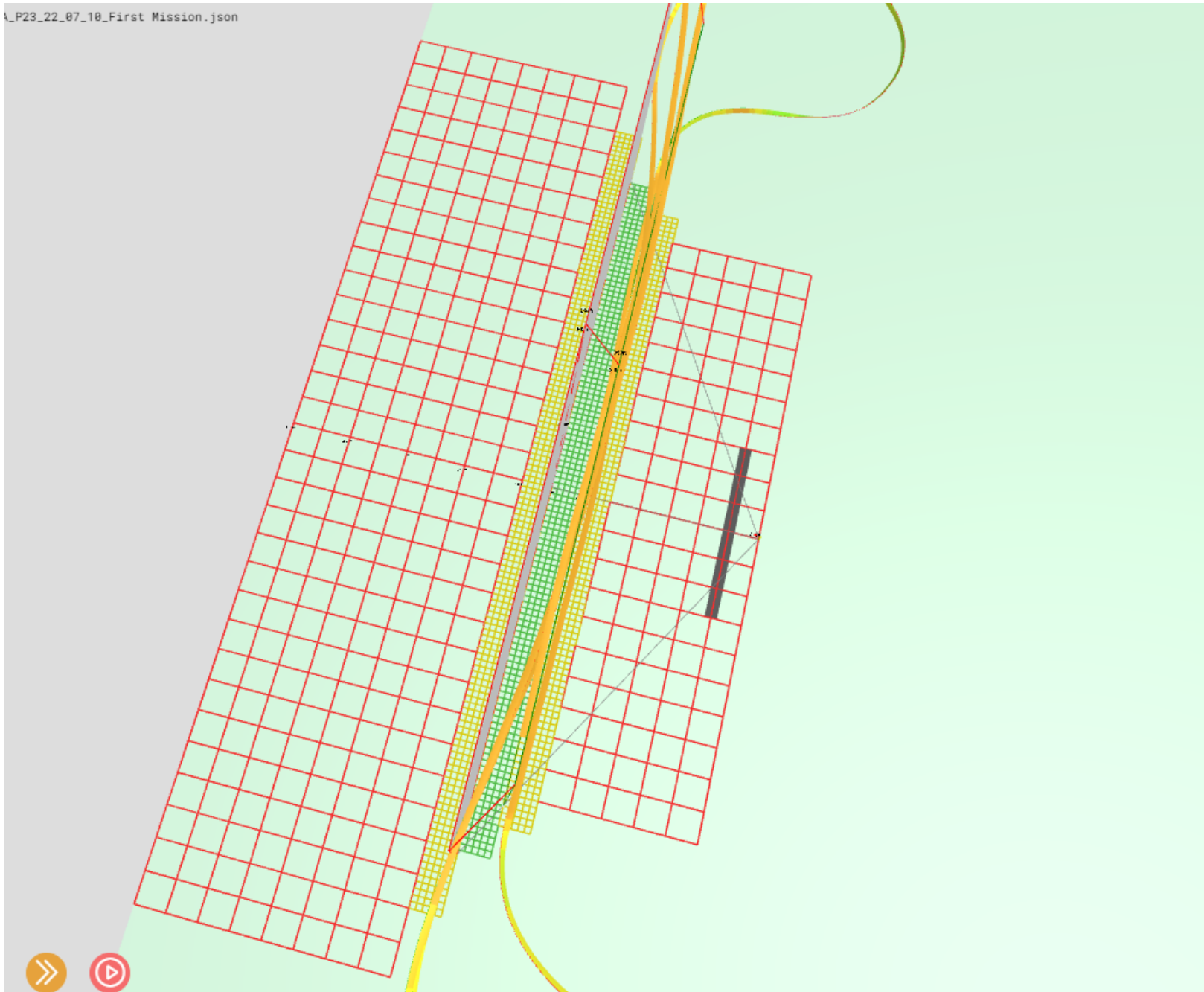
9:12 / 3:35:43

zoom

1.85  
373166600, 123.00  
73930902000, 123.00



\_P23\_22\_07\_10\_First Mission.json





# 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 1 x set of 10 questions to go!

Any Questions?

