

BEGINNERS GUIDE TO WINNING AN AEROBATIC CONTEST 2021

David Pilkington
FRAeS



RVAC AEROBATIC CONTEST TROPHY PRESENTATIONS 2003

INTRODUCTION

RVAC has been prominent in the sport of aerobatics for many years:

- This perpetual trophy was first awarded in 1935. Read out a few of the names – anyone recognise them? EG Roberts 1935, PJ Gibbs 1936, JH Hood 1938, CH Cook 1939, **CA Morrison** 1962, Miss PJ Brown 1967, WF Waterton 1968, JC Fincher 1969, GA Seymour 1971, HV Markby 1975 and RJ Maclean 1977
- RVAC pilots competing at the 1974 National Championships were **Con Simari**, Harry Markby, John Day, John Boag, Dick Maclean, **Ken McKechnie** – that was half the field!
- In 1977, new boy **David Pilkington** had joined them (started aerobatics in 1969 and later some aeros with former RVAC CFI Roy Goon).



A U S T R A L I A N A E R O B A T I C
C L U B

NEWSLETTER AUGUST 1978.

MELBOURNE CHAPTER AERO CLUB COMPETITION

Aston, Wyoming 83110
Attn: Mr. Malcolm White

Dear Mr. White,

On 29 and 30 September 95, Mr. Lester Berven, an FAA flight test pilot from the Sea ACO flight test branch reviewed your production flight test acceptance procedures for both the HUSKY A-1, and the Pitts S-2B. Mr. Berven also flew both aircraft, and completed a production flight test pilot standardization check for Messrs. Peter S. Pierpont and David J. Pilkington.

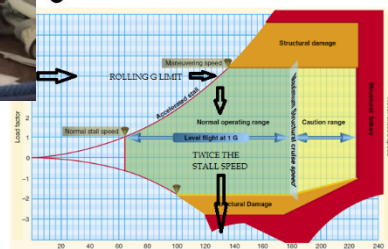
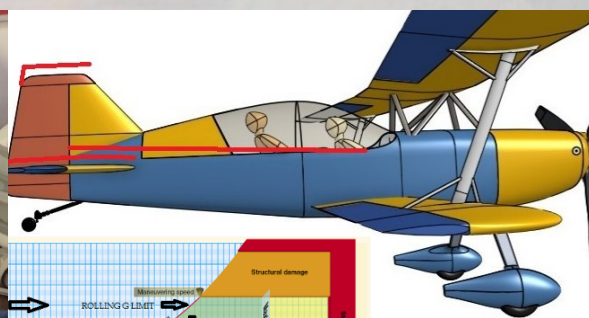
Based on the successful completion of the document review and the flight evaluation, Messrs. Pierpont and Pilkington are hereby authorized to conduct and approve production acceptance flights for both the HUSKY A-1 and the Pitts S-1, and S-2 (all variations).

Flying Instructor of the Year

2019 Winner – David Pilkington

Mr David Pilkington (Australie)

en reconnaissance des remarquables services rendus à l'aéronautique et aux sports aériens, et plus particulièrement à la voltige aérienne.



National Aerobatic Championships Griffith NSW 1985

Advanced Category

FINAL PLACINGS

NAME	SCORE
D.Pilkington	6184.7
W.Farley	5750.1
J.Walker	4623.8
C.Burns	3052.8

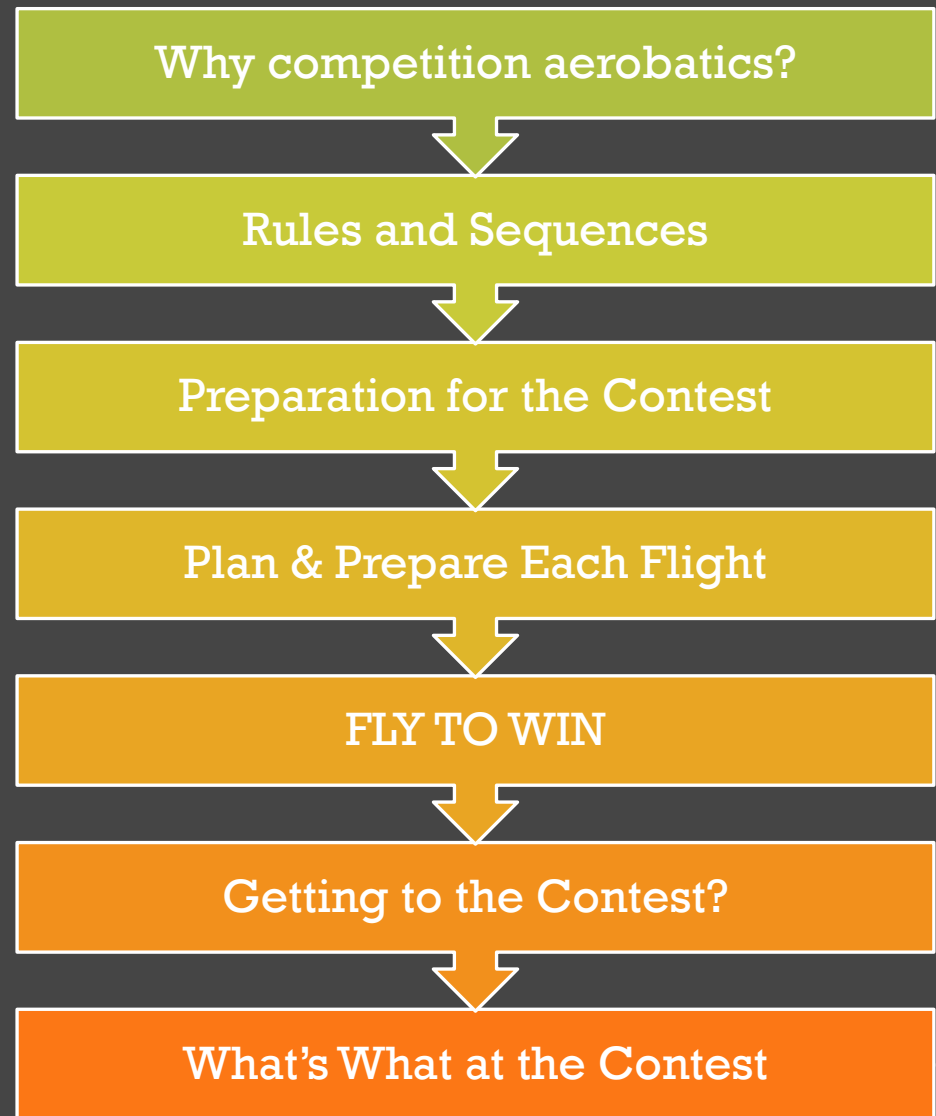
For instance, David Pilkington gave a masterly exhibition in the stock standard and now very dated ACA Super Decathlon *Little Nell*, including a half upward vertical roll, an elegant slow motion avalanche, and a remarkable knife-edge half-Cuban which he repeated in case his audience, like me, couldn't believe it was possible.



FINAL PLACINGS 1986

UNLIMITED	
NAME	SCORE
G.Selvey	13796.4
M.Beard	12869.2
B.Henderson	12820.1
P.Larsen	12354.5
S.Hart	10002.2
C.Sperou	9459.4
D.Pilkington	8845.4

CONTENT - OVERVIEW



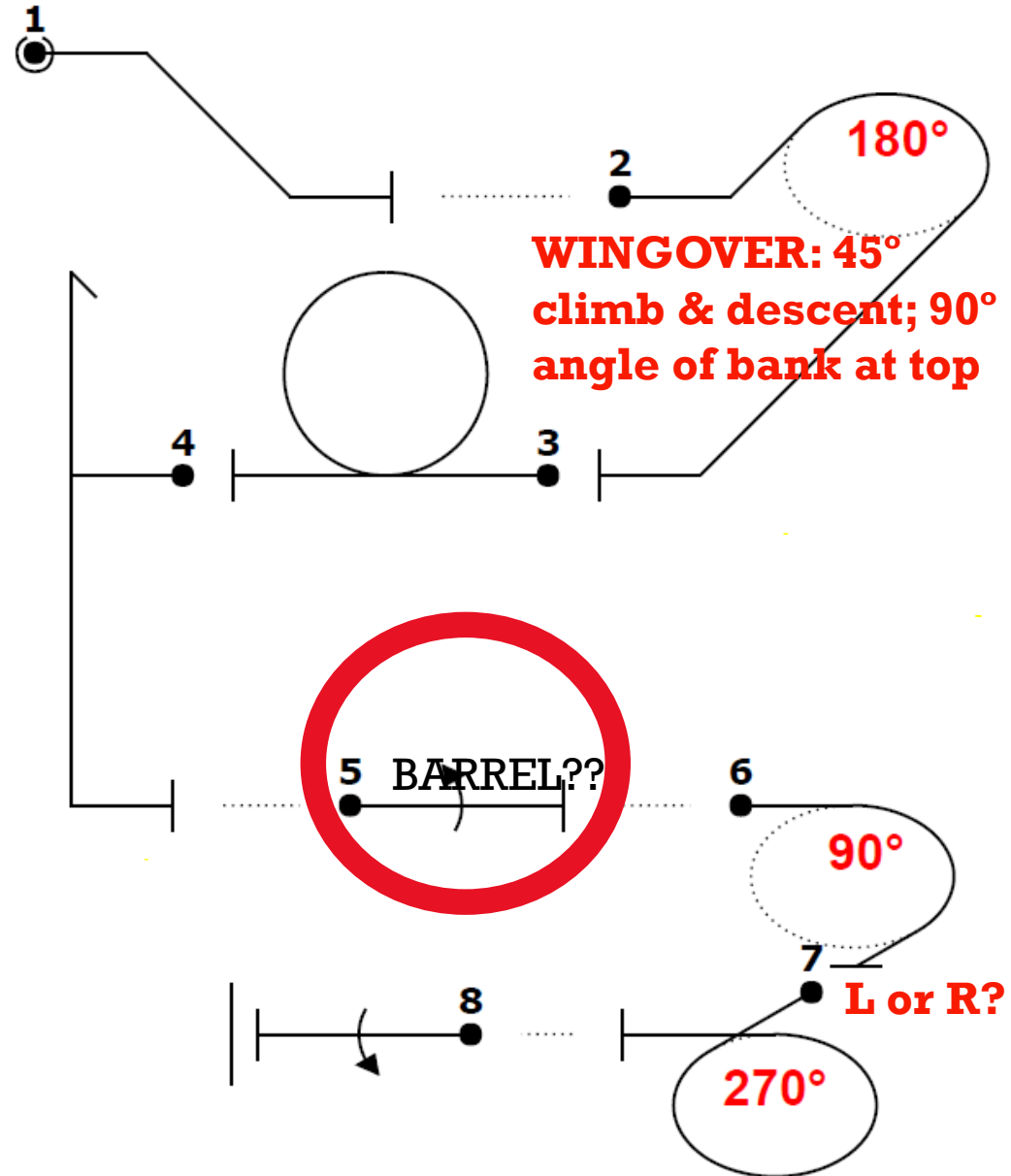
Why Competition Aerobatics

- Flights are short so good for the budget
- Want hours? – ferry aircraft to the contest and practice more – go up a category
- Easy to get up to speed after AERO endorsement
- Fly solo above 3,000 ft or DUAL?
- It is a lot of fun, challenging and educational

Official wind!



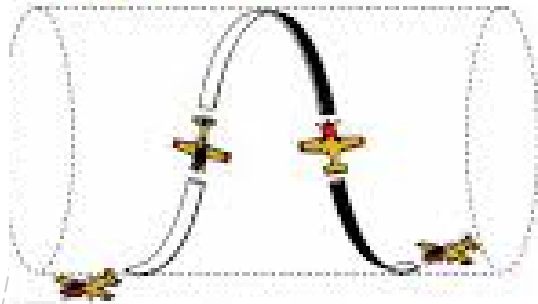
ENTRY
CATEGORY
SEQUENCE



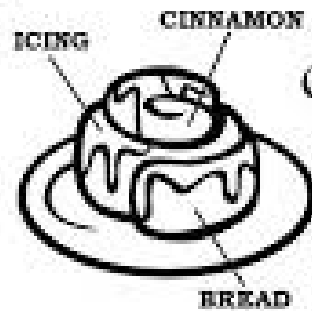
LEARN THE DIFFERENCE



AILERON
ROLL



BARREL
ROLL



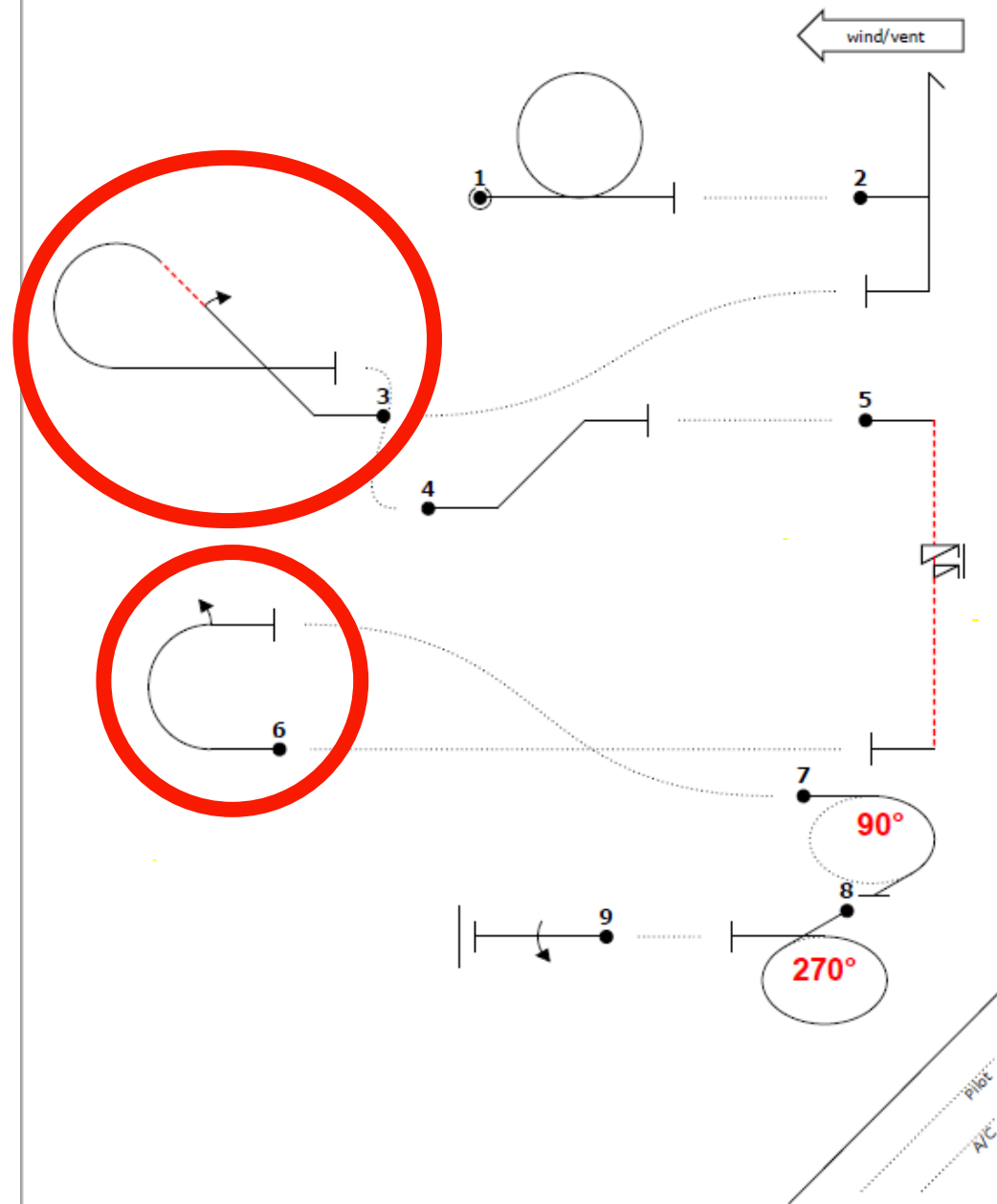
CINNAMON
ROLL

IT COULD SAVE YOUR LIFE



		Form B
Pilot ID	AAC Graduate Known	Flight #

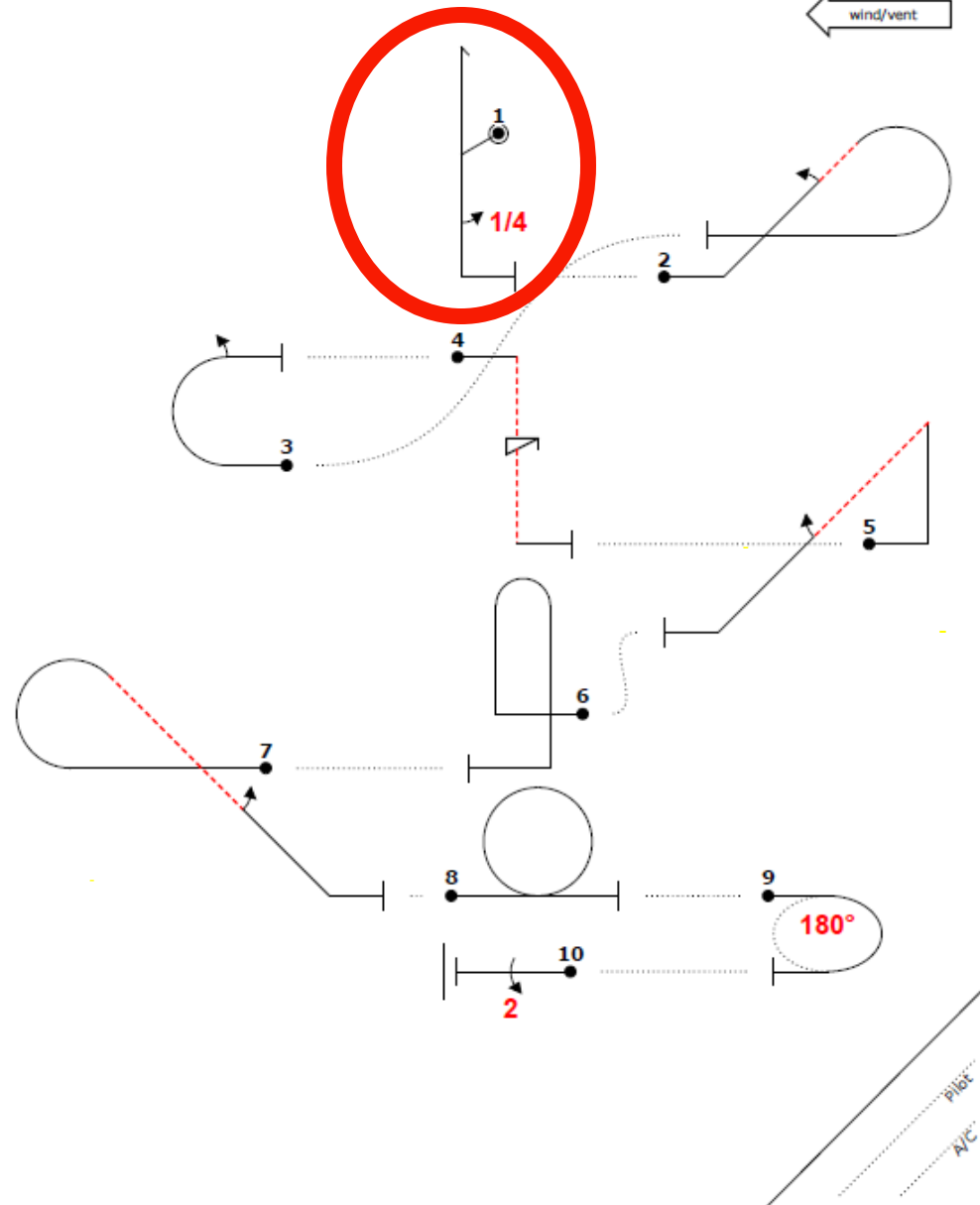
GRADUATE SEQUENCE



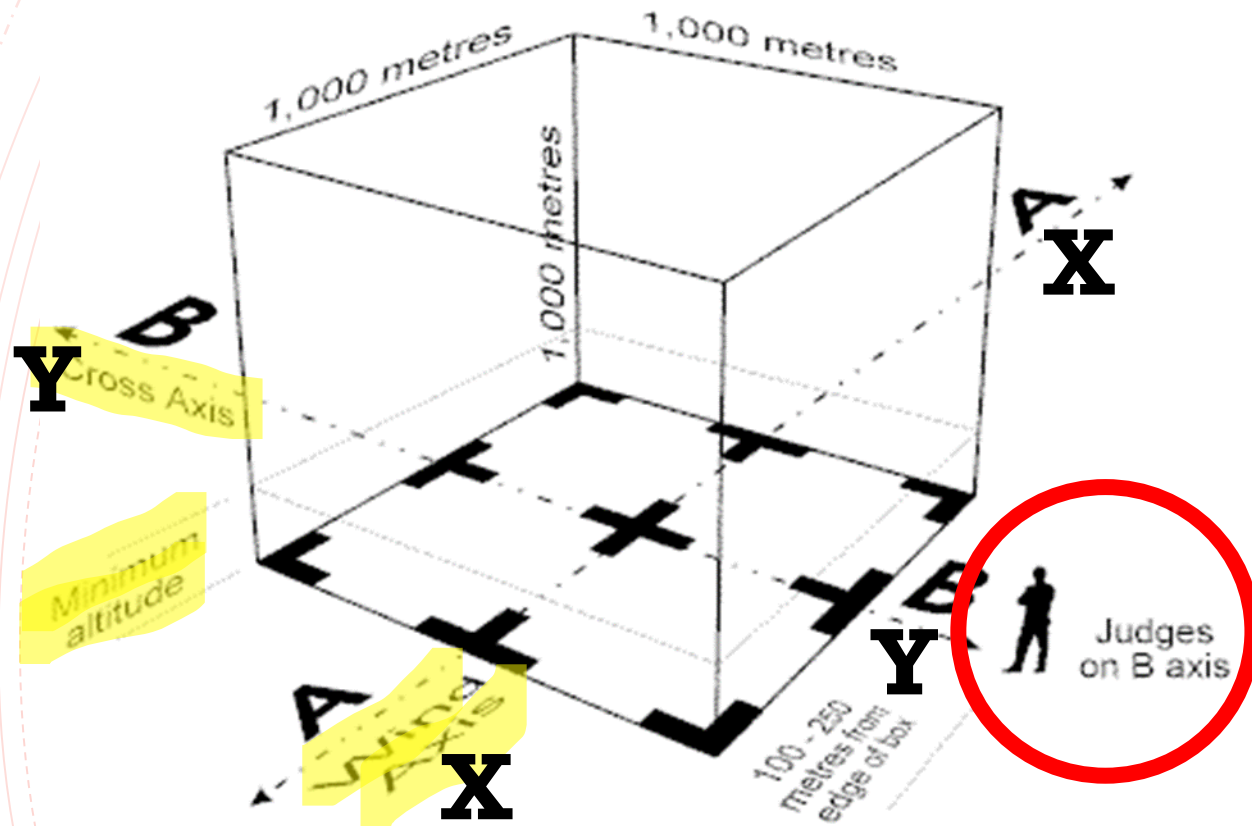
2021		Form B
Pilot ID	AAC Sportsman Known	Flight #

← wind/vent

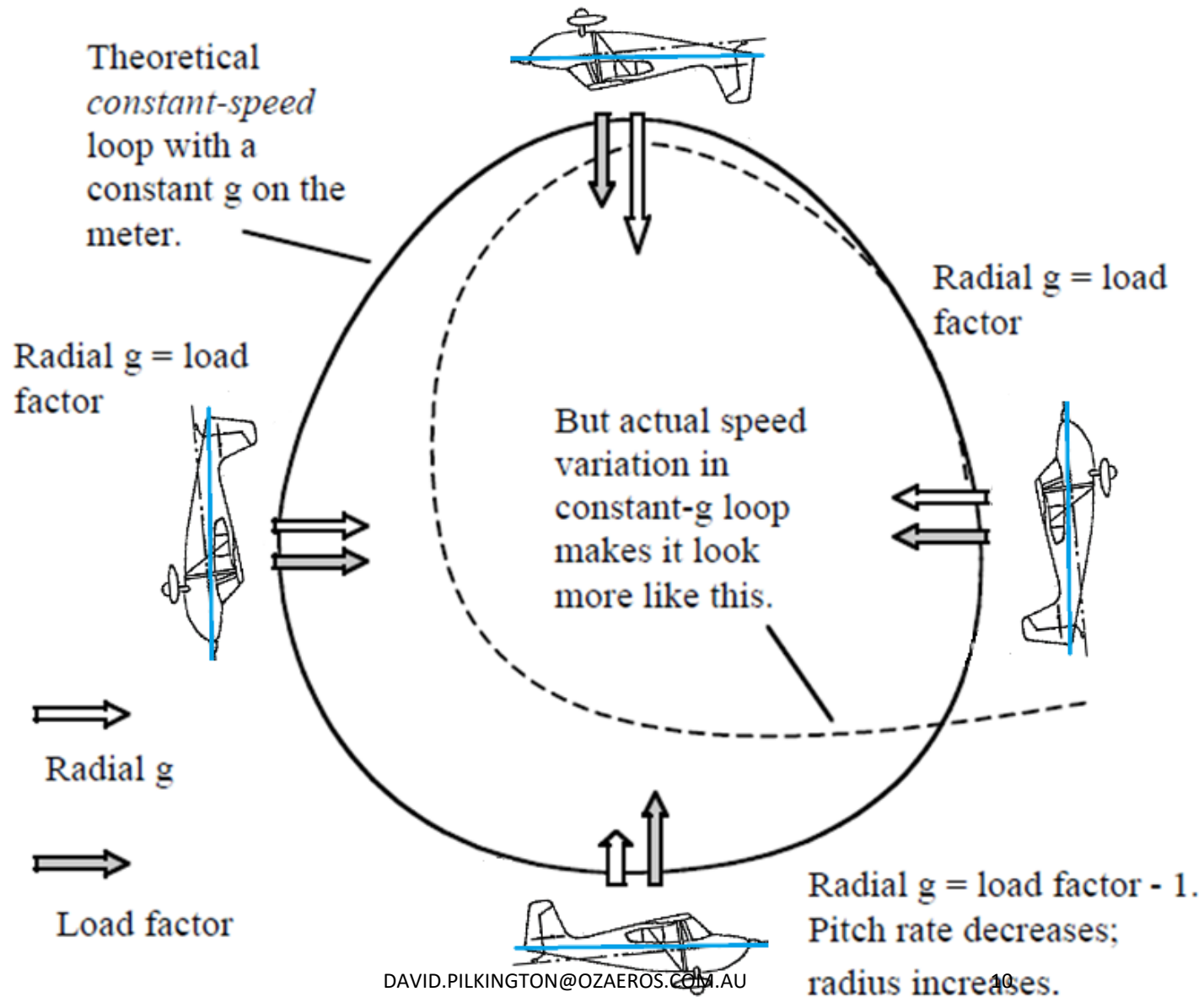
SPORTSMAN KNOWN SEQUENCE

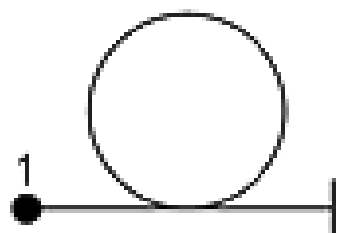


THE AEROBATIC BOX



Radial $g = \text{load factor} + 1$. Pitch rate increases; radius decreases.





Aresti symbol
Cat No. 7.4.1.1
Erect positive loop



CGT

*Full and part loops
are all judged on CGT
and the shape must be
wind corrected, ie. all
looping elements
are ROUND!*



CGT

Fast



CGT

Fast

Coaching Hint: Pitch Rate in a Loop

Per Peter Bythrow

JOHNS HOPKINS APL TECHNICAL
DIGEST, VOLUME 18, NUMBER 1 (1997)

$$\dot{V}_\theta = \frac{T}{m} - \frac{C_d \rho S}{2m} V_\theta^2 - g \sin \theta,$$

$$\dot{V}_R = \frac{V_\theta^2}{R} + g \cos \theta - \frac{L}{m},$$

$$\dot{\theta} = \frac{V_\theta}{R}, \quad R \text{ is loop radius}$$

**Pitch rate varies with ground speed
so wind correction is important!**

where

C_d = coefficient of drag,

ρ = air density,

S = surface area of the airfoil,

L = lift force supplied by the wing,

T = thrust provided by the engine,

m = mass of the aircraft, and

$G = L/m$.

The (\cdot) denotes the derivative with respect to time.

Unfortunately, since θ must vary from 0 to 2π , the small angle approximation of $\theta = \sin \theta$ cannot be used,

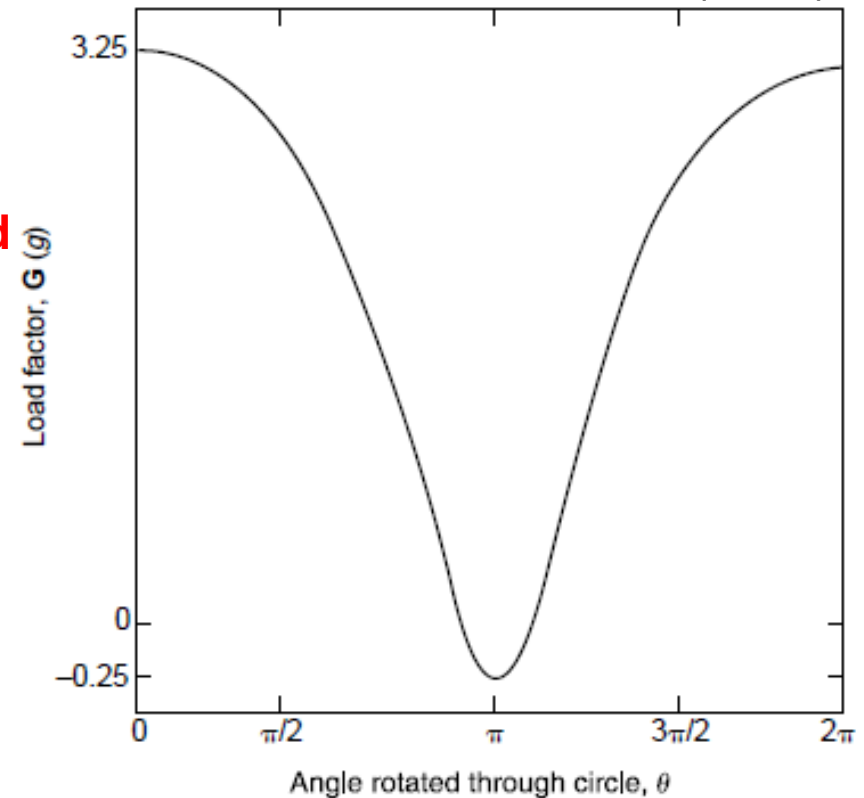
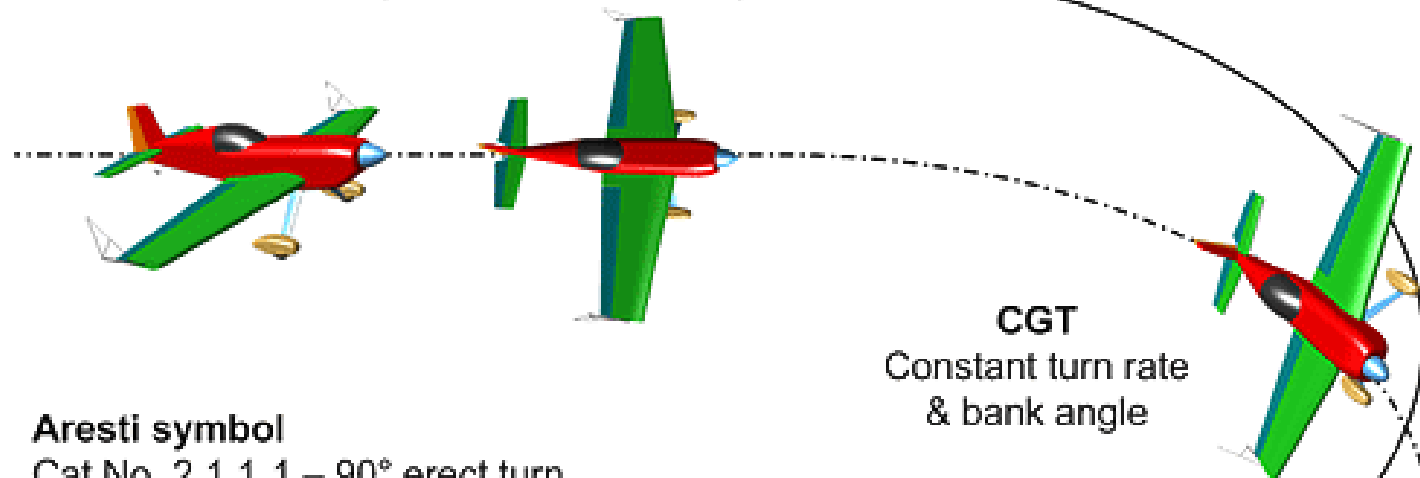


Figure 6. Load factor G experienced by the aircraft and pilot as a function of angle θ .

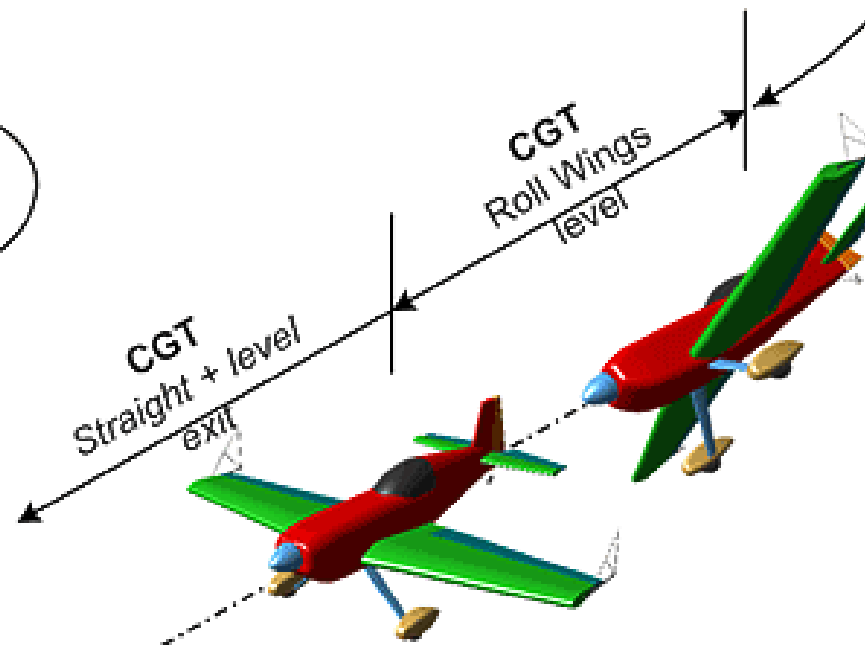
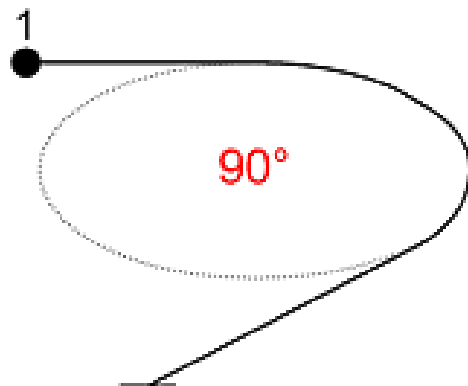
CGT
Straight + level

CGT
Roll 60° min

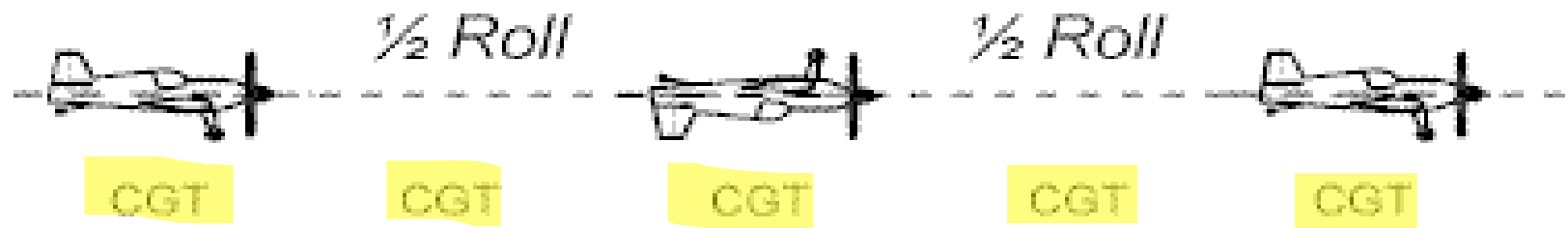
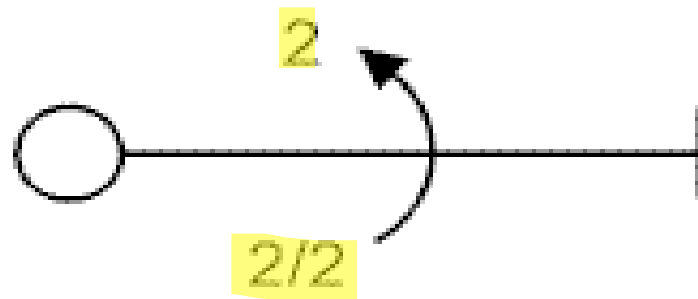
*Briskly initiate
turn here*



Aresti symbol
Cat No. 2.1.1.1 – 90° erect turn



Rolls



Vertical Lines

Fast

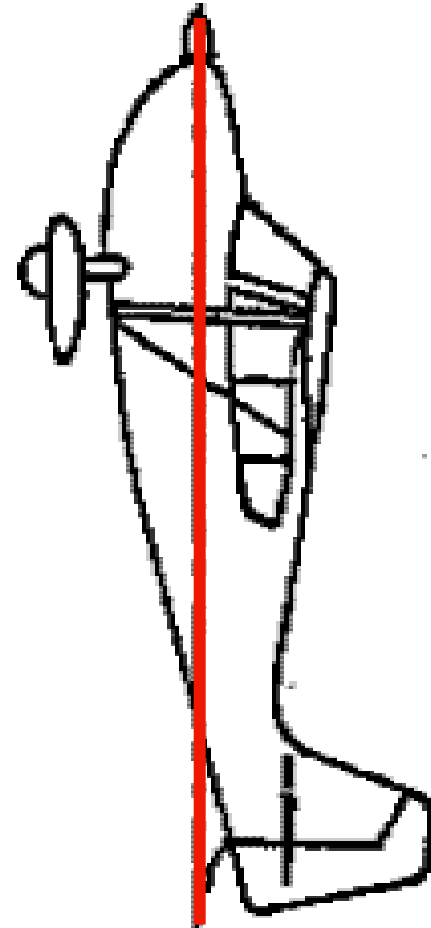
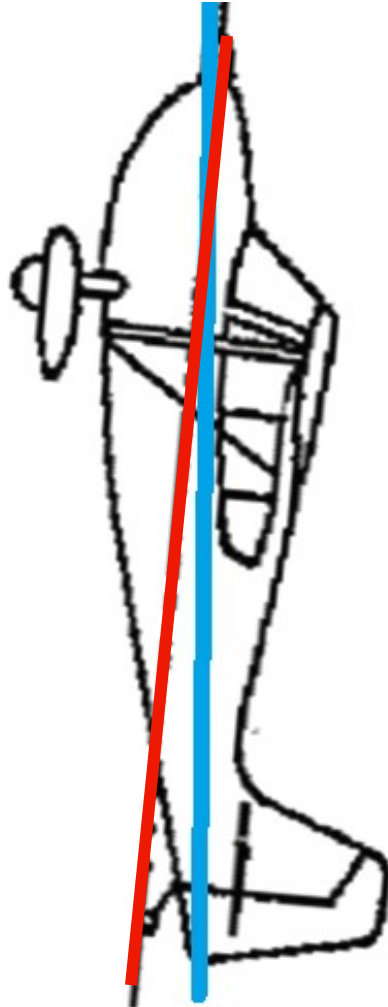


CGT

CGT

NLA

Zero Lift Angle





Marking the figures - the basic rules

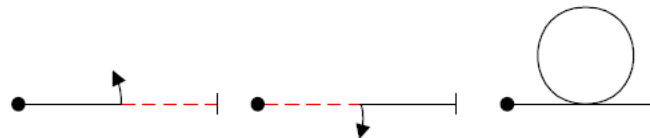
- Start with a perfect 10 – deduct errors seen to nearest $\frac{1}{2}$ point
- Every 5° off line is 1 point
- Score is multiplied by the K factor (difficulty)
 - eg loop K = 10 so 100 points
 - Stall turn K = 17
- Zero for:
 - Exceeding 90° off line
 - Wrong way on x axis
 - Wrong figure

General – IMPORTANT RULES

- **No Official Practice flights will normally be allowed** once the contest has commenced, unless permitted by the Contest Jury under special circumstances at their discretion.
- A competitor must signal **the start and finish of each sequence**, and any interruption, by **distinctly dipping the wing three (3) times** immediately one after the other by more than 45°. For the sake of clarity, “immediately” is defined as within 3 seconds of the previous wing dip.
- A time limit of **15 minutes** will apply for all Programmes, except for Known or Free Known flights which have a **10 minute** time limit.
- **This time will deem to start when the competitor acknowledges** that they have been cleared into the performance zone via the radio by the Chief Judge.
- A competitor will be given **penalty points** if he or she interrupts his or her program. **Interruptions** will be signalled by the competitor by **dipping the wing three (3) times** immediately one after the other.

General – IMPORTANT RULES

- Following a programme interruption, the competitor must restart his or her programme with the figure;
 - a) in which the interruption occurred,
 - b) immediately preceding the point of interruption, or
 - c) **immediately following the point of interruption.**
- Before signalling (wing rocks) the start of a competition flight in all programmes, it is recommended that pilots perform the **following safety figures.**



Practice box entry
Loop
Two point roll

- optional but, if flown, may only be flown once, in any order, and continuously on the same axis. **They must be flown inside the performance zone.**

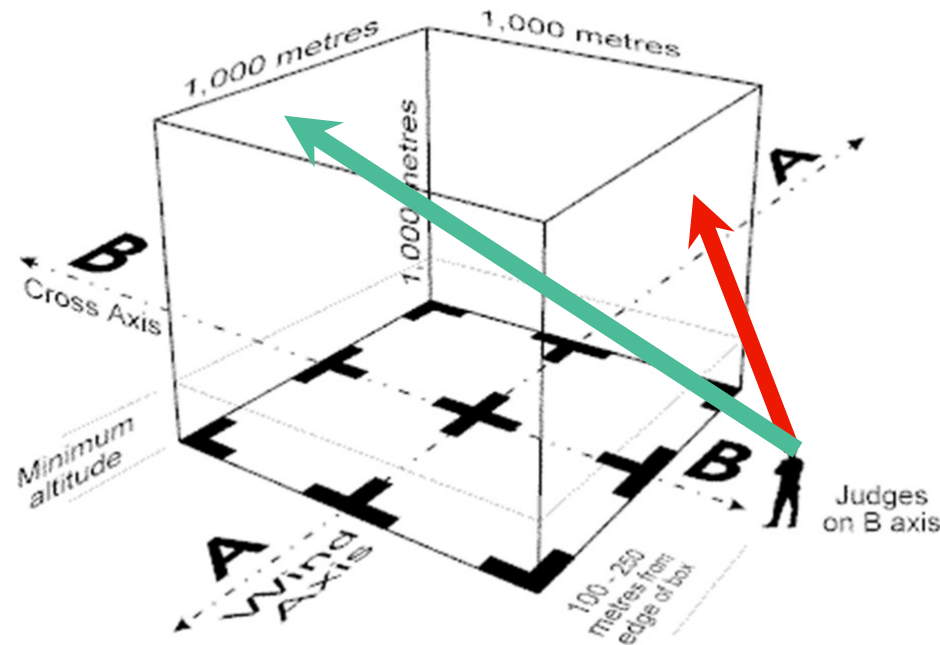
General – IMPORTANT RULES

- **Low altitude – stay well away from the limit!**
- **Don't fly behind the judges!**
- **Positioning Coefficients:**
 - Entry 5K
 - Graduate 10k
 - Sportsman 15K
- **PRESENTATION TO THE JUDGES IS IMPORTANT**

If you can see the judges they can see you and vice versa.

Judges want to clearly see the shape of each figure so

ONLY FLY IN THE HALF OF THE BOX AWAY FROM THE JUDGES



Entry – IMPORTANT RULES

- Competitors must hold a minimum of a Recreational Pilots License with applicable Aerobatic and Spinning Flight Activity Endorsements. Competitors not holding the required design feature endorsements for the aircraft type may carry a Safety Pilot.
- Entry does not require an aerobatic endorsement?
- Upper limit 3900 ft; **lower limit 3,000 ft**
- High altitude infringement – NIL
- **Programme Interruption – 10 points - cheap**
- **Fly the same sequence three times**

Graduate – IMPORTANT RULES

- Required 1500' aerobatic endorsement.
- Competitors in Entry and Graduate category will receive **automatic approval to compete with a 3000' aerobatic endorsement**, rather than the required 1500' aerobatic endorsement.
- **A Safety Pilot may be used by those pilots lacking a 1500ft Aerobatic Endorsement** in Graduate and Sportsman categories only, otherwise they must fly the sequence not below 3000ft AGL.
- **Upper limit 3,900 ft; lower limit 1,500 ft**
- **High altitude infringement – NIL**
- **Programme Interruption – 10 points - cheap**
- **Fly the Known sequence three times**

Important Rules - Sportsman

- Required 1500' aerobatic endorsement.
- A Safety Pilot may be used by those pilots lacking a 1500ft Aerobatic Endorsement in Graduate and Sportsman categories only, otherwise they must fly the sequence not below 3000ft AGL.
- In the case of Para 2.16.1, **the competitor shall apply in writing to the Contest Jury** before the use of a safety pilot shall be approved.
- Upper limit 3,900 ft; lower limit 1,500 ft
- High altitude infringement – only 10 points so cheap!
- **Programme Interruption – 20 points - cheap**

Important Rules - Sportsman

- **Known, Free (or repeat Known) & Unknown**
- DJP's advice:
 - **A Free sequence can earn an extra 100 points everything else being equal –**
 - Consider the Known and a sample Free later
 - Known has 10 figures however you may have 12 so you can simplify the sequence and maximise the scoring opportunities
 - **Practice Unknowns!**



A large red speech bubble graphic with a white border, pointing downwards. It contains the text 'Present to the Judges' in white. Above it is a smaller red rectangular box.

Present to the
Judges

- Forget the box, fly for the judges
- Judging positions will change
- Wind variations
- Mark card – S or O
 - Plan which way to turn but
- Decide where to start the sequence

Actions Prior to Flight - prep

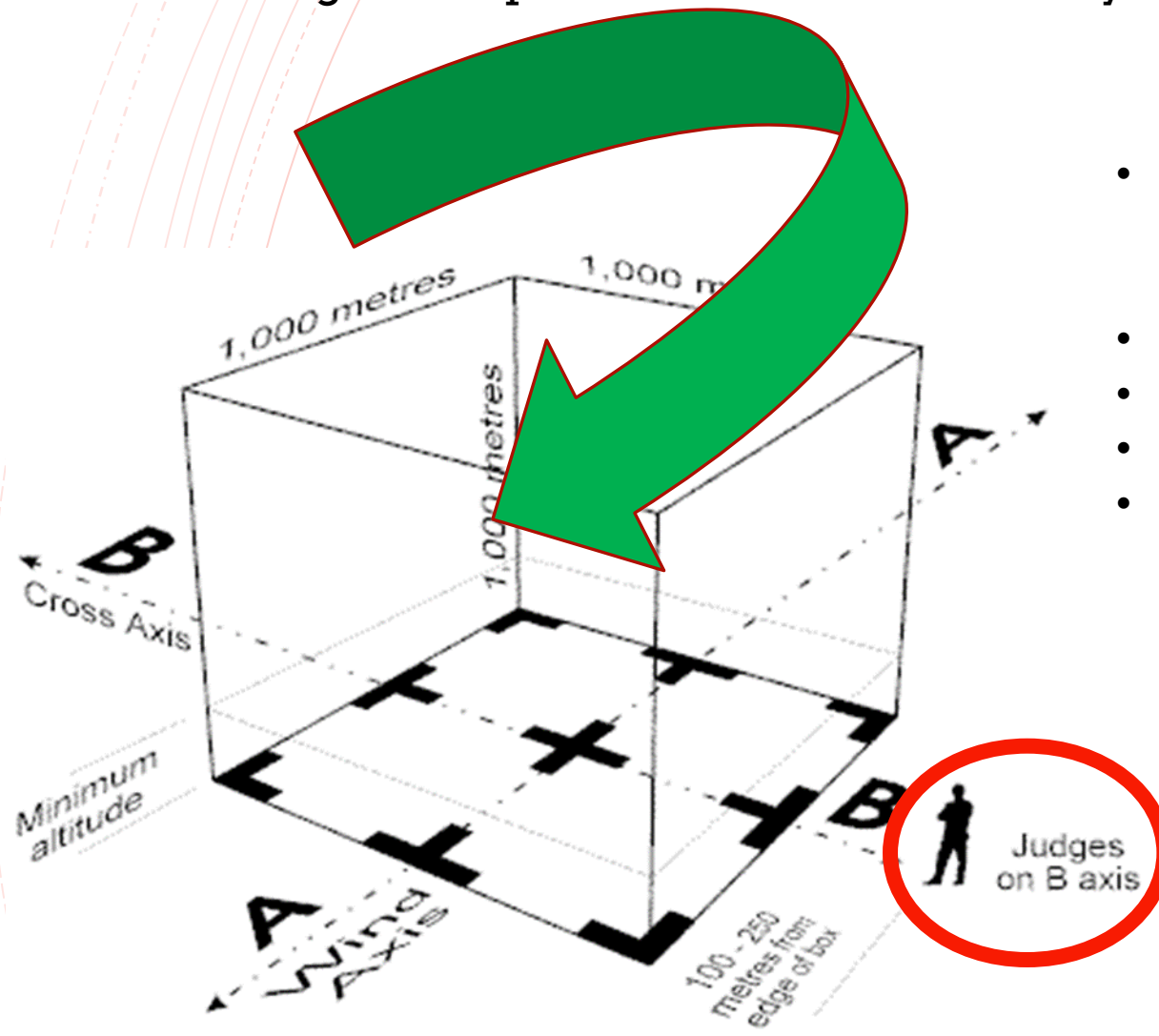
Sequence card
marked up – Blu Tack

- Walk through
 - Until you are sick of it
- Sit in the airplane:
 - Talk through
 - Where to look

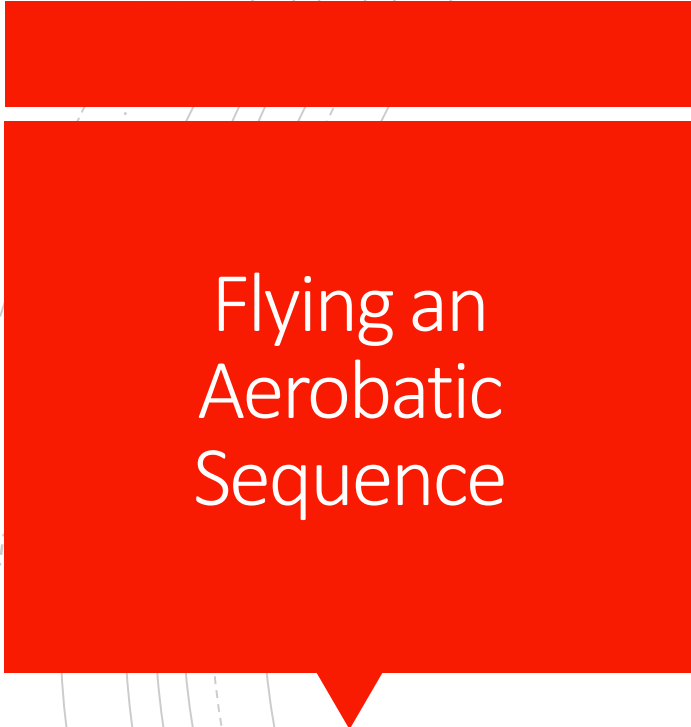


ENTERING THE BOX

- Approach from the holding area unless flying the box lower boundaries
- Fly the safety check manoeuvres in the box – use as practice
- Where to start #1, what height and speed?
- So: what height and speed to commence box entry?



- Long straight-in approaches are easy to misjudge!
- Stay close to the box
- Fly a “base leg”
- Wing dips
- Level - start

A red speech bubble graphic with a tail pointing downwards and to the left. It contains the text 'Flying an Aerobatic Sequence' in white.

Flying an Aerobatic Sequence

- Before each and every figure check the gate:
 - Altitude
 - Airspeed
 - Are you in the right place going in the right direction – where are the judges – where should they be?
- Think of the next figures
- You don't have time to think how to fly the figures so
 - Muscle memory

DISCUSS THE KNOWN:

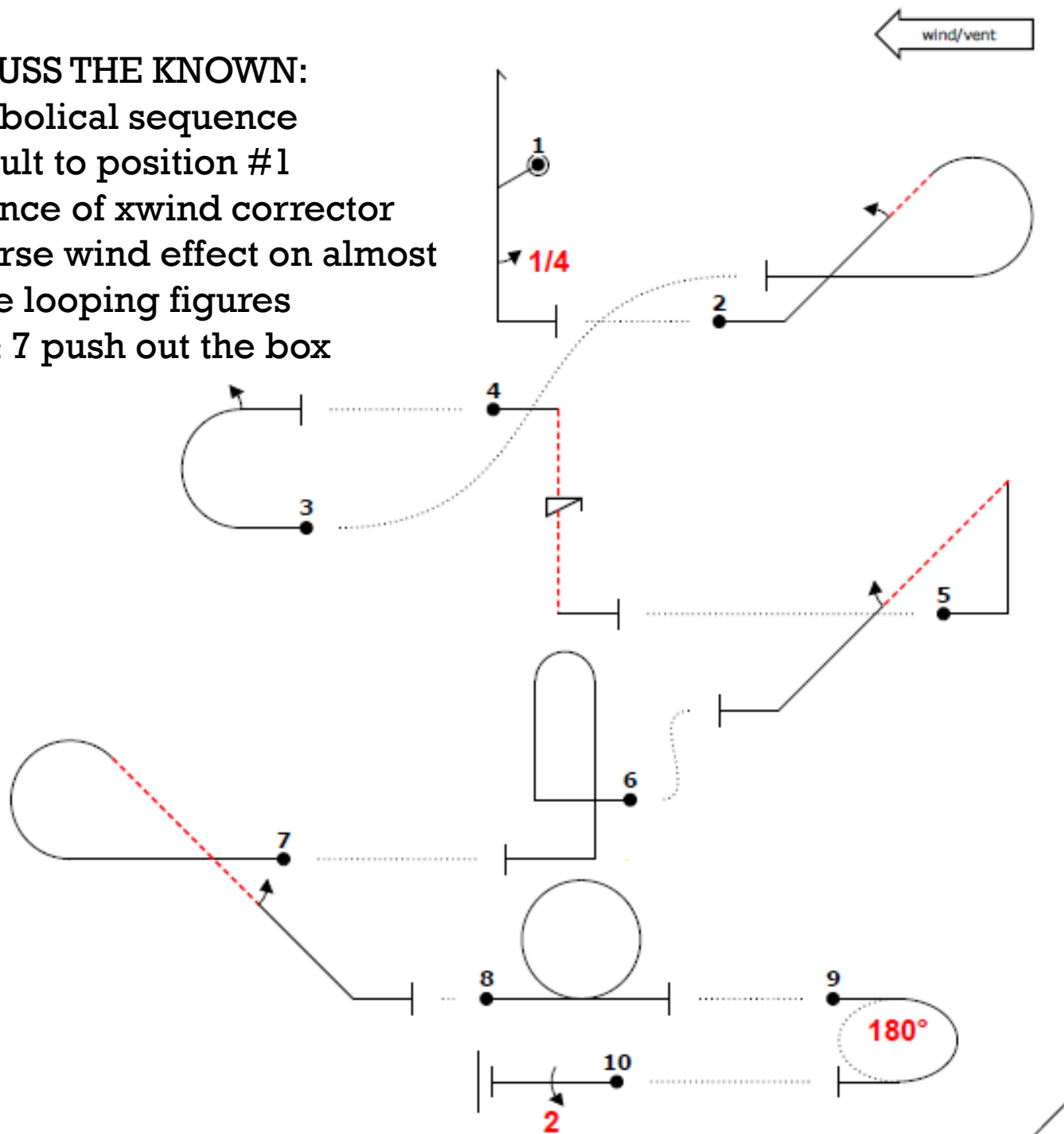
A diabolical sequence

Difficult to position #1

Absence of xwind corrector

Adverse wind effect on almost all the looping figures

5, 6 & 7 push out the box





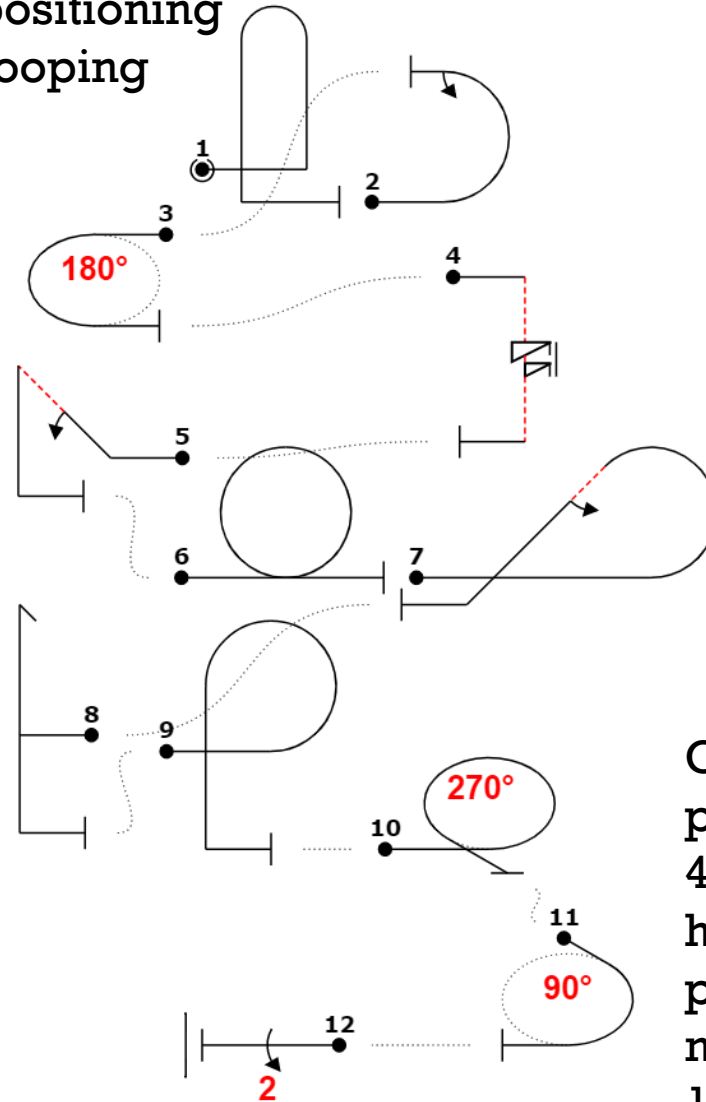
Australia Easter 2021		Form B
Pilot ID	AAC Sportsman Free	
		Flight #

DISCUSS THIS FREE:

Opportunity to maximise scores

Xwind correctors to optimise positioning

Positive wind effect on all the looping figures



Power			
Fig	Aresti	K	
1	8.4.1.1	13	13
2	7.2.2.1 9.1.3.2	6 4	10
3	2.2.1.1	4	4
4	1.1.6.3 9.11.1.6	10 3	13
5	1.2.3.1 9.1.2.2	12 6	18
6	7.4.1.1	10	10
7	8.5.6.1 9.1.4.2	10 4	14
8	5.2.1.1	17	17
9	8.6.5.1	11	11
10	2.3.1.1	5	5
11	2.1.1.1	3	3
12	1.1.1.1 9.2.3.4	2 9	11
Total K = 129 (max K = 133)			

OpenAero has positioning K as 4 not 15. Total K here excludes positioning and max K is 129 not 133.



- Fly for the judges
- Fly it like the practice
- Try not to suddenly correct an error
- Take a break – it is cheap!
- After aeros – forget and focus on rejoining circuit and landing



Swansea Free Programme 27 May 2000

Flight No.

Intermediate Free

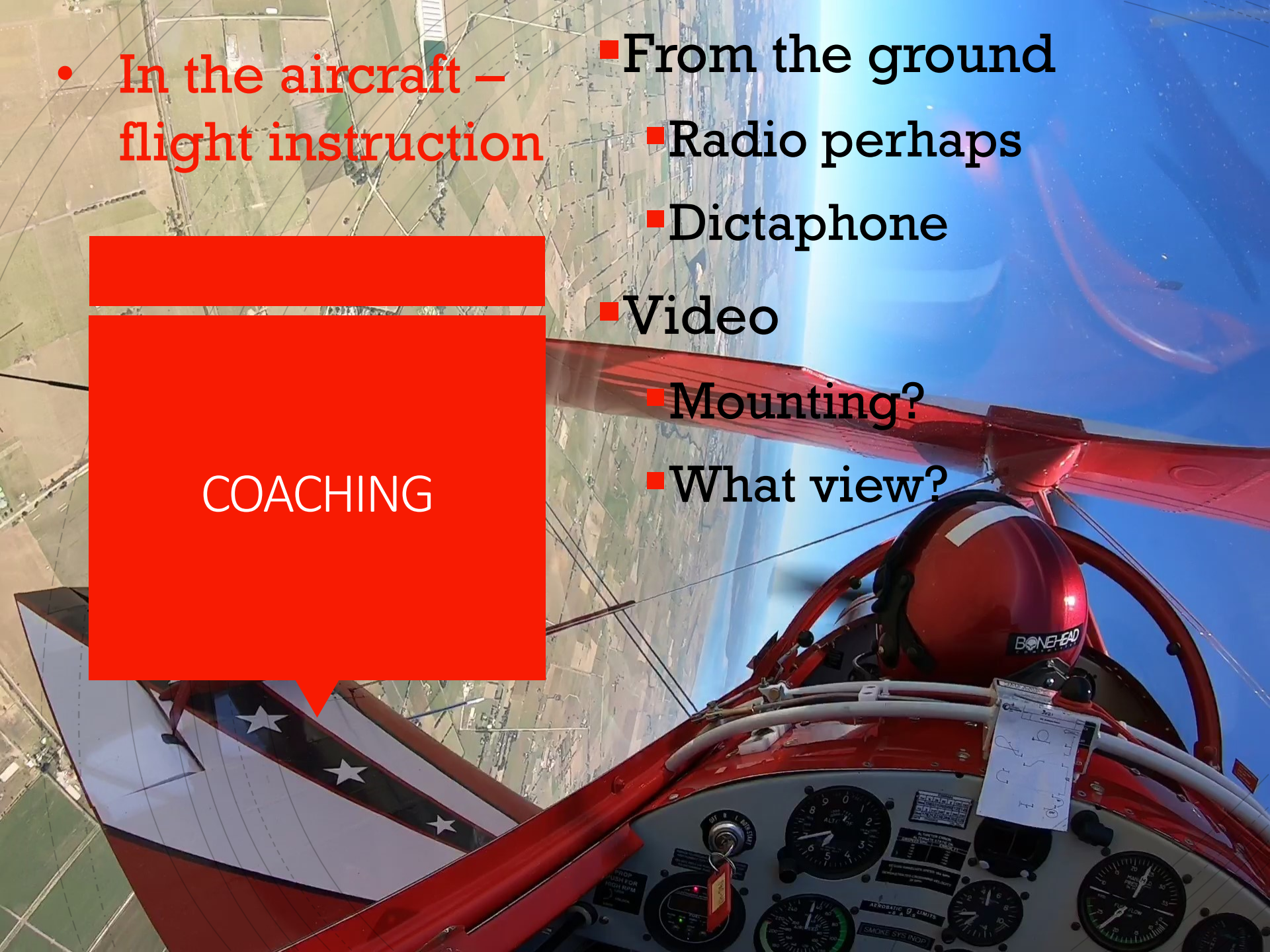
Form A

No	Symbol	Catalogue No.	K	Total K	Score	Remarks	No	Symbol	Catalogue No.	K	Total K	Score	Remarks
1		1.3.1	0	22	5.5	Very +ve up	13						
2		2.3.3 2.11.1.4	15	18	7.5	Over 20°	14						
3		3.1.4 3.2.3.4	10	15	7.0	Faster 2nd	15						
4		4.3.1	11	11	8.0	Quite nice	16						
5		5.1.1 5.3.5.1	13	20	4.5	No hesitation!	17						
6		6.1.1 6.1.5.1	15	15	4.5	70°	18						
7		7.2.1 7.1.3.2	10	10	7.0	OK	19						
8		8.1.1 8.5.3.4	13	13	9.0	Good	20						
9		9.3.3 9.4.3.2	11	11	3.5	70° & 110°	21						
10		10.1.1	6	6	8.0	OK	22						
11		11.3.2	19	19	7.5	Shallow 45°	23						
12							24						

- In the aircraft –
flight instruction

COACHING

- From the ground
- Radio perhaps
- Dictaphone
- Video
- Mounting?
- What view?



<https://youtu.be/qvAW-zBuXcA>



A red speech bubble graphic with a white border, containing the text "Discuss that Video".

Discuss that
Video

- Corrections emphasise the errors
- Stall turn – good but multiple small errors
- Roll off the top
 - Pitch rate too fast at top
 - Lost height after roll
- Spin
 - Climbing into it
 - Get vertical after
 - Get power on early

A red speech bubble graphic with a tail pointing towards the bottom left. It contains the text "Getting to the Contest" in white.

Getting to the Contest

- **Flight planning:**
 - Weather
 - YTOC arrival
- **PLB, tie-downs**
- **Checklist basics**
- **Pitot tube cover!**
- **Contest 1-5 April**
- **Arrive 30 Mar**
- **Hangarage**

A red speech bubble graphic with a tail pointing downwards and to the left, containing the text 'Equipment & Maintenance'.

Equipment & Maintenance

- **Scheduled maintenance?**
- **Oil!**
- **Spare screws etc**
- **Ladder?**

What's What at the Contest?

- Practice/coaching in days prior
- Local landmarks and “the box”
 - Runways
 - Town and river
- Registration – upload documents prior
- Jobs – penciller ...
- Briefing – for your safety

QUESTIONS?



<http://ozaeros.teejunction.com.au/>