

# MANOEUVRES EXAMPLE

8/11/2009



## MAAA FLIGHT PROFICIENCY SCHEME

### FLIGHT REQUIREMENTS & TEST CHECK SHEET

#### FIXED WING POWERED – GOLD WINGS

This Test is to be assessed by an MAAA Fixed Wing (Power) Instructor.

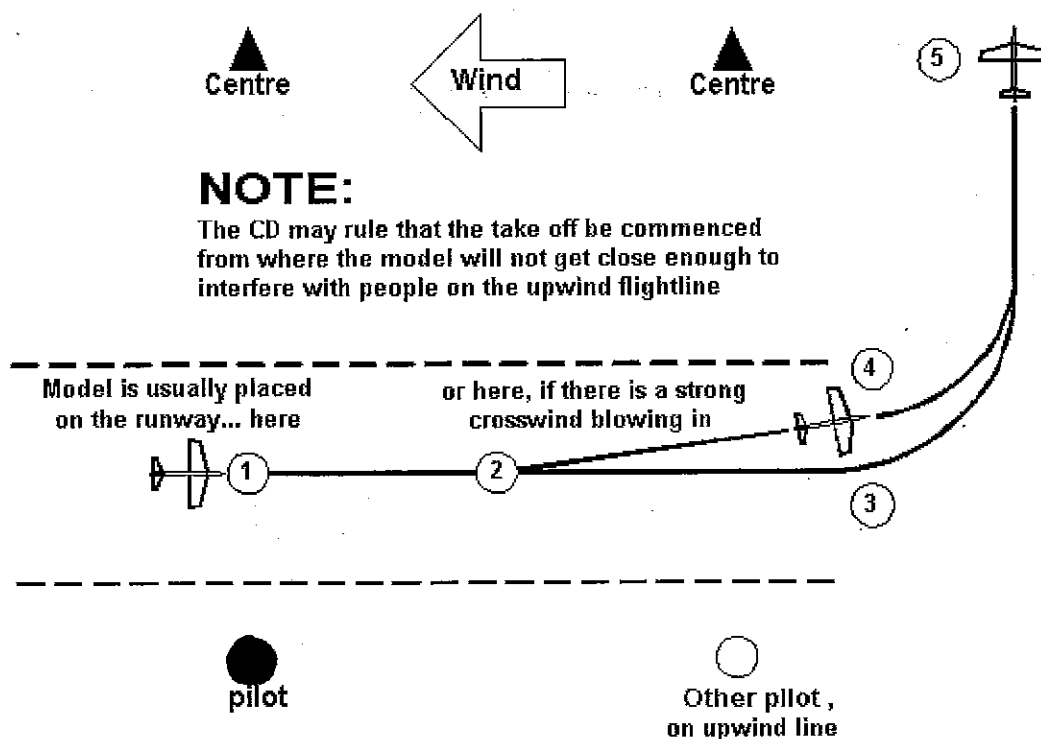
The requirements specified have been determined by the MAAA and are not to be varied.

Gold Wings (Power) are awarded when a member demonstrates, in the course of one session of not more than 4 consecutive flights, that he/she has the skills to perform the manoeuvres listed below, in a competent manner and to the required standard.

This flying proficiency examination must be completed in not more than four flights. The flights may be undertaken on two separate days. Weather conditions (wind direction) and type of aircraft (Trainer, Sports or Aerobatic) must be allowed for.

	Manoeuvres	Flight 1	Flight 2	Flight 3	Flight 4
1	Pre-flight - Dexterity with equipment - Theoretical knowledge - Pre-flight checks				
2	Start-up, taxi and positioning for take-off				
3	Take-off				
4a	Outward Figure of Eight, left to right.				
4b	Outward Figure of Eight, right to left.				
5a	Inward Figure of Eight, left to right.				
5b	Inward Figure of Eight, right to left.				
6a	Procedure Turn, 90° to 270°, left to right.				
6b	Procedure Turn, 90° to 270°, right to left.				
7a	Immelman Turn, left to right.				
7b	Immelman Turn, right to left.				
8a	Three Inside Loops, left to right.				
8b	Three Inside Loops, right to left.				
9a	Cuban Eight, left to right.				
9b	Cuban Eight, right to left.				
10	Spin, three turns.				
11a	Inverted Flight, five seconds, left to right.				
11b	Inverted Flight, five seconds, right to left.				
12a	Three Horizontal Rolls, left to right.				
12b	Three Horizontal Rolls, right to left.				
13a	Landing Circuit, left to right.				
13b	Landing Circuit, right to left.				
14	Landing, roll-out and stop.				

## 1. THE TAKE OFF SEQUENCE



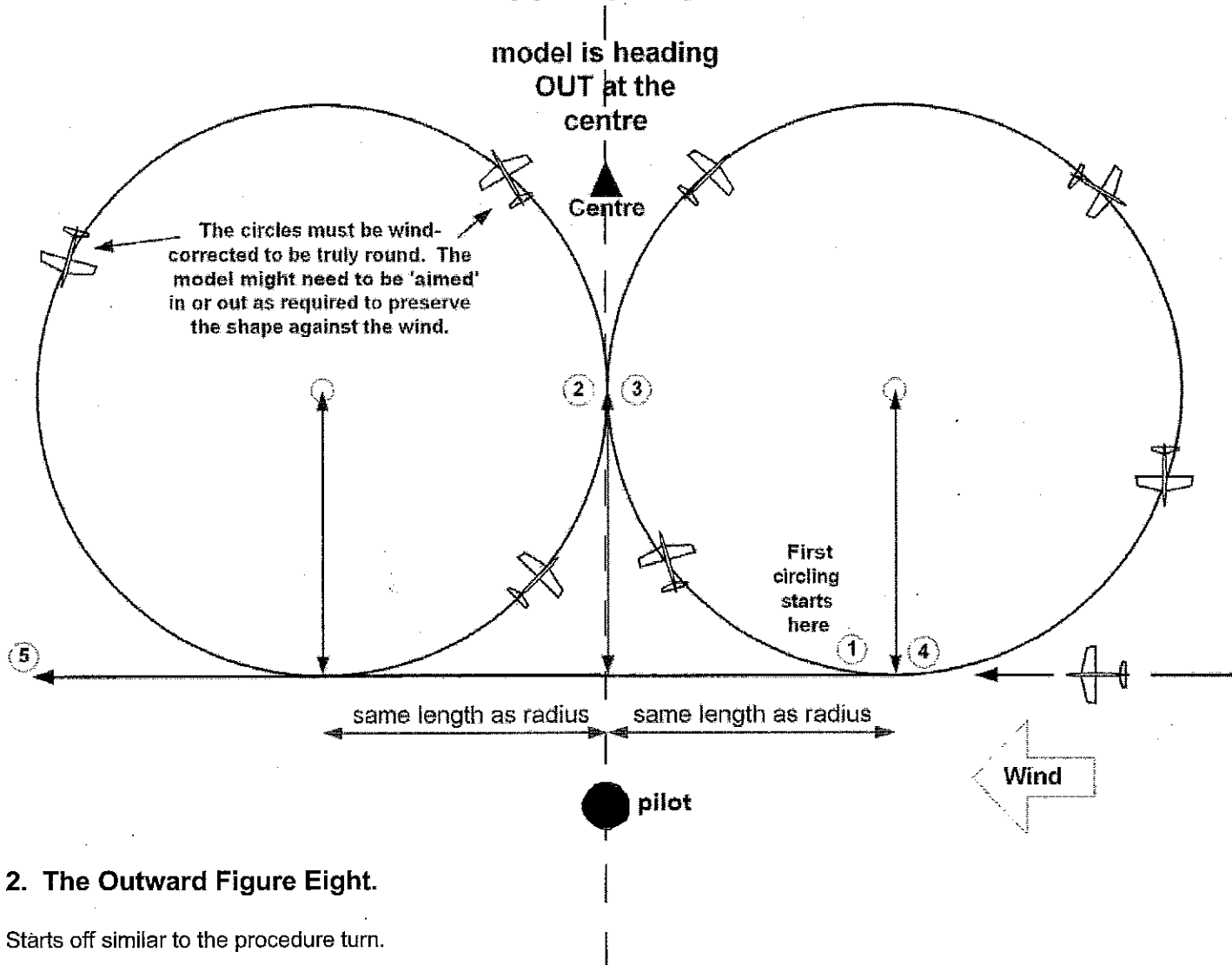
### How To:

1. The aim is to demonstrate proper control of the model during the take off sequence, safety being paramount
2. The model is usually placed on the runway by your caller or other helper, approximately in front of you
3. **NOTE:** The Contest Director (CD) may, for any safety reason, rule that for any class the downwind pilot's model be placed on the runway in some other place, often between the two pilots, such as position 2, or even in front of the upwind pilot. This is to reduce any chance of the downwind pilot steering or flying the model into anyone on the upwind line, especially if the pilots are positioned close to a narrow runway, and/or there is a strong crosswind blowing in
4. The Take Off begins when the model starts to move forward. Ideally, the model stays parallel to the runway as it accelerates, takes off, and ascends to a reasonable height to position 3, say, 50 metres upwind
5. The model is turned away 90 degrees at position 3, and flies an ascending line perpendicular (at a right-angle) to the strip
6. The CD may also rule before-hand that a take off heading that deviates away from the upwind pilot, such as to position 4, is allowable without downgrade
7. The Take Off finishes at position 5

### Watch for:

1. The model is not kept parallel to the runway during acceleration. However, maintaining a smooth, straight line that deviates away from the pilots may be deemed as being even desirable in a strong crosswind, and not cause for downgrading
2. The model oscillates from side to side during acceleration
3. The model does not rise smoothly into the air
4. The climb after take off is not maintained at a reasonable angle, especially too steep
5. The turn away at 3 or 4 is not performed smoothly, and/or with gallops in elevation
6. The climb out to position 5 is not perpendicular to the runway
7. Taking off in such a manner that causes the judges to believe that people's safety is being compromised, is a sure-fire way to get a score of zero for the take off!

## OUTWARD FIGURE of EIGHT



### 2. The Outward Figure Eight.

Starts off similar to the procedure turn.

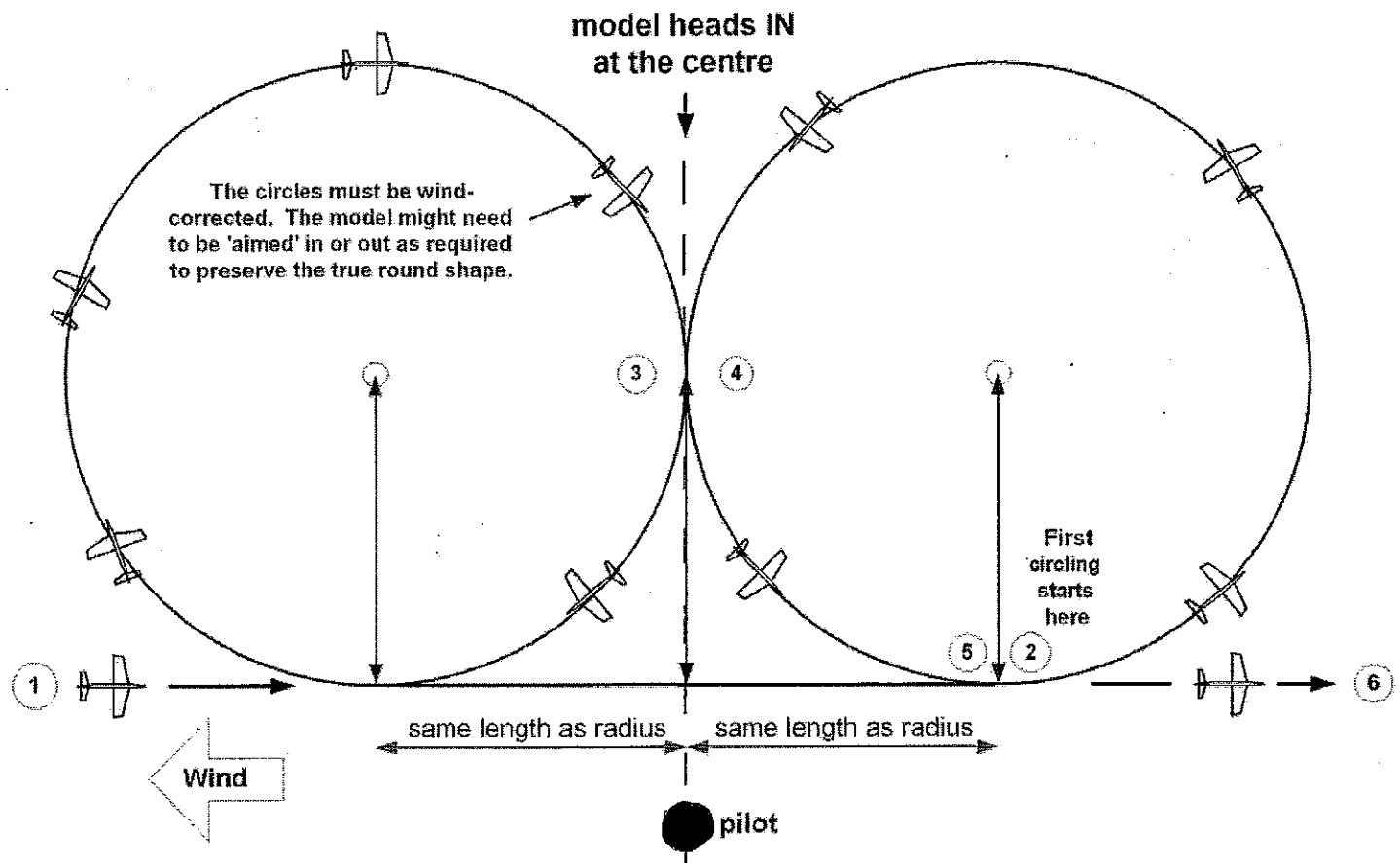
#### HOW TO...

1. The model is flown downwind on a straight & level entry line of flight only about 30 to 40 metres out from the pilot, and at about 30 to 50 metres up. The model should be at 45 to 50 degrees up in elevation from the pilot. At a chosen distance before reaching the centreline (1), which will set the radii for the whole manoeuvre, the model begins a turn outwards of constant radius until it has completed a quarter of a circle (90 degrees). At this point, the model will be directly in front of the pilot, who will be looking straight down the model's fuselage from the tail.
2. The model is flown the other way, and maintains for a complete circle (360 degrees) the same radius as the first quarter-circle.
3. At the completion of this circle (3) the model is turned the other way, at the same place (2) where it completed the first quarter-circle.
4. The model is flown for three-quarters of a circle, at the same radius, until at position (4) it exits the circle at the same place as the first circle started (1), and is flown on a straight and level exit line to position (5). The manoeuvre is not finished until the model passes position (5) During the manoeuvre, correct the wings' angle of bank if required, to keep the circles rounded
- 5.

#### DOWNGRADES...

1. All circle radii not the same. Shape should be wind-corrected: 'stretching' upwind, 'tightening' downwind
2. Circles not fully completed, and the manoeuvre becomes a horizontal plane Cuban Eight with straight lines forming a shallow X, instead of being correctly... two circles touching at the centreline
3. Positions (1) and (4) not at the same place
4. Changes in altitude
5. Positions (4) to (5) not parallel to the runway
6. Positions (2) and (3) not in front of the pilot

### INWARD FIGURE of EIGHT



### 3. The Inward Figure Eight

#### HOW TO...

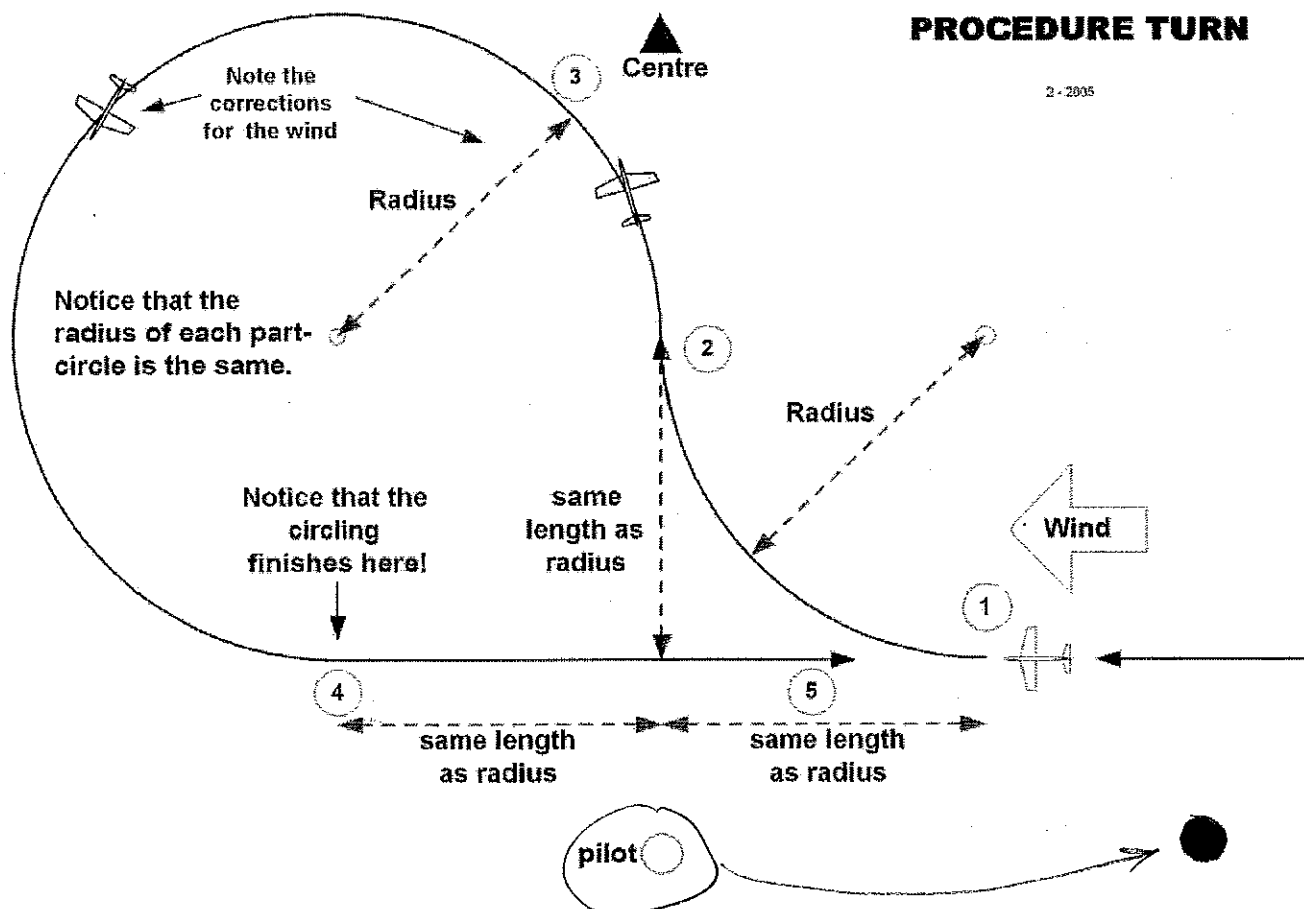
1. The model is flown upwind on a straight & level entry line of flight, parallel to the runway, only about 30 metres out from the pilot, and at about 30 metres up. After having passed the centreline, when at a chosen distance at (2) (which will set the radii for the entire manoeuvre), the model begins a turn outwards of constant radius until it has completed three-quarters of a circle (270 degrees). At this point (3) the model will be directly in front of (and heading towards) the pilot, who will be looking straight down the model's fuselage from the nose.
2. At position (3) the model is banked the other way and completes a full circle (360 Degrees)
3. At the position (4) the model will again be directly in front of (and heading towards) the pilot, who will be looking straight down the model's fuselage from the nose. The wing is banked the other way and the model is flown for a quarter of a circle (90 degrees).
4. At (5) the model finishes the quarter-circle, and flies a straight and level exit line of 30 metres to (6).
5. During the manoeuvre, correct the wings' angle of bank if required, to keep the circles rounded

#### DOWNGRADES...

1. Circles not fully completed, and the manoeuvre becomes a horizontal plane Cuban Eight with straight lines forming a shallow X, instead of being correctly... two circles touching at the centreline
2. All circle radii not the same (when circles or loops are not round, caused by visible abrupt changes of radius, the circle or loop is said to be 'segmented')
3. Positions (2) and (5) not at the same place
4. Changes in altitude
5. Positions (1) to (6) not parallel to the runway
6. Positions (3) and (4) not in front of the pilot

## PROCEDURE TURN

2-2005



## 1. The Procedure Turn.

When you are first learning to fly, the Procedure Turn is great for learning how to turn back again from each end of a long straight line of flight that passes over the runway. It helps you to learn where the runway is!

HOWEVER, in Sports Pattern competitions, it's positioning is quite different. You do the manoeuvre centred directly in front of you. This helps you to learn many other things!

Note that the manoeuvre can only be done correctly if you maintain constant radii for the entire manoeuvre.

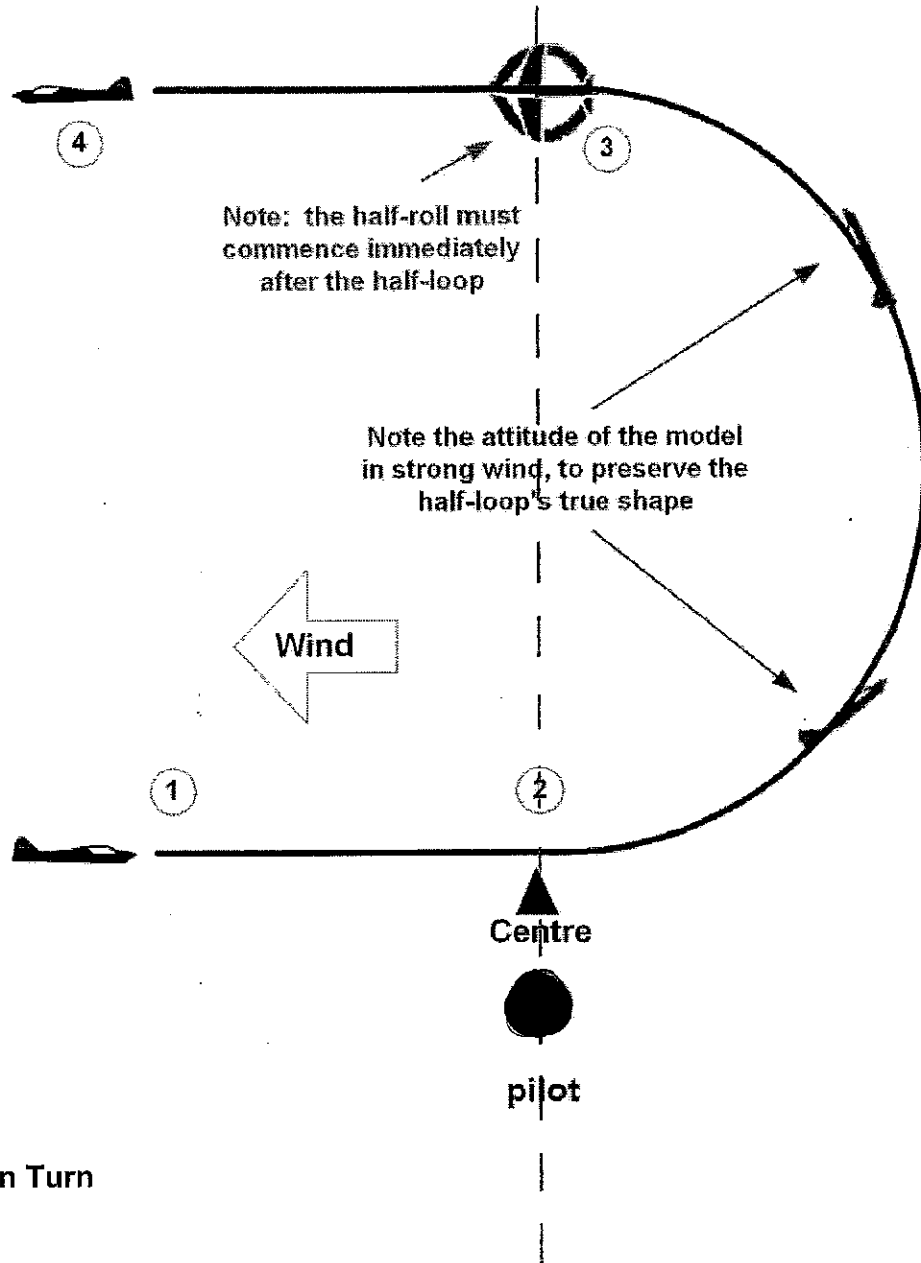
## HOW TO...

1. The model is flown downwind on a straight & level entry line of flight, parallel to the runway, only about 30 or 50 metres out from the pilot, and at about 30 to 50 metres up. The model should be at 45 to 50 degrees up in elevation from the pilot. At a chosen distance before reaching the centreline (which sets the radii for the whole manoeuvre) bank the wings to turn outwards of constant radius until it has completed a quarter of a circle. At this point, the model will be directly in front of the pilot, who will be looking straight down the model's fuselage from the tail-end.
2. Bank the wings immediately the other way, and maintain the same radius as the first quarter-circle.
3. The turn is maintained for a total of 270 degrees, or three-quarters of a circle. Adjust wing-banking as required to allow for the wind, to achieve a circular path.
4. Note where this circle finishes... the same distance from the centre-line, as the first quarter-circle started.
5. The model is flown out on the same heading, and at the same height, as the entry line
6. During the manoeuvre, smoothly adjust the wings' angle of bank if required, to keep the circles rounded.

## DOWNGRADES...

1. Changes in altitude
2. Changes in radius during any part-circle
3. All radii not the same
4. Entry and exit lines not parallel to the runway
5. Gross changes in the model's speed
6. Flown too far away, making it difficult for the judges to determine the positioning of the model, especially the entry and exit lines coinciding

# Immelman Turn



## 5. The Immelman Turn

### HOW TO...

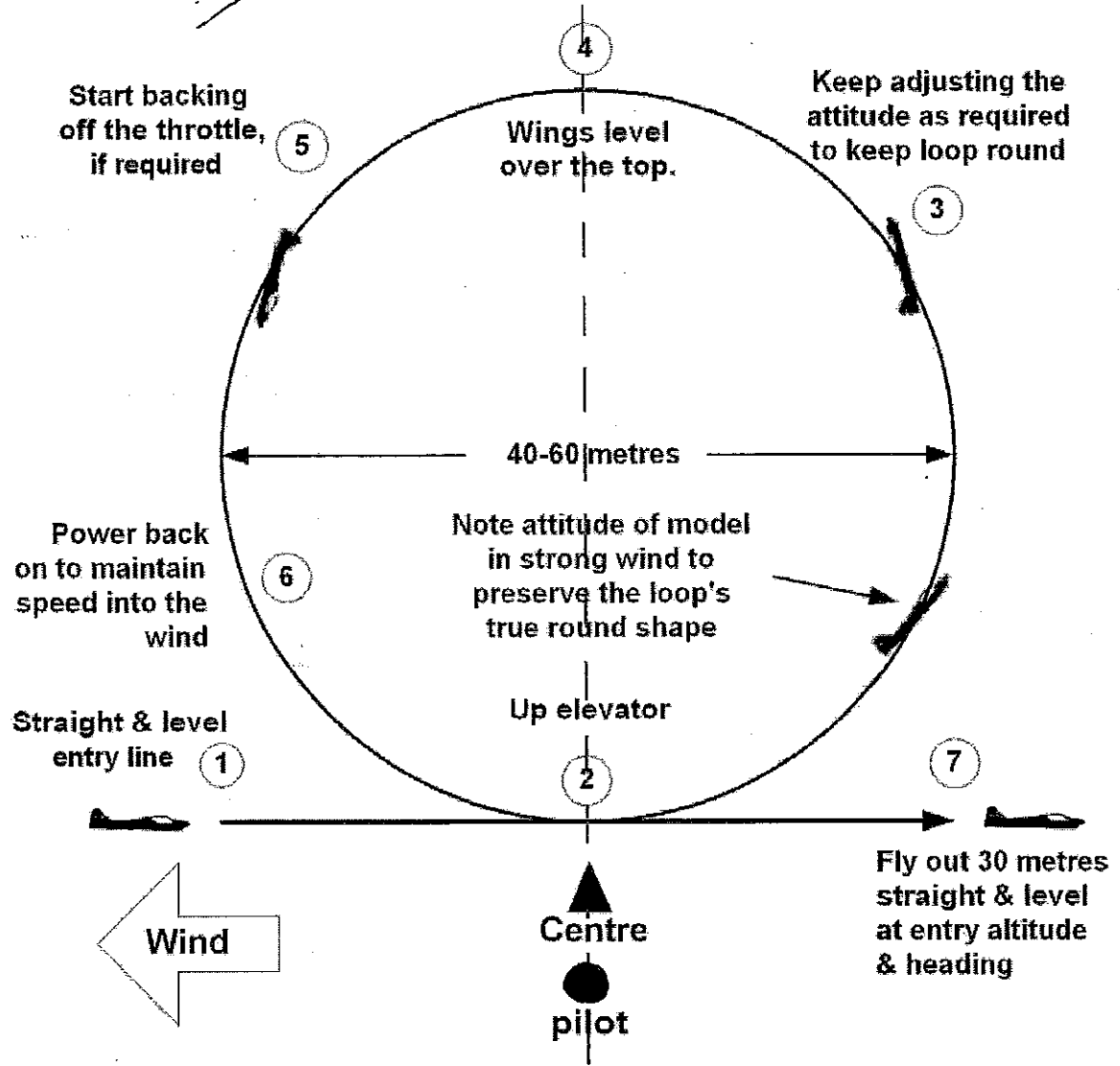
1. Because this manoeuvre is in the vertical plane, it is also flown at about 100 to 150 metres out from the pilot. Maintain a straight and level entry line into the wind, parallel to the runway, for at least 30 metres.
2. At (2) at full speed, begin a graceful half loop, squeezing the elevator to start with, backing it off if required when the vertical has been passed (effect of gravity) to keep the loop round.
3. At (3) when the half loop is finishing, apply aileron for a half roll.
4. The manoeuvre finishes after flying a 30-metre exit line.

### DOWNGRADES...

1. Half loop not round
2. Changes in radius during the half loop
3. Entry and exit lines not parallel to the runway
4. Half roll not immediately at the end of the half loop. There is a downgrade of several points for putting in any line at all at the end of the half loop... it may be better to roll a little bit early than late
5. Corkscrewing in or out
6. Manoeuvre not centred in front of the pilot
7. Manoeuvre flown too close, making it difficult to determine if the loop is round or not (and cricking the poor old judges' necks)

THREE

# Two Consecutive Inside Loops



THREE

## 6. Two Consecutive Inside Loops...

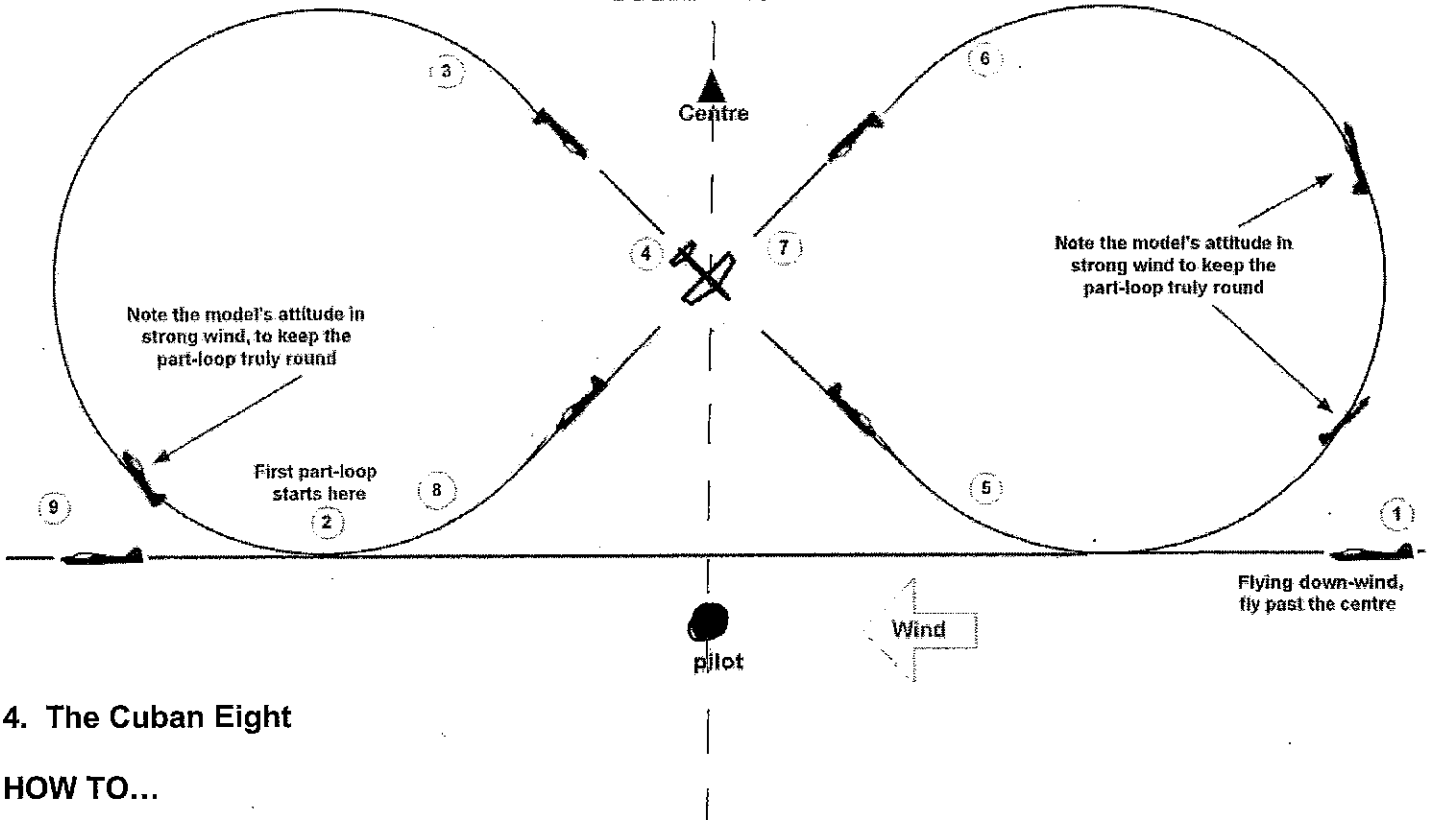
### HOW TO...

1. Because this manoeuvre is in the vertical plane, it needs to be flown on a line about 100 to 150 metres out to determine that the loops are indeed round. Fly high enough so that there is no danger of getting too low for your model's safety. The judges won't deduct much at all (if anything) for flying up a bit, but safe...
2. Enter into the wind at full power, straight (parallel to the runway) and level.
3. At the centreline, squeeze in enough elevator to achieve a graceful loop, making adjustments as required to overcome the effect of gravity. The wings should be level at the top of the loop.
4. On the way down, you may need to back off the power a bit, but remember you still need to do another loop, so don't be any slower at the bottom than the entry line in! Wings should be level at the bottom.
5. Repeat for the second loop.
6. Fly an exit line of at least 30 metres.

### DOWNGRADES...

1. Entry or exit lines not parallel to the runway, or climbing or diving
2. Entry and exit lines at different heights
3. Loops not of the same radius, and therefore not the same size
4. Corkscrewing in or out, or both!
5. Manoeuvre not centred
6. Flown too close to determine that the loops are round or not
7. Visible changes of radius during loops

**CUBAN EIGHT**



**4. The Cuban Eight**

**HOW TO...**

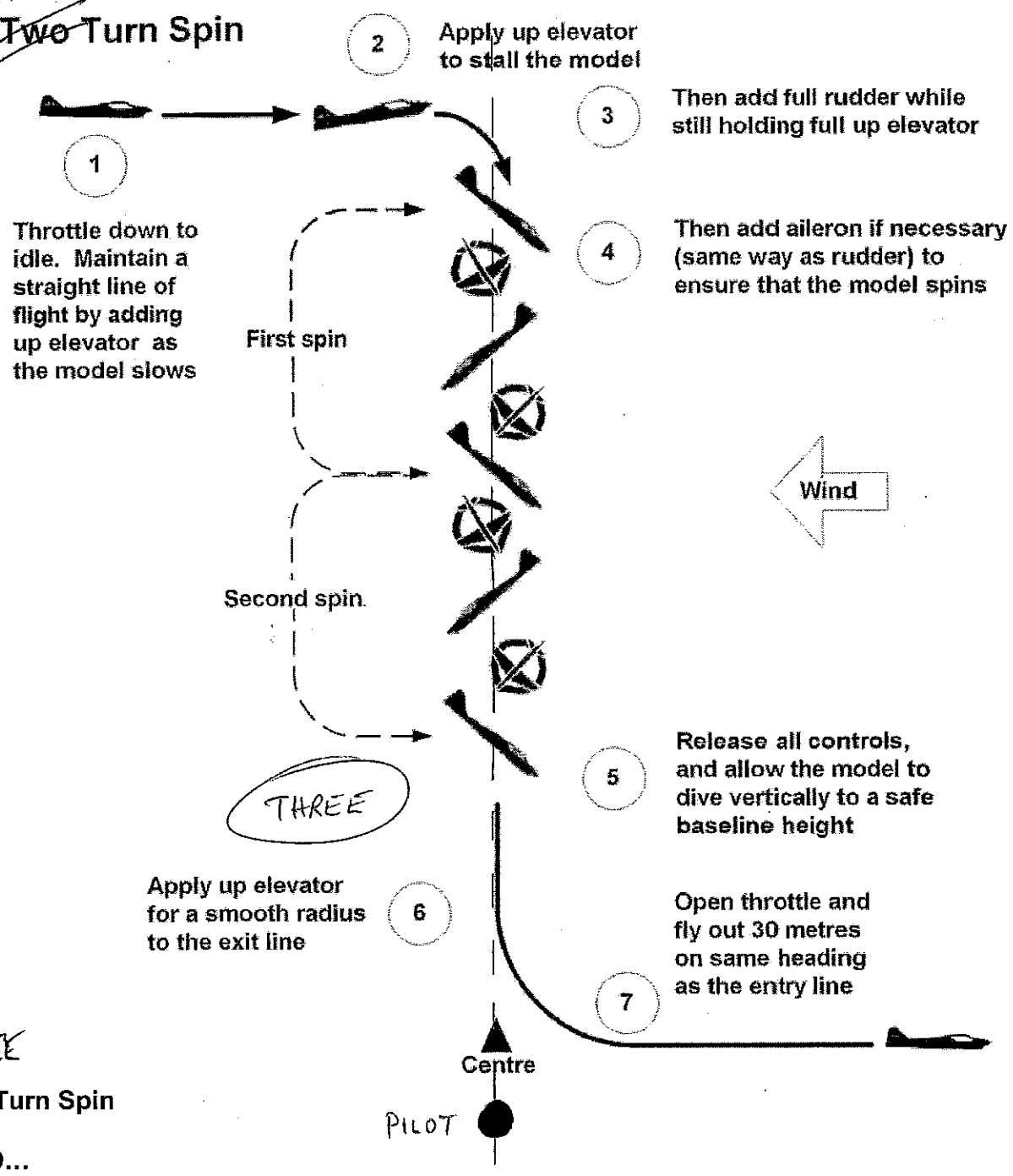
1. This manoeuvre must be flown further out at about 100 to 150 metres so that it's shape, which is in the vertical plane, is easily seen. You will need to climb quite high during the loops to give enough room for the 45-degree downlines with half rolls. Begin at (1) with a 30-metre straight and level entry line, and keep flying past the centreline to (2).
2. Fly at maximum speed at (2) applying just enough elevator to begin a graceful loop, and to allow for the effect of gravity during the loops, ease it off if required when the model has just passed the vertical, re-applying just a touch near the top of the loop, until at (3) you might even have to ride a touch of down elevator to maintain a 45 degree inverted downline. The throttle may need to be lowered on the downline.
3. At (4) apply aileron either way for a half roll, then maintain the 45-degree line for the same distance as the first part of the 45-degree downline.
4. At (5) again at full power, add up elevator gently for a graceful second loop, striving for the same height you achieved at the first, while maintaining the same radius as the first part-loop.
5. At (6) you may again reduce power, riding enough down elevator to maintain the 45 degree inverted line.
6. At (7) apply aileron again, either way, for a half roll. Maintain the 45-degree downline.
7. At (8) smoothly add up elevator and throttle, being careful to smoothly steer the model out straight.
8. Fly an exit line of 30 metres to (9).

**DOWNGRADES...**

1. Loop radii not the same
2. 45 degree lines not 45 degrees
3. Gallops in radius during the loops (be gentle on the elevator!)
4. Roller-coaster downlines (jabbing the elevator)
5. Half rolls not in the middle of the downlines
6. The two half rolls have different roll rates
7. Entry or exit lines not parallel to the runway
8. Loops corkscrew in or out, or both
9. Positioning the manoeuvre so close and high that it makes it hard for the judges to view the model (poor old judges with their stiff necks may retaliate with a lower score!)
10. Half rolls not at the centreline (manoeuvre not centred)

**Lots of opportunities for errors here!  
The pilot who makes the least mistakes scores the highest!**

~~THREE~~  
~~Two Turn Spin~~



~~THREE~~  
~~Two Turn Spin~~

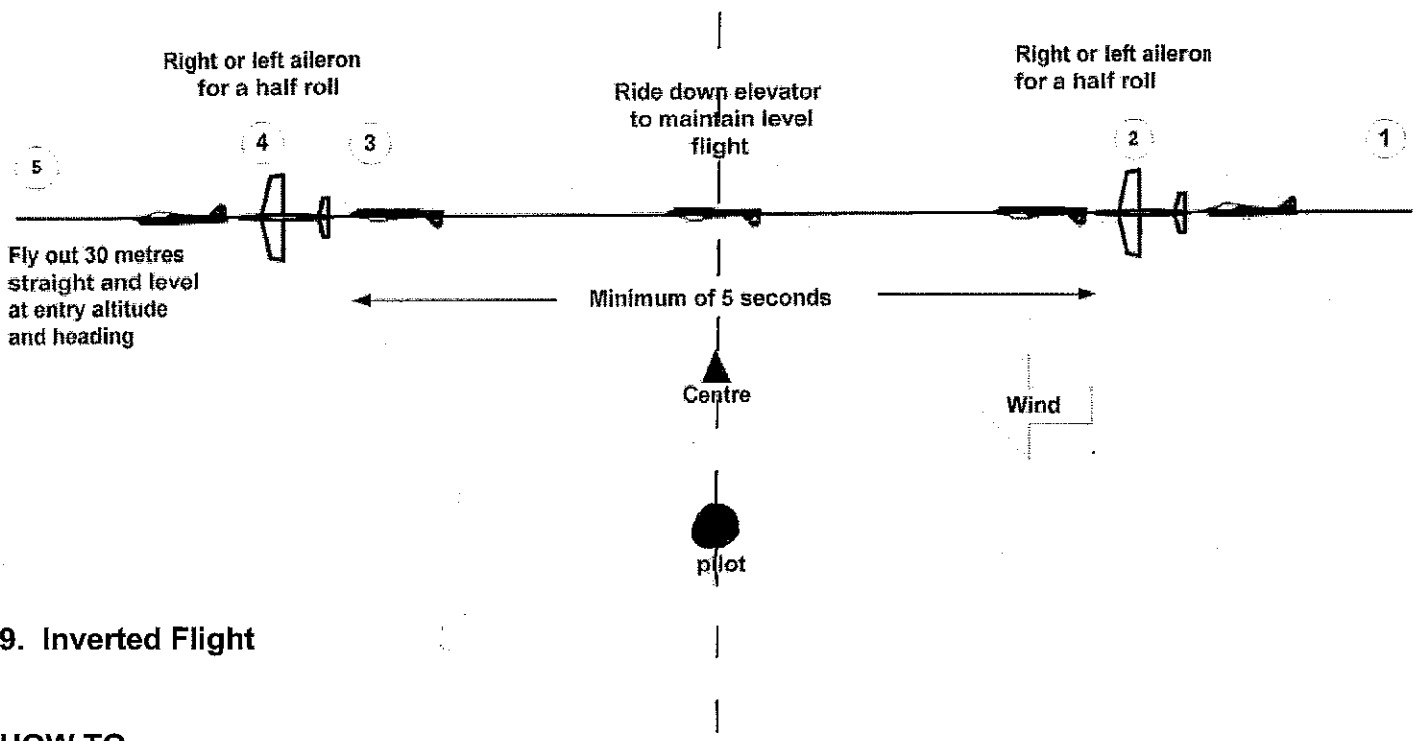
HOW TO...

1. Model is flown in on a slowing 30-metre entry line, parallel to the runway. At the centreline, the model should be quite nose-high, and about to stall. The model should still be aimed parallel to the runway.
2. At (2) full elevator is applied and held in, the model stalls, and the nose begins to drop.
3. Immediately add and hold in full rudder in the direction you want the model to spin.
4. Some models spin OK with only full rudder added to the full elevator, and others need aileron also to spin.
5. Just before (5) release the controls and the model will probably continue to turn for a quarter-rotation or so all by itself. You just have to practice, practice... to get to know just when to release the sticks.
6. If you've underdone the turns a little bit, finish with ailerons. If you've overdone them a little bit, use the ailerons to 'unturn' back to two turns. If you've only done one spin, or you've done nearly three, you've scored a zero, but you should still finish the manoeuvre off properly with a nice vertical dive, a lovely smooth part-loop, and 30-metre exit line. You never know, the judges might have blinked or something!

DOWNGRADES...

1. Wing-over or snap-roll at entry to the spin scores you zero. The cause is using the ailerons too soon.
2. Over or under rotation. One point off for each 15 degrees of error. 90° out = 6 points off. Tough, eh?
3. Entry and exit lines not parallel to the runway.
4. Spiral dive (not stalled) or snap roll entry (model 'flicks' over) scores zero.
5. Flying too close, making the judges think about their chiropractor instead of your manoeuvre!

### Inverted Flight



### 9. Inverted Flight

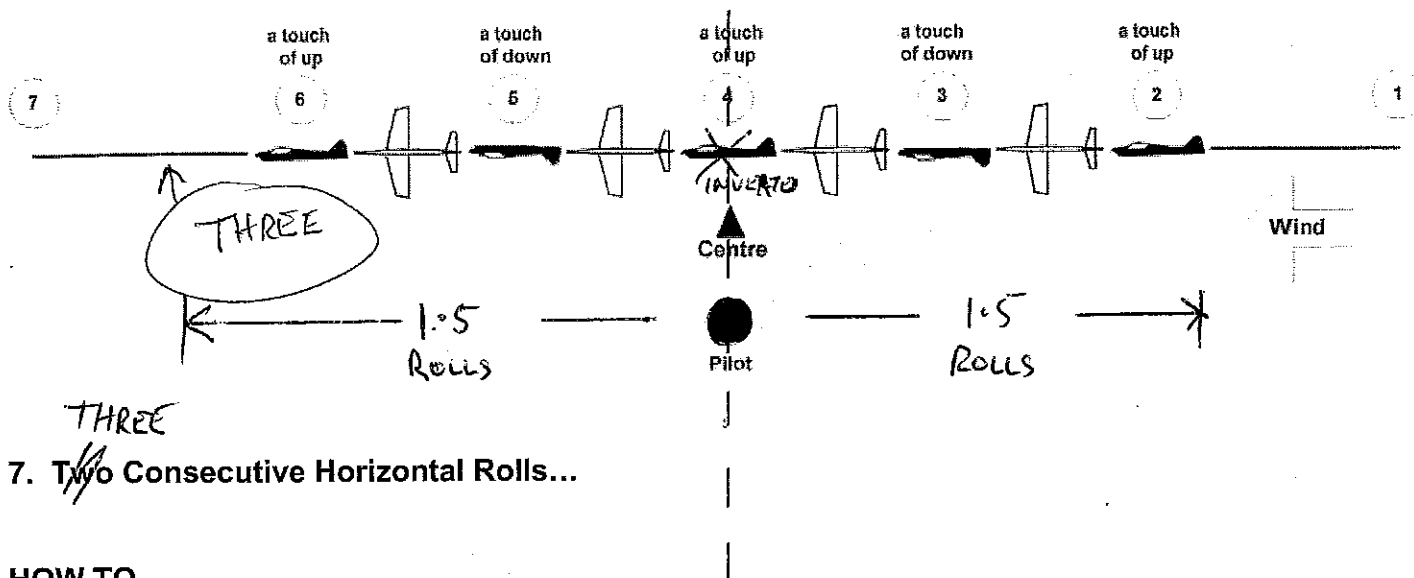
#### HOW TO...

1. The biggest mistake newcomers make in this manoeuvre, is not going far enough upwind after the manoeuvre preceding it! Your model will be travelling fairly fast for about 8 to 10 seconds in this manoeuvre, so it will use up a lot of your line of flight.
2. To get the manoeuvre centred, after the previous manoeuvre the model must be flown upwind far enough to be able to do a turnaround that doesn't finish back on the centreline! You can see this happen at almost every Sports Pattern event! If it's quite windy, it can take literally twenty times as long to get far enough upwind for a successfully-positioned turnaround than it takes for the downwind end.
3. At (1) your 30-metre entry line begins, parallel to the strip, wings level, not climbing or diving.
4. After your entry line, use aileron at (2) to half-roll to inverted. Ride down elevator to maintain level flight.
5. This is where good model-trim again becomes obvious. A well-trimmed model almost flies itself upright, needing only the slightest trace of up elevator to maintain height. And when it is rolled to inverted, it will feel exactly the same, except the slightest trace of elevator will be *down* elevator to maintain height.
6. From the end of the half roll (2) to the beginning of the half roll at (3) should take about 5 seconds.
7. At (4) use aileron to half-roll back to upright. It doesn't matter which way you do the rolls.
8. Maintain an exit line for 30 metres.
9. Remember that the inverted section is only about a third of the manoeuvre! Don't forget the entry and exit lines, the rolls, and the positioning.

#### DOWNGRADES...

1. Loss of heading at any stage, especially after the rolls
2. Inverted section not at least 5 seconds
3. Not centred
4. Rolls not exactly half-rolls
5. Roll rates not the same
6. Climbing or descending

## ~~THREE~~ Two Consecutive Horizontal Rolls



### 7. ~~Two~~ Consecutive Horizontal Rolls...

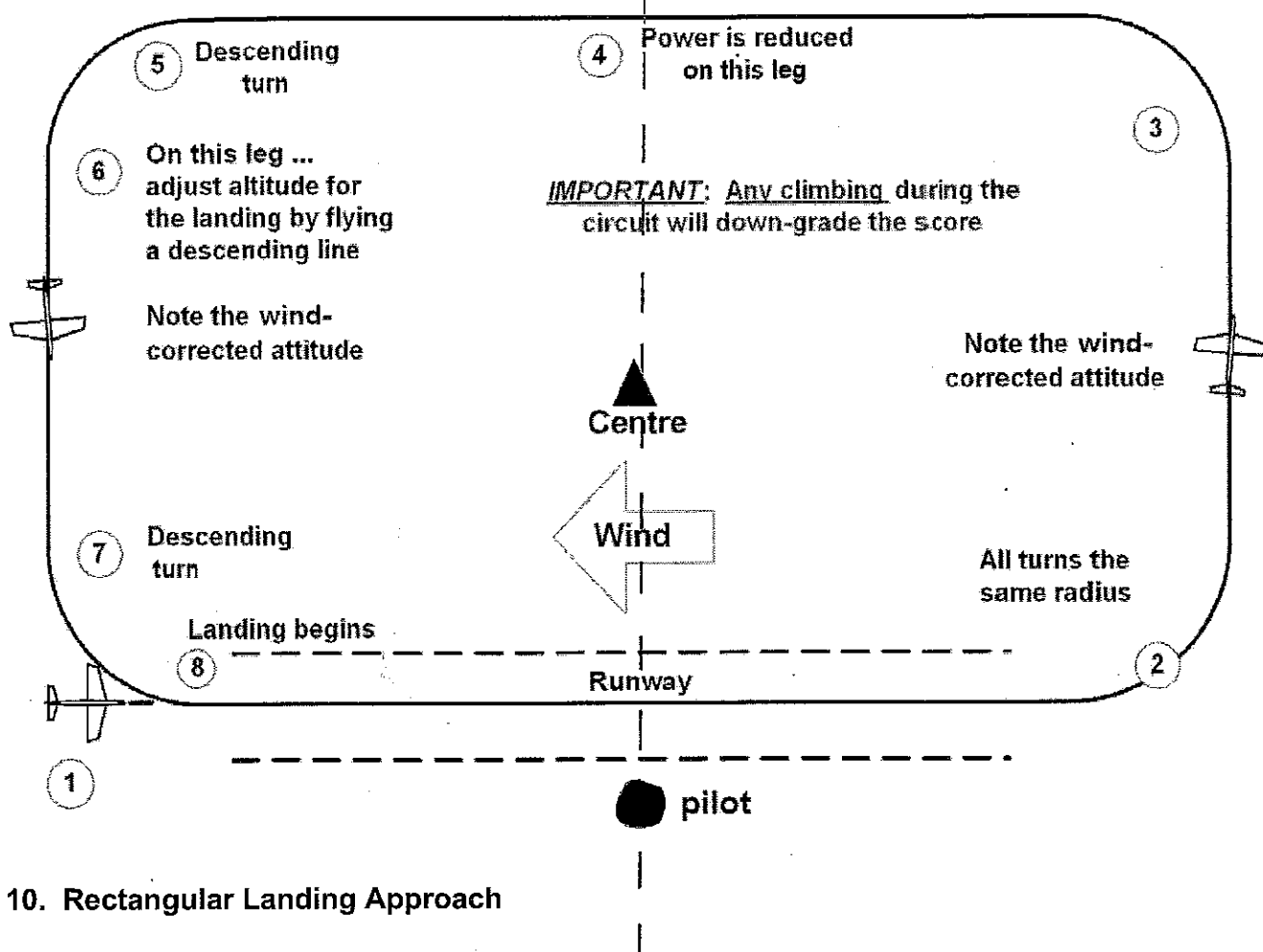
#### HOW TO...

1. Firstly, don't put your model at risk by flying too low! The judges won't deduct anything for flying up a bit, and you don't get extra points by having to abort the manoeuvre after the first roll by flying too low!
2. This manoeuvre can gobble up quite a bit of sky, so give yourself flying-room. Your line of flight should be about 100 to 150 metres out, and maybe 100 metres up (or more) for early attempts.
3. Because you finished the last manoeuvre (the Two Loops) upwind, when you get to the upwind end after that manoeuvre, it's really easy to get blown right back towards the centreline during the turnaround! If it's windy, you might have to fly way, way, way upwind to be able to turn around and get onto a nice straight line in time to be able to get the next manoeuvre centred.
4. The Two Rolls are done downwind, so the wind-speed will add to your model's speed. It's usually better for 'sport models' to fly at a fast airspeed for rolls rather than flying slowly, so expect to use up some sky!
5. Let's say you've finished your turnaround from the Two Loops OK; you're straight and level, and there is at least 100 metres distance to the centreline.
6. From (1) fly a 30-metre entry line. At (2) squeeze just a touch of up elevator, then let it off and start rolling. What you want here is to lift the nose just a degree or three so that after you've done the first part-roll to inverted, the model will be about level again. Maintain aileron to complete two consecutive rolls (either way, so long as they're the same way, with no pauses!) Don't let the aileron off until you have finished two rolls!
7. The nose will want to drop as soon as the wings are not level, so you will need to smoothly push in just a touch of down elevator as the wings pass through inverted at (3) to keep the nose up. Then ease it off.
8. As the model becomes upright again, it should be at the centreline (4). As the wings pass through level, you will need to smoothly squeeze in a touch of up elevator again to keep the nose up.
9. Repeat the process for the second roll.
10. Fly a 30-metre exit line to (7), parallel to the runway.
11. If you roll too fast, the elevator inputs have to become 'jabs', trying to 'keep up with the roll-rate', and the line will look very jumpy. Your model should take about 2 seconds to do one roll with full aileron. There are no manoeuvres in beginner aerobatics that require fast roll rates!
12. If you're thinking of using rudder during the rolls, you should be competing in F3A competitions!
13. If your model always heads for the ground when you're upside down, get an experienced aerobatic flyer to help you with trimming your model. This could easily be worth many points to you, each manoeuvre! The difference between the same model in a well-trimmed state and a badly trimmed state can be amazing.
14. By the way, trimming doesn't just mean using the Tx trim levers! If there's no one at your club who can help you, the Sporty Forty judges are usually able to give you quite a bit of help, before and after the event is run. Or go to a pattern comp. Just ask!

#### DOWNGRADES...

1. Roll rate not constant, and/or pauses in the roll
2. Changes in heading or altitude
3. Manoeuvre not centred
4. Rolls are rushed and jerky, lacking smoothness and gracefulness
5. VERY BIG downgrade for no elevator inputs at all
6. BIGGEST downgrade is for loss of control of the model... don't fly so low or close that you have to 'chicken out' and lose control! If you have to abort the manoeuvre, or even worse... crash, you score a zero!

## Rectangular Landing Approach



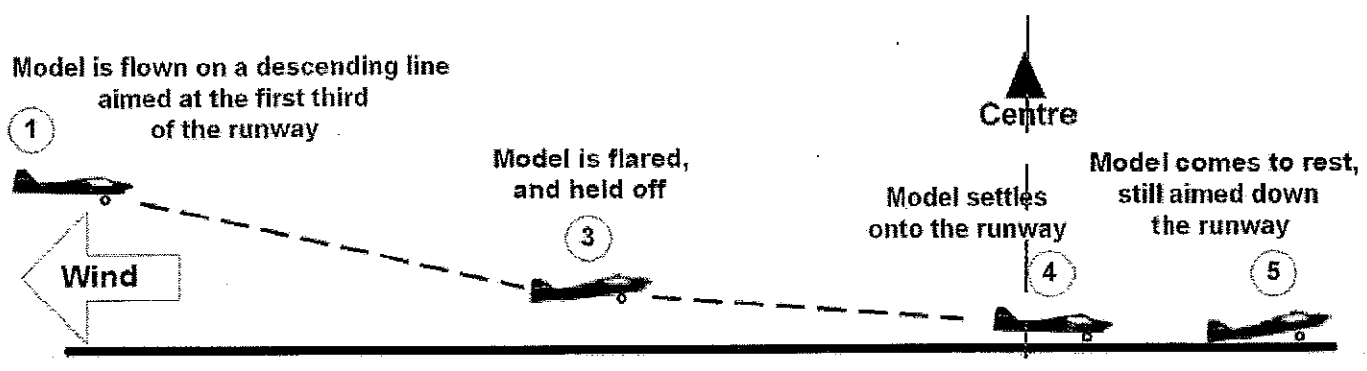
### 10. Rectangular Landing Approach

#### HOW TO...

1. This is a very simple and straightforward manoeuvre, but very few pilots get good scores, simply because they don't follow the directions! The manoeuvre is a rectangular landing approach, so don't make the mistake of flying it as a rectangular take-off approach. Establish an entry line to position (1) at an altitude chosen by the pilot. From position (1) if the model climbs anywhere at all during the manoeuvre, points are lost according to the severity of the gain in altitude. For example, if the manoeuvre was otherwise flown perfectly, but the pilot chose to pass over the strip at say 10 to 20 metres (as is so commonly seen) and then the model climbs during the manoeuvre to say 100 metres on the downwind leg (usually so they can still land if a dead-stick occurs), then many points would be lost. It's not a take-off manoeuvre!
2. Position the model so you're looking up at 50 to 60 degrees as it passes in front of you. An entry-line of about 30 metres to position (1) should be flown over the far side of the runway, or even a bit further out (don't fly overhead... remember those poor old judges' stiff necks!) at a height that will be safe for the model for the whole circuit without any need to climb. This may be about 40 to 100 metres up, depending on the size chosen for the circuit, determined largely by how strong the wind is blowing.
3. At (2) (3) (5) and (7) the model makes turns of equal radius. (2) & (3) should be at equal height.
4. At (4) on the downwind leg, the power is reduced. *Where* exactly depends on the individual model's characteristics (heavy/fast, or light/slow etc.). The turn at (5) may be a slightly-descending turn, since it's safer to have the nose down a little during a turn when the power is down.
5. The leg at (6) is the descending leg, where height is reduced sufficiently for a final slightly-descending turn at (7), but leaving enough height for a controlled descending trajectory for landing.
6. NEVER fly in such a position that you couldn't land safely if the motor stops. If you realise your entry line at (1) is lower than you had planned, just make the circuit smaller. In any event, you shouldn't really need to fly more than about 150 metres away from yourself at any point for this manoeuvre.

#### DOWNGRADES...

1. Any climbing at all after the entry line at (1)
2. Turns not of equal radius
3. Respective opposite legs not the same length
4. Deviations in lines



## Landing and Rollout

### 11. The Landing

#### HOW TO...

1. From the final turn, the model is flown on a descending line that is aimed to contact the runway at a point that is about one-third the way up the runway. The model should be flying quite slowly at this time.
2. Ideally, the model should be kept in a flat attitude (1) horizontal with the runway. If there were no power available, the model would keep slowing down in this attitude, making more and more drag, until it stalled. If just a 'click or three' of power is left on during this approach, the descending path shown (2) should be achieved. However with some 'slippery' models, just two clicks might let the model fly on forever until the fuel is all gone! Achieving the model's attitude shown, using a tiny amount of power as described, has to score better than a 'simulated dead-stick' style, so it's worth practicing!
3. If it looks like the model is going to land short, add a click or two more power to 'drag' the model a little further along the strip. The model's attitude should not alter at all.
4. If the model looks like it's going to overshoot, then back off the power, and let it slow down some more.
5. When the model is about half a metre above the runway, the 'flare' (3) should be started to slow it down more. This means simply adding and maintaining a touch more elevator to lift the nose a 'degree or three', which will cause more drag. Be careful to not add too much though, or you might force a stall...
6. The model is then 'held off', maintaining the slightly nose-high attitude. This causes drag, and the model keeps slowing down until it loses enough lift that it settles to the runway by itself (4).
7. The power can then be set to idle, and the model is allowed to roll to a stop (5) still parallel with the runway. Allow your caller to retrieve the model for you.
8. If you choose to taxi the model back, don't turn the model towards the pits or people. Instead, turn it outwards, away from everyone, and taxi back parallel with the runway. Steering an unrestrained model at people with the motor running, especially where the model is close, and most especially if those people are the judges, is a sure-fire way to score zero for your landing. Remember commonsense and safety.
9. Never stop 'controlling' the model until your assistant/caller has got the model restrained.

#### DOWNGRADES...

1. Landing path not maintained straight in relation to the runway
2. Bouncing at touchdown (usually a result of still too much airspeed)
3. Loss of heading after touchdown, during the roll-out
4. Proper control not being shown (the landing is an 'arrival')
5. Not following commonsense safety issues, especially after coming to a stop

Please note... in some of the HOW TO's above, more issues are discussed other than the basic manoeuvre geometry, etc. such as where it says don't point your model at people, don't do the two rolls too low, etc.

These words have been included for the benefit of budding aerobatic pilots, as they are an accumulation of observations and knowledge from many experienced people. We hope they help you avoid some potential problems along the way.

**Fly for fun, and make it fun for others, too!**