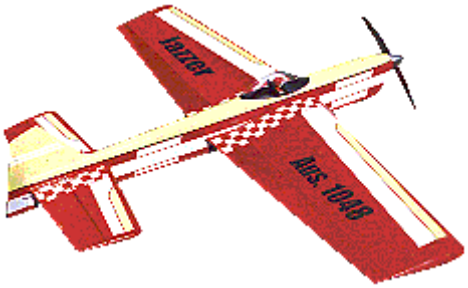
The Judge's View of F2B



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VIC STUNT

The pattern has not changed significantly since the FAI adopted the then AMA American Pattern in the early 1960's as THE pattern to be used for all World Championships. Of necessity, most Countries use this pattern for their own Championships as well, the most notable exception being the Americans with their AMA Pattern, although today the differences are few.

When viewed through the pilot's eyes, the figures may well be perfect and in accord with every part of the description, and this should be the ONLY way of judging ALL the manoeuvres - WITHOUT EXCEPTION !

It is for the judge to see them as the pilot sees them, and **NOT** for the pilot to attempt to make them look correct and "by the book" as the judge or spectator would see them. To expect otherwise is to demand the impossible from the pilot! The Rules and Descriptions for the execution of manoeuvres applies to the pilot's view, and **NOT** the judge's view. The Judge's view is quite different for all manoeuvres, and the illustrations very clearly show the magnitude of these differences. The exceptions are Level and Inverted Flight, and the Reversed Wingover when it is executed directly in line with the Judge.

To put it in clearer terms, it is for the judges to KNOW what the manoeuvres will look like, from their position outside the circle, when the pilot performs them correctly!

THAT is the starting point for the judge's marks, with deductions for visible errors according to a sliding scale of severity. If the judges see a perfectly square "Square Loop", then the pilot has made major errors!

There is nothing in the Rules for F2B that dictates, or even suggests, WHERE within the Flight Circle the manoeuvres should be performed. The pilot is entitled to perform them anywhere he likes. Certainly, the tradition of exactly due downwind is generally observed - if for no other reason than common sense. However, there are also common-sense times when the pilot will deviate from that position. On these occasions, it is a MUST that he NOT be penalised for what some people see as a "positional error" - **There is no such thing ! ! !**

YOU are expected to KNOW what the manoeuvre will look like when performed "correctly", and that applies to wherever it is performed, not just downwind. It is occasions such as these that call for your "knowledge and experience", and your ability to "assess" from your less-than-ideal position when you are denied the ability to "see" from your due-upwind position.

The wise pilot, after advising where he would like the judges to stand, will accurately ascertain some landmark that is exactly opposite that position. That point is then the centre of all his manoeuvres, adjusting appropriately the actual start point for each manoeuvre. It is **NOT** your task to make a wise pilot out of an un-wise pilot.

You should **NOT, EVER,** follow the pilot's positioning if he deviates from due downwind.

Your **CORRECT** position is, at all times, due upwind - you should be diligent on this point - and constantly check with whatever wind indicator is available to maintain that position. Remember also that while you are entitled to move + or - 1/8th lap from where you started to accommodate a wind shift, you **MUST NOT** move during a manoeuvre, but only between them.

The illustrations used here are screen-captured still images from Keith Renecle's absolutely brilliant 3D program "CL Sim 1-0.exe", and is available for download as a 1.4Mb zip file. In the zip package is the program, the necessary list of keyboard key functions, and an instruction manual. Click on the image at left.

NOTE: This program requires a very fast system processor and super-fast graphics - an AGP graphics card is a must.

There are many judges who believe it is not just "appropriate" but "essential" to use their pencil (or some other implement) as a marker for the intersection point of horizontal eights and the Cloverleaf, and even sometimes for the edge of single loop manoeuvres.

A little arithmetic shows how inadvisable this is. The distance, from your position to the model when in manoeuvre, is 140 feet (65 feet line length [130] plus 10 feet [140] away from the flight path), or 42.5 metres. Use that as the radius of a "judging" circle, with the model's position of manoeuvre on the circumference and your position as the centre. That calculates to a circumference of 880 feet, or 267 metres. 1/360th of that is 2.5 feet, or 0.75 metres.

All you need do is rotate your body 1° while holding that pencil as the intersection marker, and YOU have moved the intersection 2½ feet, or ¾ of a metre ! ! ! While following the Eight, you can rotate your body 3 or 4 degrees without even realizing it.

Can YOU be absolutely certain that you don't move or rotate?

Added to that, having that pencil so close to your eyes draws your attention to the intersection ONLY, with less interest in observing overall shape, equality of size, and heights.

If it is claimed "line up the pencil with a background object" ? - use that background object without the pencil.

STARTING:

Should be self-explanatory. **YOU**, the Judge, are expected to be alert and attentive for when the competitor indicates to you that he is ready. At his signal, the 7 minutes commences. That moment is also the commencement of the 1 minute limit for release. Care need be taken to ensure your eyes are on the model as it's released, and not on the watch.

TAKE-OFF:

This is the first "judged manoeuvre", yet it is amazing how many contestants dismiss it as being relatively unimportant.

4.2.15.3	b)	Ground roll and lift off segment: before lifting off the model aircraft should run along the ground for a distance of **not less than 4.5 metres** and **not more than 1/4 of a lap**. The lift-off should be smooth, meaning without a "sudden jump" into the air.

When the contest is on a grass surface, it may seem appropriate to be lenient and make allowances.

NOT SO ! ! !

The moment you think to yourself - "He couldn't help that jump into the air" - you have backed yourself into a Judge's Corner.

What do you do if the next competitor holds it down for the required distance?

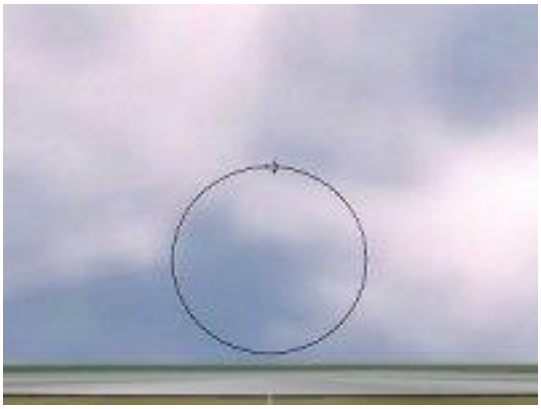
REVERSED WINGOVER:

4.2.15.4	Note: All turns in this manoeuvre should be between 1.5 metres and 2.1 metres radius.

The ease of seeing this manoeuvre accurately rests entirely with the pilot. He is entitled to commence it anywhere, so must not be "penalised" deliberately if that first climb is not directly in front of you. The further away from your position it is, the more you will be compelled to "assess" the straight path by the model's attitude rather than it's actual flight path. Even then, it is possible for the model to be pointing slightly off from its flight path, yet still travel in a straight line.

YOU are judging the path the model travels through and not the direction it is pointing as it does it.

INSIDE LOOPS:



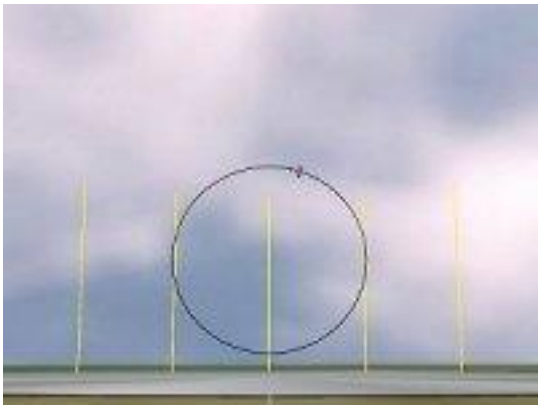
This illustration shows the Loop as **YOU** will see it, when performed to the Rule by the pilot.

Look carefully, and you will notice that it is **NOT** exactly round, due to the top of the loop being closer to your position than the bottom, therefore your "view" of the vertical diameter is oblique while your view of the horizontal diameter is square to you.

This view is also when the pilot performs the manoeuvre centred exactly opposite your position - to your eyes the precise bottom point is behind the pilot.

A tip for observing the required identical flight path for successive loops - DON'T move your head from the moment of the first loop - align your view to the centre of the loop. Keep your body and head perfectly still and use your eyes only to track them. The very best indicator of spatial relativity you have at your disposal is your eye muscles. They will tell you if you are, or are not, looking in the same direction far better than your neck muscles.

4.2.15.5	Manoeuvre size, overall: height 45 degrees line elevation angle; width 1/8th of a lap.

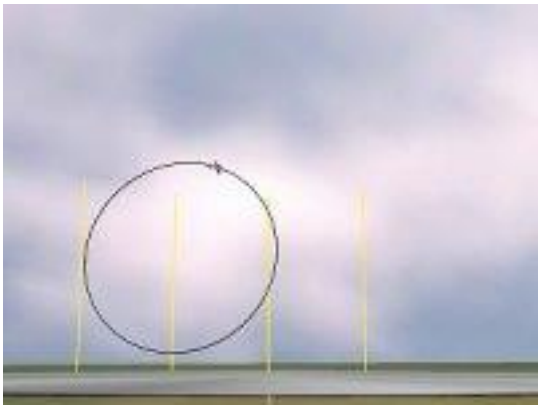


The Rules call for a loop that is 45° of arc in diameter vertically, and 45° of arc in diameter horizontally as would me "measured" at level flight height.

This view shows the difficulty in "assessing" the nominal width (diameter) of the loop. The marker poles are placed at the 22.5° segment points relative to level flight height - the base of the hemisphere. Note also that only the pole behind the centre of the loop is vertical, with the others angled slightly in at their top, representing the respective verticals as the pilot would see them.

However, your eye cannot "measure" the horizontal diameter relative to the base, as the manoeuvre is tangent to it. Therefore, as the diameter of 45°, as measured at base level, is now placed on a level of 22.5° above the base, the horizontal diameter will appear wider. That is **NOT** a fault in the shape of the manoeuvre, but because our theoretical grid map is in the wrong position for measuring both loop diameters. Incline that grid map to where the base line is at 22.5°, and both diameters will "measure" the same.

The manoeuvre's position relative to the outer-circle markers may be thought to give a better indication of it's size, but caution is needed in using these markers for that purpose. More about those later.



The pilot is entitled to place his manoeuvres anywhere in respect to both your position and the prevailing wind direction. It can be said that the pilot who deliberately performs manoeuvres "off" from due downwind is simply making things harder for himself. It is **NOT** your function to make any allowance for that, or to give him any extra "benefit of the doubt" marks. It **IS** your function to know what the manoeuvre will look like when the pilot performs it exactly to the Rule, but not centred on your position.

Assuming that **YOU** are maintaining an upwind placement on the edge of the circle, this view is from YOUR position when the pilot is performing the manoeuvre **22.5°** to **HIS** left of nominal downwind. (Note the small marker is no longer in line with the centre pole.)

This is extremely common practice in windy weather, and **MUST NOT** earn any deliberate mark-down. The Inside loops are usually positioned to HIS left, and the Outside's usually to HIS right.

It is **ESSENTIAL** that YOU maintain, to the best of your ability, a position that is exactly upwind at all times. It is **NOT** correct to "follow" the pilot in his placement of manoeuvres. The best example is when, should you move to your right after the Inside loops because the pilot has "biased" to his left - YOU will then be almost profile to the Outsides when the pilot biases them to HIS right.

INVERTED FLIGHT:

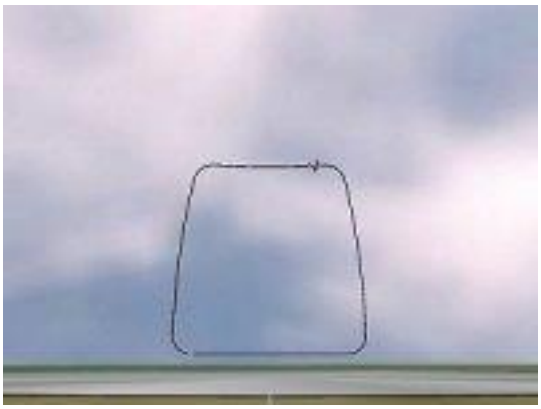
4.2.15.6	a)	Start of manoeuvre: at the start of the third lap after the exit from the previous manoeuvre.
	b)	2 laps of inverted flight segment: the model aircraft should maintain 2 complete laps of smooth and stable inverted flight at a height of 1.5 metres with no height deviations of more than plus/minus 30 cm, and with no abrupt changes of attitude.
	c)	End of manoeuvre: at the end of the fourth lap after the exit from the previous manoeuvre.

As the two level laps between manoeuvres are not subject to judging, it is essential that you mentally "count" through these laps, and judge only laps 3 & 4.

OUTSIDE LOOPS:

Same as for Inside.

INSIDE SQUARE LOOPS:



This illustration shows the Square Loop as **YOU** will see it, when performed to the Rule by the pilot.

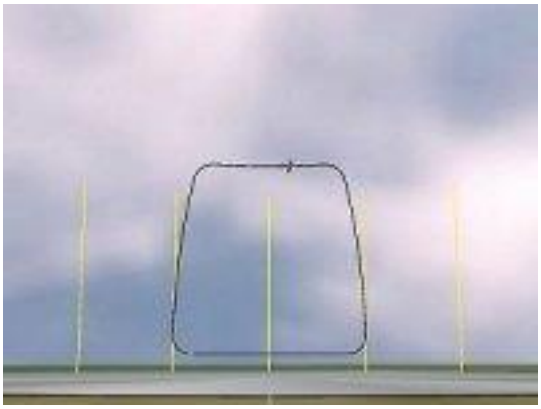
As clearly stated in the F2B Rules and Judging Guide, the manoeuvre is described as "viewed by the pilot and **not** the judges. (The word **not** in bold face is as per the FAI document.) Therefore, assuming that the judges are exactly diametrically opposed to the imaginary vertical centreline of the square loop, they will see the sides angled very slightly in, with the top leg shorter than the bottom leg.

THAT is the way it appears if the pilot is flying it correctly - the sides are "vertical" to the pilot's eyes and not the judges.

It is for you to "assess", from your view, whether or not the pilot has followed the Rule.

The execution of a true "square" loop is an absolute impossibility on our hemi-spherical flying surface. As the pilot flies it, it appears square, with the sides being vertical respectively to the horizontal paths preceding them, and all corners having the appearance, to **HIM**, of 90 degrees.

4.2.15.8	Note: All turns in this manoeuvre should be between 1.5 metres and 2.1 metres radius. Manoeuvre size, overall: height 45 degrees line elevation angle; width 1/8th of a lap.



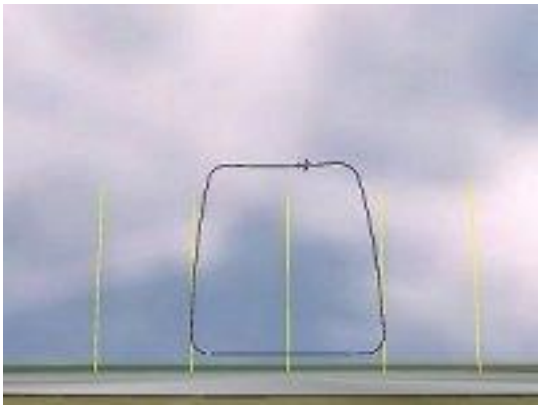
The Rule states specifically that the bottom leg should be "1/8th of a lap (including the turns)." This means, of course, that the 45° length of the sides and the 45° length of the base are the same, but the top is shorter.

A little geometry and trigonometry gives the circumference on 65 foot lines as 408 feet. One eighth (45°) of that is 51 feet. BUT - the circumference at the 45° mark is only 72% of the level flight circumference - 297 feet, with one eighth of that being 37 feet.

From your view, the most common error is the top of the loop being too long, turning the "square" into a "rectangle". If you see the top as being equal in length as the side, then that is a **MAJOR ERROR.**

Likewise, if you see a perfectly Square Loop, with sides that are splayed out for an equal length top, the pilot has **NOT** performed it according to the Rule.

Also, should outer circle markers be in place, be wary of using them to determine the correct width of the base of the loop. The very real problem of parallax error is discussed later.



In practice, it is rare for the square loop to be "centred" around the pilot in this manner, as usually one side or the other will be very close to the pilot's position, thereby allowing the judge to see the same vertical as the pilot flies it.

This view is when the pilot performs the Square Loop just a few degrees to **HIS** right of due downwind.

One side is closer to being directly opposite your position, therefore appears closer to "vertical".

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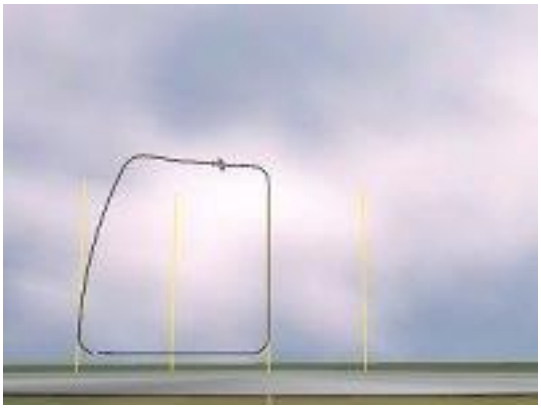
INSIDE SQUARE LOOPS: (cont.)



This view is when the pilot performs the Square Loop 22.5° to **HIS left** of due downwind.

The pilot has placed the manoeuvre exactly half of its width to the left of due downwind, therefore one side is exactly opposite your position. **YOU** see the same vertical as the pilot.

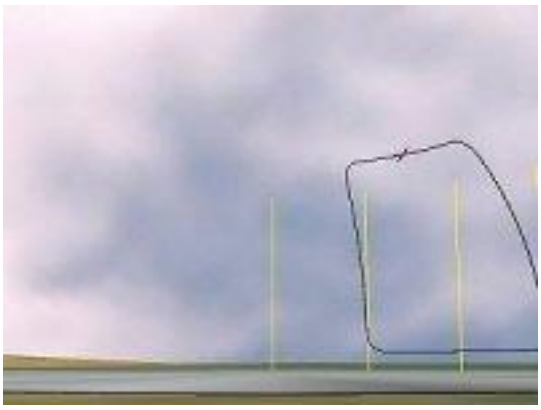
How close to "vertical" is the left side? That is **YOUR** task, and is at best an "assessment".

YOU need to be cautious in two ways –

1) Down-marking because it "looks" to be angled to the right, when in fact it may be true vertical;

2) Up-marking because you expect it to be angled, but your "guess" at what may be vertical includes a true angled path that is not vertical.

It **MUST** be noted that this illustration of the "Judge's" view of a Square Loop is when the pilot has performed it **EXACTLY AS DESCRIBED**. This does **NOT** deserve down-marking, even though it looks odd.



This view is when the pilot performs the Square Loop 45° to **HIS right** of due downwind.

It must be stressed that **HE** is entitled to, so must **NOT** be down-marked simply because he has performed it in a place other than opposite you.

This may seem extreme, but occasionally the pilot will place his manoeuvres in this position. **HE** is making your task more difficult when he places manoeuvres so far off-wind, so should expect a potentially lower mark.

BUT, he may still perform it absolutely correctly, and it's only from your viewing position that it appears to be entirely the wrong shape and with incorrect vertical sides.

The best **YO**U can do is "assess" the correctness of the manoeuvre from your position.

This view is when the pilot performs the Square Loop exactly centred due downwind and shows the 22.5° segment marker poles **and** each segment gridline on the hemisphere.

As each gridline is "vertical" to the pilot, they represent to **HIM** the vertical sides of the Square Loop.

In the F2B Pattern, this is the best example of how difficult Judging is, and how it is more "assessment" than actual vision of correct shapes, sizes and lines.

When the pilot performs a manoeuvre exactly **AS DESCRIBED** by the Rule, it will **NOT** appear "as described" to the Judge. The only exceptions to this are Level and Inverted Flights, and the Reversed Wingover when it is exactly in line with the Judge's position.

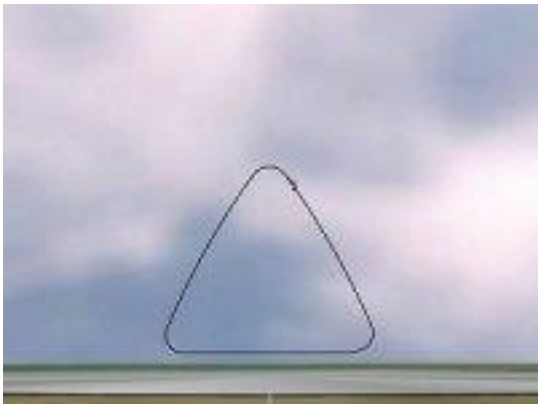
OUTSIDE SQUARE LOOPS:

Same as for Inside.

TRIANGLES:

4.2.15.10	Note: All turns in this manoeuvre should be between 1.5 metres and 2.1 metres radius. In each turn the model aircraft should change its angle of pitch attitude by approximately 120 degrees. Manoeuvre size, overall: height 45 degrees line elevation angle; width slightly more than 1/8th of a lap.

This illustration shows the Triangle as **YOU** will see it, when performed to the Rule by the pilot.



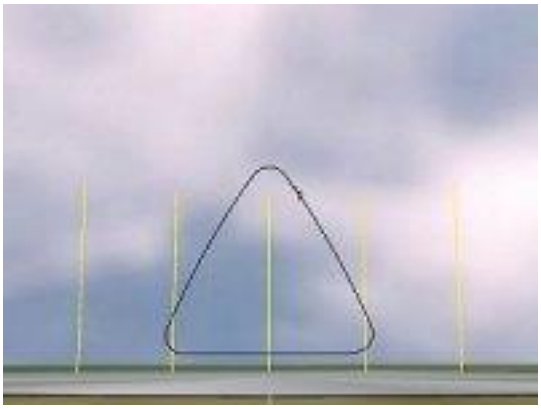
At least the Triangular Loop is possible on our hemispherical surface, with all sides equal length and all internal angles equal. However, the description applies to a flat plane (2D) view, as the pilot sees it. Hence the model turning through "approximately 120°."

In reality the hemisphere changes that, and the turn required for a Triangle of slightly more than 45° width at the base is approximately 108°.

You doubt this? - Consider a Triangle which is 90° wide at the base - a quarter of the circle. The sides will also be 90° of arc - equal length as the base. In effect, the sides would be half-wingovers, with the top turn exactly above the pilot's head.

The model turns exactly **90° for each turn ! ! !**

This illustration shows the necessity of a Triangle being "slightly more than 1/8th of a lap.".

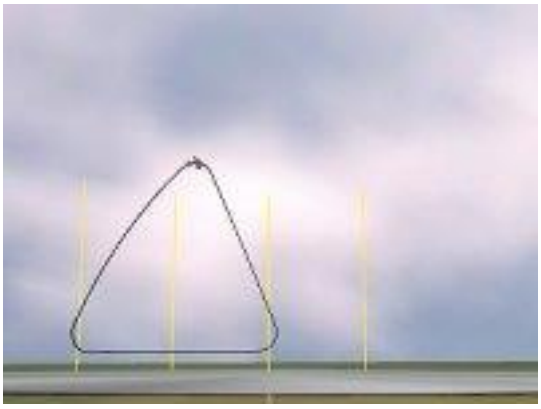


The Rule calls for a manoeuvre that is 45° in height - NOT with sides that are 45° of arc in length. However, it must be admitted that no-one could possibly determine the difference.

If there is one common error, it is the pilot turning too far on that first turn, resulting in a Triangle which is considerably wider.

The best you can do is visually measure the lengths of the sides by looking for the Triangle to be perfectly equilateral in it's shape, and with a vertical height of 45° - the same "height" as other loops.

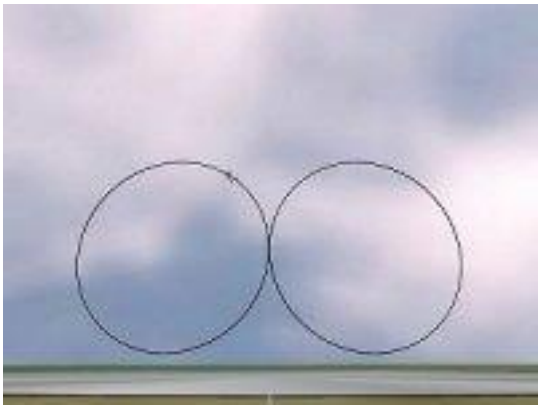
This view is when the pilot performs the Triangle **22.5°** to **HIS left** of due downwind.



Once again, **HE** is entitled to perform it anywhere he likes, and should not be down-marked **UNLESS**, in your opinion, the Triangle is clearly not equilateral, or incorrect width and/or height.

HORIZONTAL EIGHTS:

4.2.15.11	Manoeuvre size, overall: height 45 degrees line elevation angle; width 1/4 of a lap.	
	a)	Start of manoeuvre: when the model aircraft passes the intersection point for the first time. Note: when the model aircraft reaches a "vertical" climbing attitude for the first time this has **defined the intersection point** for the whole manoeuvre (that is: after 1/4 of the first loop of the first eight has been flown).



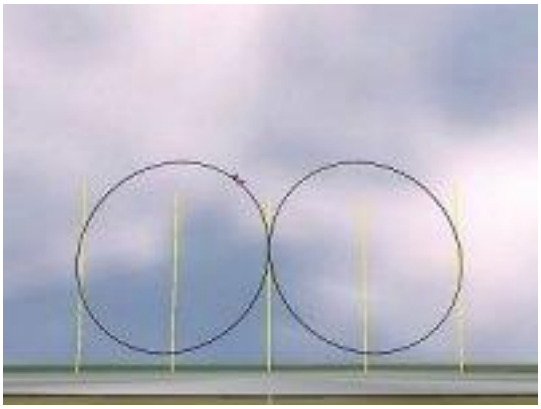
This illustration shows the Horizontal Eight as **YOU** will see it, when performed to the Rule by the pilot.

The curvature of the hemisphere causes the distortion, with both the tops and the outer sides of the loops being closer to your position than the intersection.

The most common error is a shifting of the point of intersection. While there are many other "errors" which should be looked for, this is certainly the easiest to see. It should **NOT**, however, be the only error **YOU** should be looking for. Of equal importance to "intersection" is "equal size loops"; "equal placement of loops based on level flight height"; and "equal roundness of loops."

Another common error is waiting too long at the vertical point of intersection, resulting in the appearance of a short vertical straight line in the centre, then a marked open corner at the commencement of the next loop, thus destroying the roundness.

As mentioned earlier, **DO NOT** hold your pencil in front of you as the intersection marker.



With the marker poles in view, the distortion creating the appearance of the vertical axes of the loops being inclined inward is understandable.

Of course, the pilot is at the centre of the hemisphere, therefore each loop is perfectly round, and not elongated toward the ellipses **YOU** see.

This view is when the pilot performs the Eight **22.5°** to **HIS** left of due downwind.

The distortion is considerably greater, as the left loop is closer to being a profile view to you.

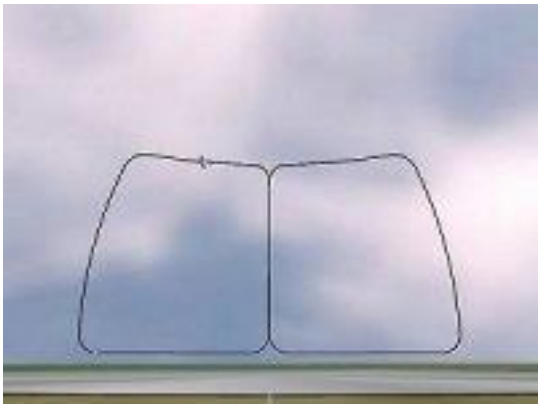
YET, this manoeuvre, no matter how oddball it looks, is performed by the pilot **EXACTLY** to the Rule. It is only **YOUR** position when viewing it that causes the distortion.

When the pilot positions it here, YOUR view of the manoeuvre would probably lead you to be reasonably severe in your down-marking, **YET** the pilot has performed it exactly to the Rule.

It would be extremely difficult to give this full marks, but it deserves them.

HORIZONTAL SQUARE EIGHTS:

4.2.15.12	Note: all turns in this manoeuvre should be between 1.5 metres and 2.1 metres radius. Manoeuvre size, overall: height 45 degrees line elevation angle; width 1/4 of a lap.



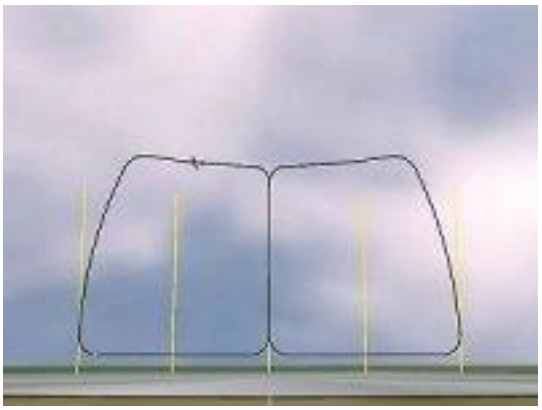
This illustration shows the Horizontal Square Eight as **YOU** will see it, when performed to the Rule by the pilot.

Note that when your view is centred on the intersection, each loop is exactly the same as the Square Loop when the pilot places it 22.5° to the side.

The outer sides appear to be higher/longer, but they are correct. They appear to be excessively angled in at the top, **YET** this view is of the pilot performing this Eight **EXACTLY AS DESCRIBED ! !**

DO NOT hold your pencil in front of you as the intersection marker.

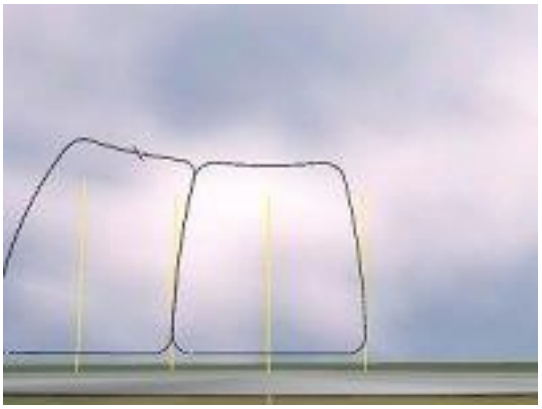
A word of caution! - Using the pilot as a fixed reference point for the intersection is OK only as long as he doesn't move sideways during the manoeuvre. Much wiser to use something in the background beyond where the manoeuvre is placed.



With the marker poles in view, and the placement exactly opposite your position, the intersection is vertical and effectively behind the pilot.

While the sides of the Square Loop will appear to be slightly curving, this is much more apparent in the Eight. The task here is to determine whether the sides are "vertical", when your view is oblique rather than in line.

When you **KNOW** what the manoeuvre **WILL** look like when performed correctly, regardless of your viewing position; then you will be marking fairly and justly, without down-marking for what might appear to be errors but are actually correct.



This view is when the pilot performs the Eight **22.5°** to **HIS** left of due downwind.

As with the round Horizontal Eight, the further away from the optimal placement, the more distorted your view will be, and the more subjective your task becomes. That is the pilot's choice.

"Optimal" placement is obviously with the intersection directly opposite the Judges, thereby granting them the most objective view.

Should the pilot vary his placement from optimal, then it is **HE** who is increasing the subjectivity.

From your position, the left side clearly appears to be angled in at the top and too long (too high), **YET** it is correct.

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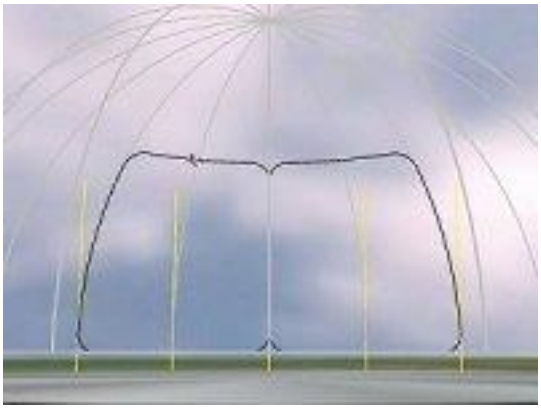
HORIZONTAL SQUARE EIGHTS: (cont.)

This view is when the pilot performs the Square Eight exactly centred due downwind and shows the 22.5° segment marker poles **and** each segment gridline on the hemisphere.

As each gridline is "vertical" to the pilot, they represent to **HIM** the vertical sides of each loop.



VERTICAL EIGHTS:

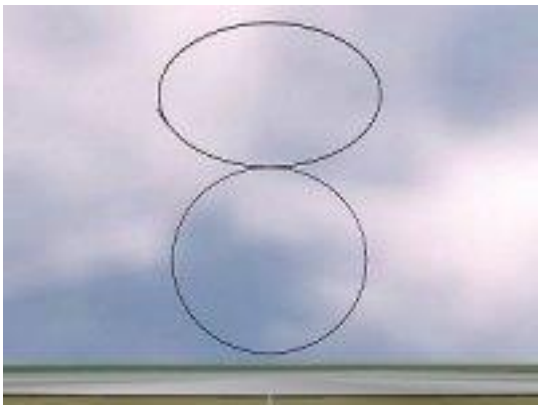
4.2.15.13	Manoeuvre size, overall: height 90 degrees line elevation angle; width 1/8th of a lap. Recommended entry procedure: from normal upright level flight at a height of 1.5 metres, fly upward along a circular flight path to a height of line elevation angle 45 degrees. At this point the model aircraft should be inverted.	
	a)	Start of manoeuvre: after the model aircraft has flown the first half of an inside loop, as it passes through the intersection point for the first time. Note: the intersection of the whole manoeuvre is defined when the model aircraft passes through inverted level flight at a height of 45 degrees line elevation angle for the first time.

This illustration shows the Vertical Eight as **YOU** will see it, when performed to the Rule by the pilot.

Most people will recognise the oblique view of the upper loop, therefore expect to see an ellipse rather than a round loop. The apparent "larger" horizontal diameter of that upper loop is caused by the difference in distance from your position, and **MUST** be recognised as correct.

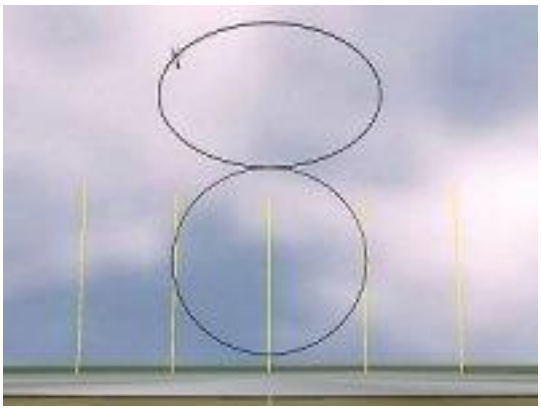
Should it appear to be the same horizontal diameter as the lower loop, it is a **MAJOR ERROR.**

Remember that the Vertical Eight "commences" at the intersection - JUDGE it from that point, and not from the Level Flight position; and deliberately look away as the model passes through the intersection for the last time so as not be influenced by the remaining half loop recovery to Level Flight.



In this view with the marker poles, the upper loop appears even more to be incorrect - as being elongated horizontally rather than "round."

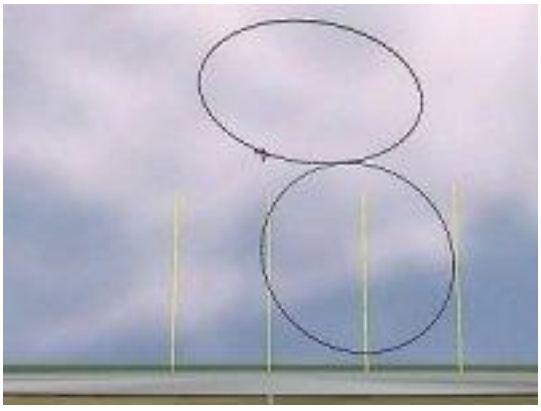
It is CORRECT ! ! !



This view is when the pilot performs the Eight **22.5°** to **HIS** right of due downwind.

Added to the "elongation" effect is the appearance of the skewed sideways vertical axis of the Eight.

It is only when the manoeuvre is centred opposite your position that **YOU** will see the central axis as vertical. Once again, your task is to "assess" how close to vertical it is when it appears skewed sideways.



HOURGLASS:

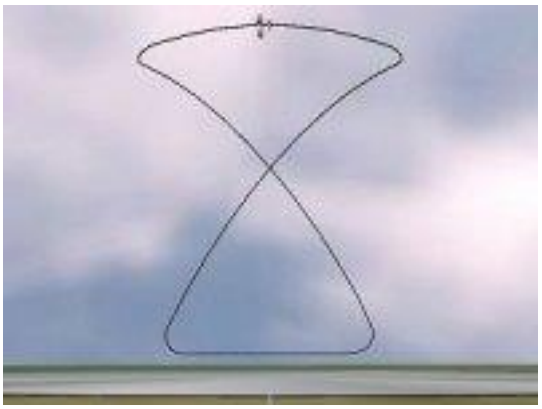
4.2.15.14	Note: all turns in this manoeuvre should be between 1.5 metres and 2.1 metres radius. In each turn the model aircraft should change its angle of pitch attitude by approximately 120 degrees. Manoeuvre size, overall: height 90 degrees line elevation angle; width slightly more than 1/8th of a lap.

This illustration shows the Hourglass as **YOU** will see it, when performed to the Rule by the pilot.

In a manner similar to the Vertical Eight, the top appears wider/longer than the base due to being closer to your position. As what you are seeing is a segment of a cross-wind wingover, you cannot expect to see it as a straight line. In this illustration, the model as shown should be exactly above the pilot's head.

In a manner similar to the Triangle, the actual "turn" is through less than the 120° that is used for a "flat plane" description for the pilot.

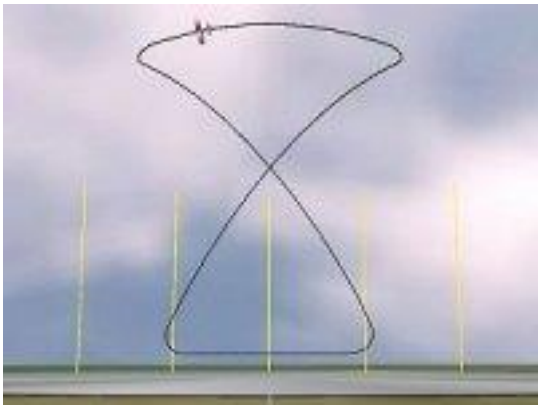
The sides, although "straight lines" to the pilot, will appear slightly curved. If **YOU** see them as "straight", then the pilot is not performing the manoeuvre according to its description.



With the marker posts in view, the same difficulty is encountered as with the Vertical Eight.

Many pilots deliberately make the top very "narrow" - referred to as making the manoeuvre "stand up". While this may make for a "closer-to-vertical-axis" manoeuvre, the top should still be slightly longer than 1/8th of a lap - slightly greater than 45° of arc. It may help to visualise each top corner as being halfway out to the width of the loop in the Overhead Eight. Anything either greater or less than that is incorrect.

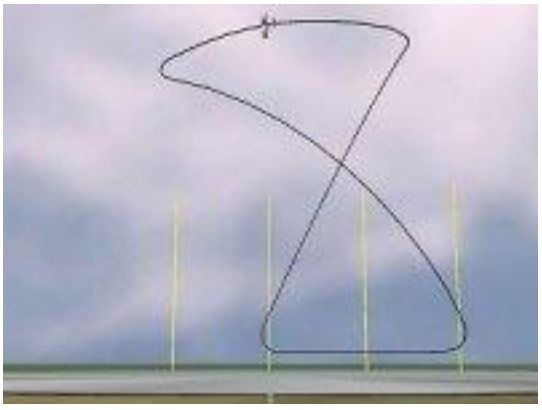
Others turn too far on the first turn, thus making the total width too great, then make the top too long to compensate, thus destroying the overall shape and deviating even further from the correct manoeuvre.



This view is when the pilot performs the Hourglass **22.5°** to **HIS** right of due downwind.

As with the Vertical Eight, the effect is the appearance of a skewed sideways vertical axis of the Eight.

It is only when the manoeuvre is centred opposite your position that **YOU** will see the central axis as vertical. Once again, your task is to "assess" how close to vertical it is when it appears skewed sideways.



OVERHEAD EIGHTS:

4.2.15.15	Manoeuvre size, overall: loop diameters 1/8th of a lap; lowest points of both loops at 45 degrees line elevation angle. Recommended entry procedure: from normal upright level flight the model aircraft should climb in a wing-over flight path to a point directly over the centre of the circle.	
	a)	Start of manoeuvre: as the model aircraft passes through the overhead point for the first time. Note: the intersection point of the complete manoeuvre should be directly over the centre of the circle and should be maintained throughout this entire manoeuvre

This illustration shows the Overhead Eight as **YOU** will see it, when performed to the Rule by the pilot.

Clearly, you cannot expect to see "round" loops, so their "roundness" is mostly guesswork based on any deviations of path or changes in the model's attitude through the loop.

Remember that the Overhead Eight "commences" at the intersection - JUDGE it from that point.

Even though you will see the "recommended entry ... climb in a wingover path", **DO NOT** allow it, particularly the implied "tight wingover turn", to influence your **JUDGING** of the manoeuvre. You should also deliberately look away as the model passes through the intersection for the last time so as not be influenced by the remaining dive and recovery to Level Flight.

These marker poles are not of any use in this view of the manoeuvre.

The intersection point should be exactly above the pilot's head, and remain there. Any movement to your left or right is very easy to see, whereas movement toward or away from you is more difficult.

The outer extremities of the loops should be at 45°, and is reasonably easy to determine.

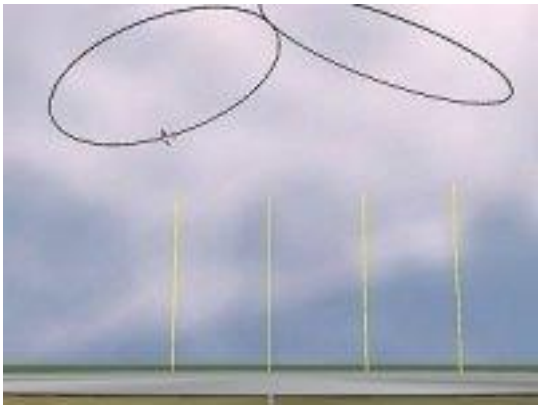
The most common error is loops not being of equal size.

Another common error is a length of straight flight through the intersection, followed by a noticeable sharp turn into the next loop. While tracking the path is difficult, the abrupt change in attitude is very easy to see, and should be marked accordingly.

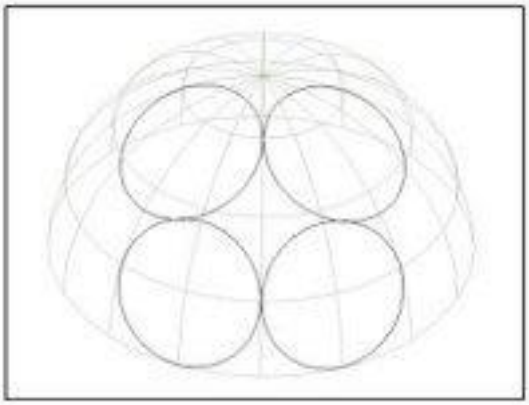
This view is when the pilot performs the Vertical Eight when the long axis (nominally crosswind) is **22.5°** to **HIS** right of due crosswind. This would be the result if he entered the manoeuvre from that 22.5° to HIS right of due upwind.

The distortion is huge, making **YOUR** task of "assessment" extremely difficult. **YET** this illustration is of the manoeuvre performed correctly, with your viewing position causing the distortion.

Even though convention has the entry from exactly upwind, the pilot is entitled to position it anywhere. If he feels the upwind point to be other than your position, you must be prepared for a distorted view, even though he may perform it faultlessly.



CLOVERLEAF:



This "description" is impossible to plot on a 3D hemispherical surface the - the Rule is written for the flat plane 2D instruction for the pilot.

The actual manoeuvre "cannot" be performed with the tangency points at the expected 3, 6, 9 and 12 o'clock points of the loops as determined by the 2D description.

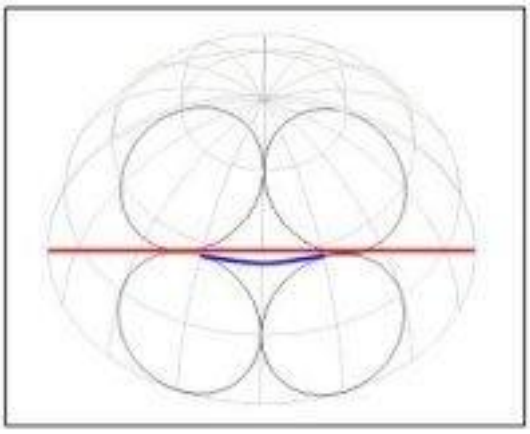
WHY? - Because these points, when viewed from INSIDE the hemisphere, are:-

in the example of loop #1 to loop #4 - at 7 o'clock and 1 o'clock respectively (approximately);

and in the example of Loop #2 to loop #3 - at 11 o'clock and 5 o'clock respectively.

This means that the elevation required for the commencement of the first loop must be **LOWER** than the stipulated 42°, yet the top of the loop beneath it **IS** at 42° because that is it's diameter above Level Flight.

If this sounds complicated, it is! - and it's about to become even more so.



The horizontal straight flight path cannot be "parallel" to the ground, but would need to be a curving path as part of an Equatorial Meridian on the surface of the hemisphere.

This would be the equivalent to having a Level Flight path inclined at an angle to the base of the hemisphere, with one side (the centre of the manoeuvre) up at the 42° elevation level and the other side (behind the pilot) down at 42° below the base of the hemisphere in which flight takes place.

The blue line is a straight path parallel to the ground, requiring tangency points of the lower loops with the upper loops at 12 and 6 - parallel to the ground.

The red line is the Equatorial Meridian line which would correctly join both tangency points. This would NOT be a "straight line path" to the pilot, but a shallow upward curve - impossible both for the pilot to perform accurately, and for the Judge to determine as correct.

From outside the hemisphere, all Equatorial Meridians will appear "straight" when your eye is aligned to them. The ONLY E.M.'s available to the pilot are Level Flight and (for half an E.M.) all Wingovers. With this diagram, imagine your view of that red line from the base of the hemisphere - a curving arc.

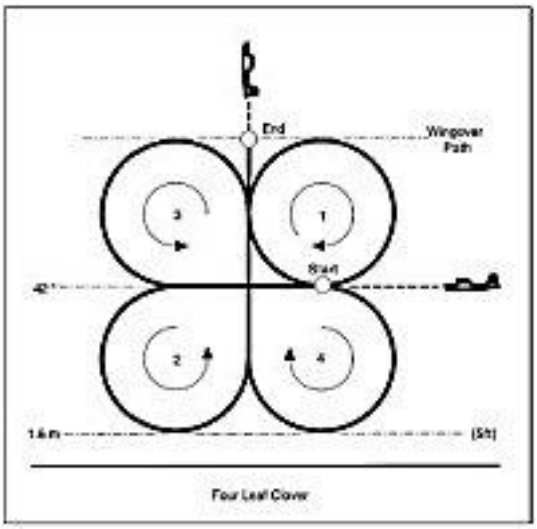
Flying from a 3 o'clock position to a 9 o'clock position, passing through a point of 45° elevation at the 12 o'clock point, is **NOT** a straight line flight path within the hemisphere in which the pilot must fly.

…… continued next page

CLOVERLEAF: (cont.)

4.2.15.16	Manoeuvre size, overall: height 90 degrees line elevation angle; width ¼ lap. Recommended entry procedure: use ¾ of a lap to climb to a height of 42 degrees line elevation angle and maintain this height in upright level flight for 1/8th of a lap.	
	a)	Start of manoeuvre: at the point of entry into the first (inside) loop.
	b)	The first complete (inside) loop figure: "complete loop" (above) means a full circular loop of 360 degrees. The top of this first loop should be tangential to the wing-over path located at 90 degrees to the centre line axis of the whole manoeuvre. The model aircraft should recover into upright level flight at a height of 42 degrees line elevation angle. This loop should be positioned tangentially to an imaginary "vertical" line drawn upwards at right angles from the ground. The lateral position of this line is determined when the model aircraft reaches a "vertical" attitude for the first time and this imaginary line then becomes the lateral reference for the whole manoeuvre.
	j)	End of manoeuvre: at the end of the last "vertical" climb, as the model aircraft passes through a point directly above the centre of the circle.

As the illustration shows, a complete loop is followed by three three-quarter loops.



The roundness of the loops tends to take second place to the straight paths between them, and THE most important factor is the length of those straight paths.

Each joining path is expected, as per 2D geometry, to be the DIAMETER of the loops, and there lies the most common error, especially the first "horizontal straight path" from #1 to #2; which, if too short, places the next "vertical straight path" cutting in to the first loop, sometimes as far into it as climbing through it's centre.

In reality, it needs to be just a whisker longer than the apparent diameter of that first loop.

The second most common error is the climbing Path from #2 to #3, which must be a straight line vertical climb and not a wide curving arc.

Remember that you will "see" distortion of the loop's roundness similar to that of the Vertical Eight when performed off-centre. The further away from centre-opposite-you the imaginary manoeuvre centre line is, the greater the distortion of one half of it is - YET it may be perfectly correct.

Look away the moment the model passes the point above the pilot's head, as that is the end of the JUDGED portion of the manoeuvre and the dive and recovery into Level Flight should not be an influence.

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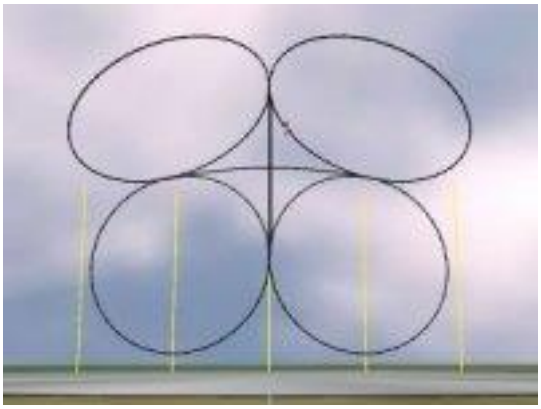
CLOVERLEAF: (cont.)

This illustration shows the Cloverleaf as **YOU** will see it, when performed to the Rule by the pilot, **AND** when placed centred on your position.

Most will recognise the oblique view of the upper loops, therefore expect to see ellipses rather than round loops. The apparent "larger" horizontal diameter of the upper loops is caused by the difference in distance from your position, and **MUST** be recognised as correct. This is basically the same distortion as the upper loop of a Vertical Eight when skewed to the side.

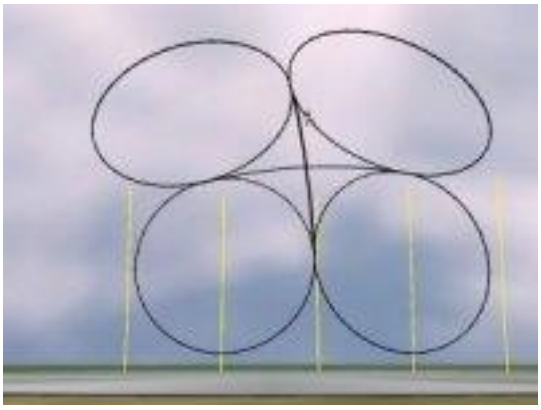
The Rule calls for the horizontal joining path to be "parallel to the ground" - that is the only logical path that the pilot can see, therefore fly. This illustration shows the curving arc, otherwise it wouldn't "join" the loops.



This view is when the pilot performs the Cloverleaf approximately **12°** to **HIS right** of due downwind.

As with the Vertical Eight, the effect is the appearance of a skewed sideways vertical axis of the Eight.

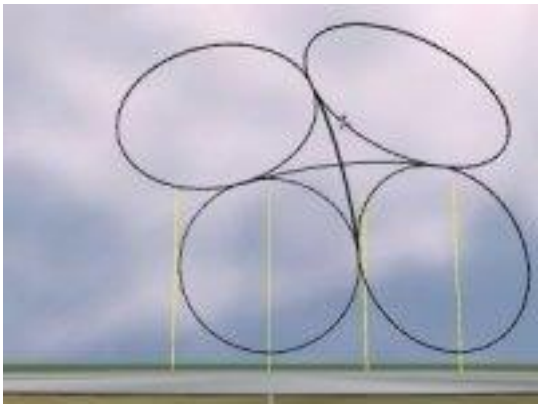
It is only when the manoeuvre is centred opposite your position that **YOU** will see the central axis as vertical. Once again, your task is to "assess" how close to vertical it is when it appears skewed sideways.



This illustration shows This view is when the pilot performs the Cloverleaf **22.5°** to **HIS right** of due downwind.

The distortion is huge, with both the horizontal and vertical components looking anything but horizontal and vertical.

The complexity is in "assessing" the manoeuvre when placed off from directly opposite your position of view - yet the pilot has flown this **EXACTLY** as it is described, and it is displayed here as best as the Simulator program can with the limitation previously mentioned.



LANDING

4.2.15.17	a)	Start of manoeuvre: as the model aircraft leaves a height of 1.5 metres, plus/minus 30 cm, and with the motor/s stopped (gliding flight).
	b)	The descent segment: the model aircraft should fly for 1 full gliding lap (power off condition), measured from the start of the descent at the 1.5 metres plus/minus 30 cm height, until the point of touchdown. The rate of descent should remain constant throughout this whole gliding lap, from the moment that it leaves the 1.5 metres height until the moment that it touches down. The touch down itself should be smooth and either a "2 point" or a "3 point" touch down shall be judged as being equally correct.
	c)	End of manoeuvre: when the model aircraft comes to a complete stop after touching down at the end of the ground roll which is clearly in a forwards direction and in line with its normal flight motion. The length of the ground roll shall not exceed one lap.

A number of points **MUST** be noted:

Regardless of the model's height when the engine stops, **JUDGING** does **NOT** commence until it descends to a height of 1.5 metres, plus/minus 30 cm. Should the engine stop when the model is significantly below that height, then the manoeuvre has not commenced correctly and should be marked accordingly.

It must be noted exactly where in the circle this point is, as the model should "touch down" at that same point - "1 full gliding lap" - later. (A number of prominent pilots find this requirement somewhat stupid, but while it's part of the Rule, it is to be observed and JUDGED accordingly.)

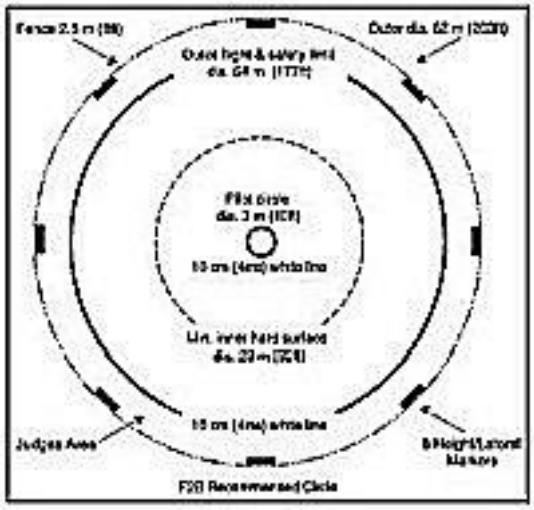
Even on a hard surface, it is unlikely any model will ground roll for more than one lap from touchdown, but it is theoretically possible.

DO NOT take your eyes off the model and check the watch for the 7 minute expiry time - Stop the watch as the model stops rolling **THEN** check it. When the engine stops is not relevant to the overall time permitted.

Note also that it is **ONLY** with this manoeuvre that particular wind conditions **MAY** be taken into account, should the Landing be adversely affected.

CIRCLE MARKERS

Commencing 1st January 2006, the FAI Sporting Code "recommends" "circle markers. Of course, this recommendation applies primarily to World Championship and World Cup events, and may be adopted by the organisers of any competition when they are adhering strictly to FAI Rules.



At right is the FAI diagram for the dimensions and placement.

It has been said that these markers "are for the guidance of the judges, in that they provide an indication of the width of the 1/8th lap."

It has been said that these markers "are not necessarily for the judges to use when determining the width of the pilot's manoeuvre."

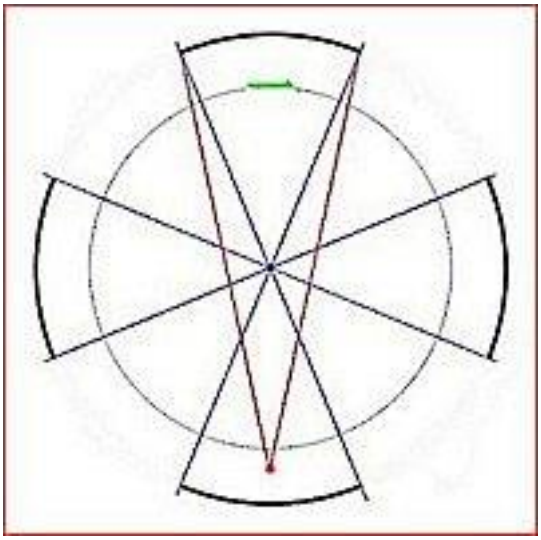
It has also been said that "these markers are not there for the purpose of directing the pilot precisely where to position his manoeuvres."

What is their purpose if not to "assist" the judges in their assessment of 45° horizontal arc/ 1/8th lap?

No matter how much a judge may try to ignore them, he could not avoid being influenced in his judgment of the manoeuvre's width relative to them.

Herein lays the major problem.

At right is the distance between these markers illustrated as 1/8th (45°) segments of the circle. These arcs represent that portion of the outer fence between two marker signs.



The **green** model represents the pilot's flight circle

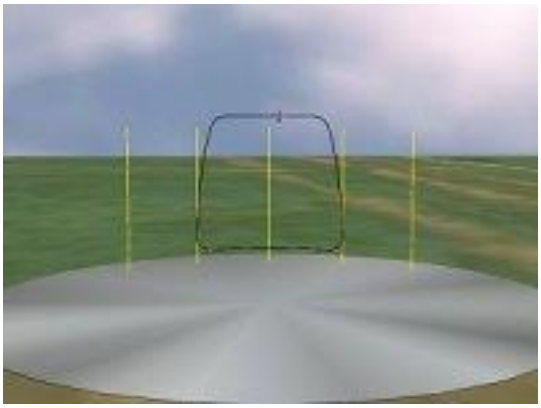
The **blue** lines are the pilot's alignment of each segment - 45° of arc is exactly the same to him regardless of the diameter of the circle on which these markers are placed.

The **red** lines are the judge's alignment of each segment, viewed from his position on the opposite side of the circumference.

In this view, the judge is exactly opposite the centre of the manoeuvre. As can clearly be seen, his "vision" of the 45° of arc width differs markedly from the pilot's, in that if the pilot places his manoeuvres according to them, they will appear to the judge as smaller than the required width.

While this may seem insignificant, consider also that a height comparable to the width will determine the overall size of the manoeuvre to the judge's eye.

At right is the view from Keith Renecle's program, with the camera position elevated to the 45° line and a little behind where the Judge would be standing.



The marker poles are **O**N the same circumference as the model in flight.

The pilot's view, as per the blue lines in the above diagram, is of each vertical side being **IN LINE** with each pole, and the judge's view, as per the red lines, will be the same.

Both views are of the same portion of the same circle.

As seen by the judge, it is exact.

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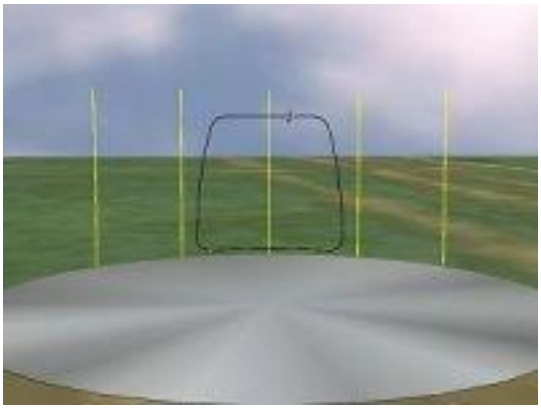
CIRCLE MARKERS (cont.)

At right is the same view, but with the marker poles moved **OUT** to the edge of the concrete circle - on the circumference of a larger circle.

The apparent "width" of the Loop, as seen by the pilot, would still be the same - his line of vision is "radial" from the centre of the circle.

As seen by the judge, the Loop is considerably smaller, and if he (the judge) is not aware that parallax is causing this difference, a reduced mark would be awarded yet not deserved.



At right is the same view, but shifted **22.5°** to **HIS** left - that is, the pilot performs the manoeuvres to the left of directly opposite the judge's position.

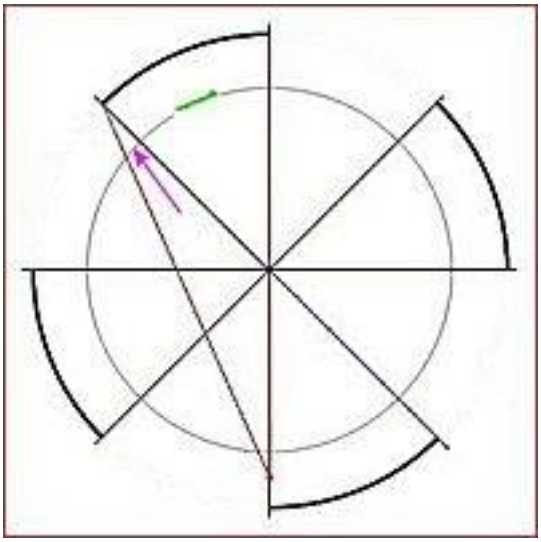
Both pilot and judge now have the same alignment for the right side, but the difference on the left now appears substantial, as indicated by the **magenta-coloured arrow**. In effect, it is the total of the differences on each side in the previous view.

This makes for a significant "error" in the mark the judge is likely to award, when in fact the pilot has adhered to the 45° width exactly.

Added to the obvious problem illustrated here are two other factors:

1) The larger the diameter of the fence, the greater the error; and

2) The shorter the pilot's lines, the smaller his flight circle in relation to the fence diameter, hence the greater the error to the judge's eye.



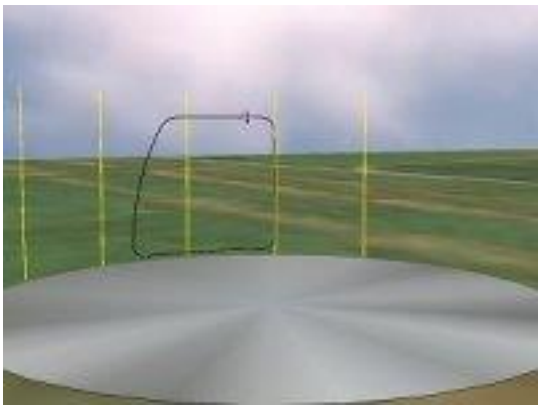
These markers are NOT in the best interests of either pilots or judges, as they will lead to -

1) the pilot being penalised for errors he hasn't made; and

2) the judges being misled into awarding lower marks than are deserved.

With the marker poles on the circumference of a larger circle, the pilot has performed the manoeuvre **22.5°** to **HIS** left of due downwind, resulting in your position being to the left of ideal.

When the poles are **BEHIND** the Flight Circle path, as the Circle Markers would be when attached to a fence, this parallax error - the **magenta arrow** in the diagram above - becomes a real problem for both pilots and judges, as the manoeuvre is still the same width.



The question must be asked - "Why was such a concept even considered?