

2017-2018
Senior Pattern Association

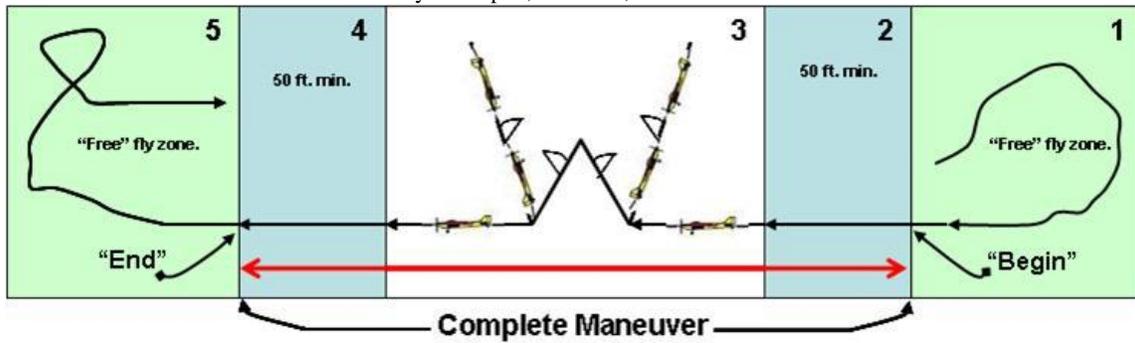


Section III
Maneuver Descriptions

NOTE: MANEUVER DESCRIPTIONS THAT FOLLOW ARE TAKEN *VERBATIM* FROM THE APPROPRIATE AMA RULE BOOKS FROM WHICH THE MANEUVERS WERE TAKEN. THE ONE EXCEPTION IS FOR THE SQUARE HORIZONTAL EIGHT, FOR WHICH EVERY APPEARANCE IN THE AMA RULE BOOK ENDED AS AN INCOMPLETE DESCRIPTION. THE SPA BOARD HAS CREATED WHAT WE THINK WOULD BE THE APPROPRIATE ENDING, WHICH IS SHOWN ON PAGE 34 *IN ITALICS*.

Anatomy of an SPA Maneuver

by Phil Spelt, SPA 177, AMA 1294



SPA pilots are flying what is called "Precision Aerobatics," in the official AMA publications" -- the old-time way (pre turnaround). The emphasis in that name is on the word "Precision." That means pilots are supposed to display precise control of their aircraft in front of the judges. This precision should, ideally, be shown from the moment the plane is placed on the runway until it stops at the end of the landing rollout. Technically, the judges are only supposed to "judge" during the actual maneuvers, but they will notice either wild or tame turnarounds – whether deliberately or accidentally.

An SPA maneuver consists of five sections, which can be viewed as an onion sliced through the middle vertically – so there are 2 pairs of layers, or parts, surrounding the actual maneuver in the center, as illustrated. The outer pair (sections 1 and 5) comprises the "free flight" area, which is used to turn the aircraft around and get it lined up to enter the next maneuver. Most pilots use a Split-S maneuver for the turnaround, thus maintaining the track of the plane at the distance from the runway at which the maneuvers are performed. This aids in keeping a proper tracking for the upcoming maneuver. The last part of the turnaround portion is the name of the upcoming maneuver. The illustration above shows the infamous "Figure W with snap rolls in all 5 quadrants" – with a tip of the hat to our friend Sid Austin. The name of the maneuver should be called loud and soon enough to let the judges know what is coming next. This really helps judging, so they don't have to look down at the score sheet to see what is next.

Sections 2 and 4 are almost as important as the maneuver itself. These are the required 50-foot minimum straight and level flight entering and exiting the maneuver, and are the parts that most often either are omitted entirely or are highly truncated. ALL airborne maneuvers require 50 feet of straight and level flight as a minimum, after the pilot has called "Begin" for the start of the maneuver, and before he calls "End" to complete it. The speed of our planes means that 50 feet is about 0.5 to 1 second of straight and level flight. Therefore, it is probably better to extend this segment to between 2 and 3 seconds, to present better to the judges. Many pilots think "Oh, 'straight and level', of course I can do that..." However, many (most?) really need to practice that aspect of flying, once the plane has been properly set up to fly hands off straight and level with no wind.

One other point to be made is the "balance" of the whole maneuver around the center line. Ideally, the absolute center of the maneuver is right on the center line in front of the judges. In order to keep the maneuver balanced, the straight and level segments must be of equal length – if the beginning leg is, say, 67 feet, so the ending leg should also be 67 feet. In other words, a lengthy entry leg should be balanced by an equally lengthy exit leg.

2017-2018 Maneuver Listing for each Class:

SPA Novice	K
1. Takeoff (U)	1
2. Straight Flight Out (U)	1
3. Procedure Turn	2
4. Straight Flight Back (D)	1
5. Stall Turn (U)	2
6. Immelmann Turn (U)	2
7. 2 Inside Loops (U)	2
8. 2 Horizontal Rolls (D)	2
9. Reverse Cuban 8 (U)	2
10. Straight Inverted Flight (D)	2
11. Landing Perfection (U)	1

SPA Sportsman	K
1. Takeoff (U)	1
2. Double Stall Turn (U)	3
3. 3 Horizontal Rolls (D)	2
4. Double Immelmann (U)	2
5. Slow Roll (D)	3
6. 3 Inside Loops (U)	2
7. 180 Degree Turn (D)	3
8. Cobra Roll with 1/2 Rolls (D)	2
9. 1 Reverse Outside Loop (U)	2
10. Cuban 8 (D)	2
11. 3 Turn Spin (U)	2
12. Landing Perfection (U)	1

SPA Expert	K
1. Takeoff (U)	1
2. Figure M with 1/4 Rolls (U)	5
3. 3 Outside Loops/Fr Top (D)	3
4. Cobra Roll/Full Rolls (U)	3
5. Reverse Knife Edge(D)	4
6. Reverse Double Immelmann (U)	2
7. 4 Point Roll (D)	4
8. Square Horizontal 8 (U)	5
9. 8 Point Roll (D)	4
10. Square Loop with 1/2 Rolls (U)	5
11. 180 Degree Turn (D)	3
12. Triangle Rolling Loop (D)	4
13. 3 Turn Spin (U)	2
14. Landing Perfection (U)	1

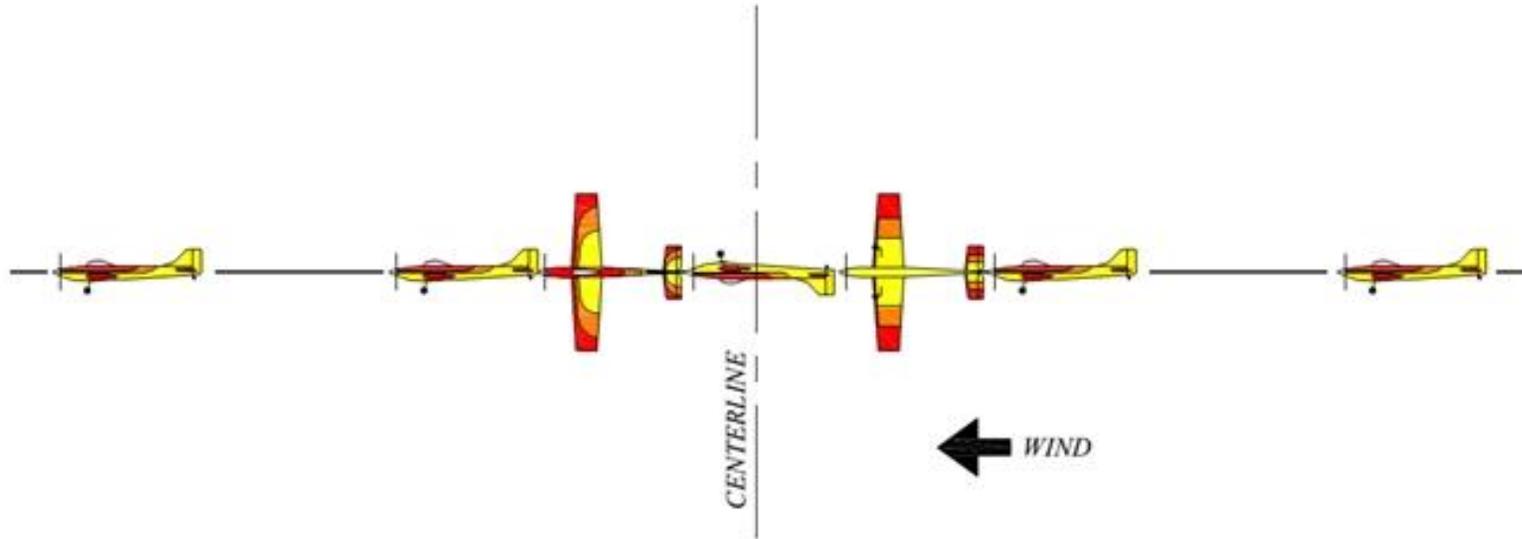
SPA Advanced	K
1. Takeoff (U)	1
2. Figure M (U)	4
3. 3 Horizontal Rolls (D)	2
4. Reverse Double Immelmann (U)	2
5. Slow Roll (D)	3
6. Square Loop/No Rolls (U)	3
7. 4 Point Roll (D)	4
8. Top Hat (U)	4
9. 3 Outside Loops/Fr Top (D)	3
10. Cobra Roll/Full Rolls (U)	3
11. Triangle Rolling Loop (D)	4
12. 3 Turn Spin (U)	2
13. Landing Perfection (U)	1

Maneuvers Index for the 2017-18 Cycle

1 Horizontal Roll (D)	1	8 Point Roll (D)	16	Reverse Cuban 8 (D)	28
1 Inside Loop (U)	2	Cobra Roll w/Full Rolls (D)	17	Reverse Dbl Immelmann (D)	29
1 Reverse Outside Loop (U)	3	Cobra Roll with 1/2 Rolls (D)	18	Reverse Knife Edge (D)	30
1/2 Cuban Eight (U)	4	Cuban 8 (U)	19	Slow Roll (D)	31
180 Degree Turn (D)	5&6	Double Immelmann (U)	20	Square Loop (U)	32
2 Horizontal Rolls (D)	7	Double Stall Turn (U)	21	Square Loop - 1/2 Rolls (U)	33
2 Inside Loops (U)	8	Figure M no Rolls (U)	22	Square Horizontal Eight (U)	34
2 Rolls Opposite Directions (D)	9	Figure M With 1/4 Rolls (U)	23	Stall Turn (U)	35
3 Horizontal Rolls (D)	10	Immelmann Turn (U)	24	Straight Flight Back (D)	36
3 Inside Loops (U)	11	Inverted 3-TurnSpin (U)	25	Straight Flight Out (D)	36
3 Outside Loops (D)	12	Inverted Rev Cuban 8 (U)	26	Straight Inverted Flight (D)	37
3 Reverse Outside Loops (U)	13	Landing Perfection (U)	27	Takeoff (U)	38
3 Turn Spin (U)	14	Non-Rolling Fig. M (U)	28	Top Hat (U)	39
4 Point Roll (D)	15	Procedure Turn	36	Triangle Rolling Loop (D)	40
				Vertical 8 (U)	41

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1 HORIZONTAL ROLL.....	1	4 POINT ROLL	15	REVERSE KNIFE EDGE.....	30
1 INSIDE LOOP	2	8 POINT ROLL	16	SLOW ROLL	31
1 REVERSE OUTSIDE LOOP.....	3	COBRA ROLL WITH FULL ROLLS	17	SQUARE LOOP	32
1/2 CUBAN EIGHT	4	COBRA ROLL WITH ½ ROLLS	18	SQUARE LOOP WITH HALF ROLLS	33
180 DEGREE TURN	5	CUBAN EIGHT	19	SQUARE HORIZONTAL EIGHT	34
180-DEG TURN	6	DOUBLE IMMELMAN.....	20	STALL TURN	35
2 HORIZONTAL ROLLS.....	7	DOUBLE STALL TURN:.....	21	STRAIGHT FLIGHT OUT	36
TWO INSIDE LOOPS	8	FIGURE M W/NO ROLLS.....	22	PROCEDURE TURN	36
2 ROLLS IN OPPOSITE DIRECTIONS	9	FIGURE M WITH ¼ ROLLS.....	23	STRAIGHT FLIGHT BACK	36
3 HORIZONTAL ROLLS.....	10	IMMELMANN TURN	24	STRAIGHT INVERTED FLIGHT	37
3 INSIDE LOOPS	11	INVERTED THREE TURN SPIN.....	25	TAKEOFF	38
3 OUTSIDE LOOPS	12	INVERTED REVERSE CUBAN EIGHT	26	TOP HAT.....	39
3 REVERSE OUTSIDE LOOPS.....	13	LANDING PERFECTION	27	TRIANGLE ROLLING LOOP	40
3 TURN SPIN	14	REVERSE CUBAN EIGHT	28	VERTICAL EIGHT	41
		REVERSE DOUBLE IMMELMANN	29		

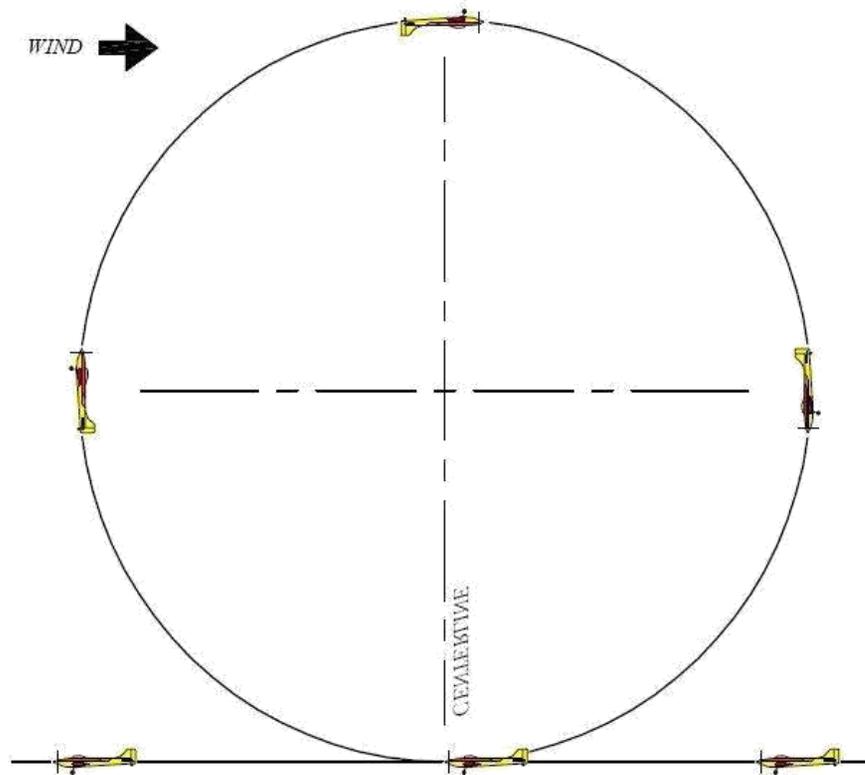


1 HORIZONTAL ROLL: Model rolls at a uniform rate through one (1) complete revolution in either direction. Center is inverted portion of maneuver.

Downgrades:

1. Changes in heading during roll
2. Changes in altitude during roll
3. Roll rate not constant
4. Model does not perform exactly one roll

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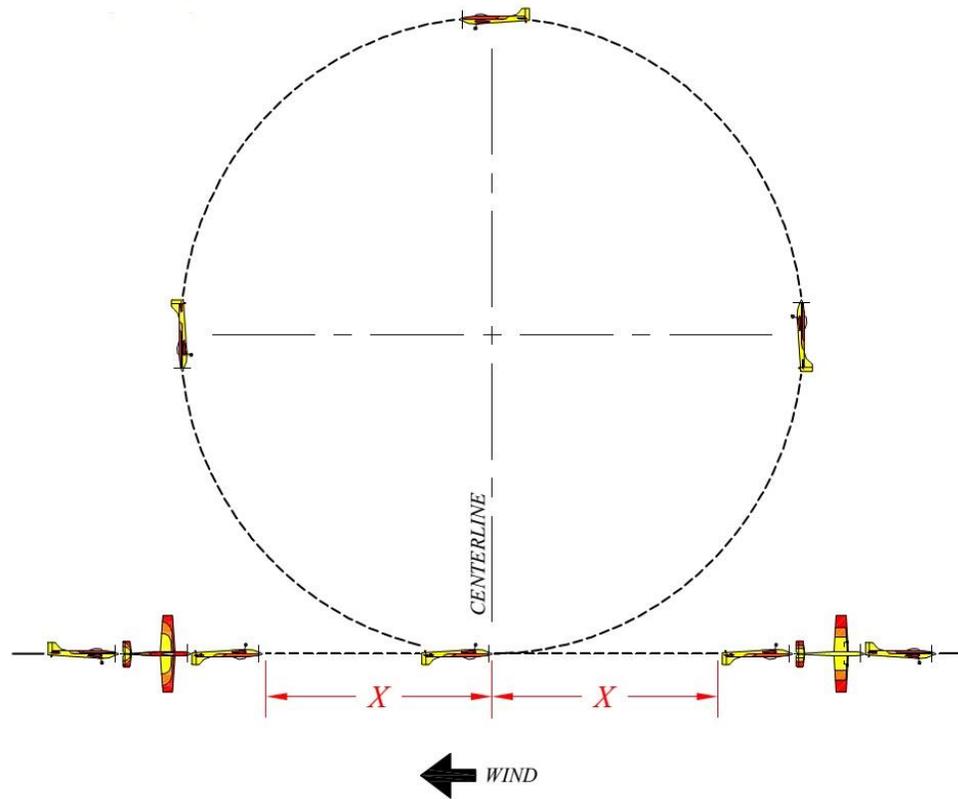


1 INSIDE LOOP: The model starts the maneuver flying straight and level, and then pulls up into a smooth, round loop with a straight and level recovery finish.

Downgrades:

1. Loop not round and smooth
2. Wings not level during loop
3. Changes in heading during loop
4. Exit not same heading and altitude as entry

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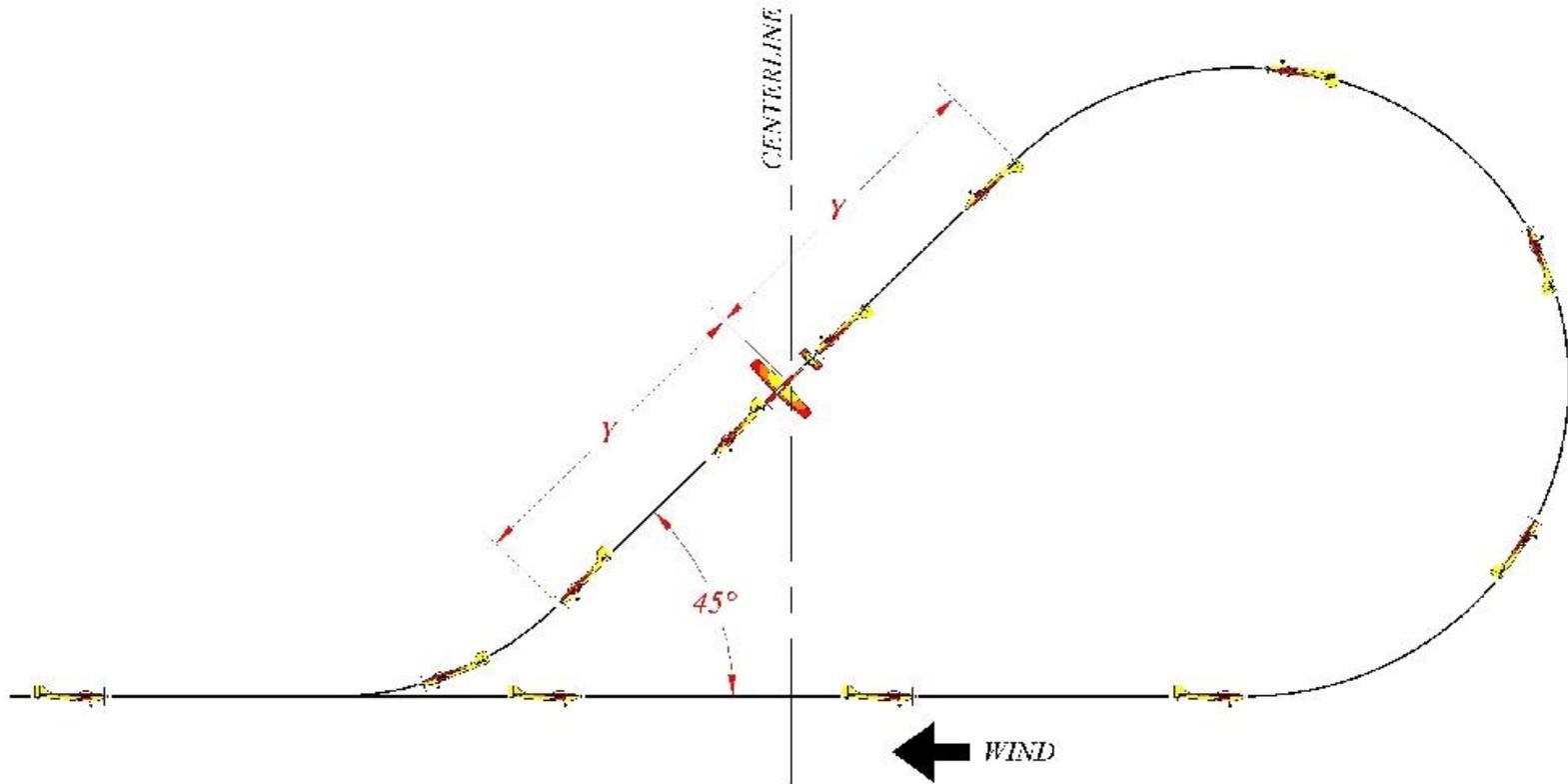


1 REVERSE OUTSIDE LOOP: Model half rolls to inverted, pauses for greater than one (1) second and pushes up to execute an outside loop, pauses for greater than one (1) second then half rolls to level flight.

Downgrades:

- 1 Loop not round
- 2 Changes in heading during loop and rolls
- 3 Wings not level during loop
- 4 Model pauses less than one (1) second before and after loops
- 5 Pauses of level flight not equal

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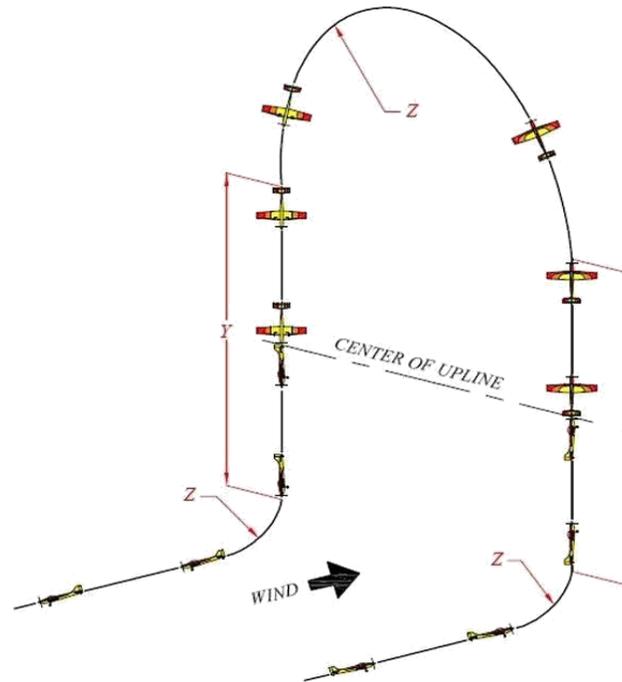


1/2 CUBAN EIGHT: Model flies past center and executes five-eighths (5/8) inside loop to 45 degrees down, hesitates, does one-half (1/2) roll, hesitates, then performs one-eighth (1/8) inside loop back to level flight in opposite direction as entry.

Downgrades:

1. Loop segments not round with the same size and radius
2. Model not at 45 degrees before and after half roll
3. Changes in heading in loop segments or after half roll
4. Half roll not centered in 45 degree line
5. No hesitations before or after half roll

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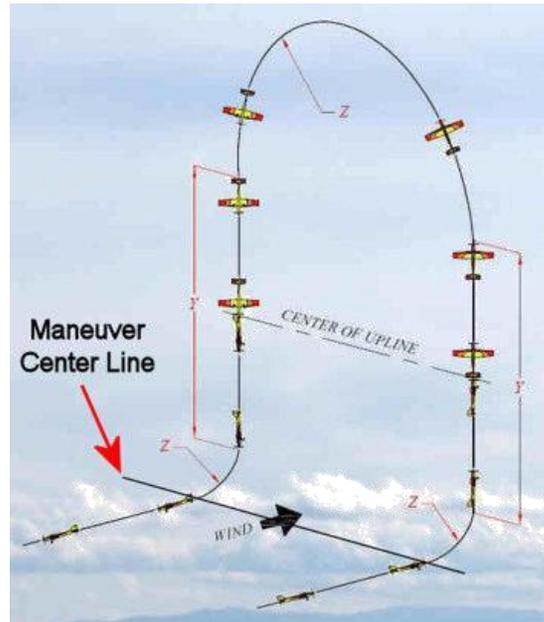


180 DEGREE TURN: The plane starts in straight and level flight, pulls up into a vertical climb, rolls 90 degrees, performs half of an outside loop, rolls 90 degrees in the opposite direction to the first quarter roll and pulls out at the same altitude but with a 180 degree heading change.

Downgrades:

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Entry not straight and level 3. Roll is more or less than 90 degrees 5. Half outside loop deviates left or right 7. Second 90 degree roll path is not straight vertical line 9. Pull out is not to same altitude and 180 degrees opposite heading to entry | <ol style="list-style-type: none"> 2. Pull up is not to exact vertical climb 4. Path of roll is not straight vertical line 6. Half hoop is not smooth and round 8. Pull out to level flight is sudden or jerky 10. Plane fails to perform straight and level flight at end of maneuver |
|---|---|

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180-deg Turn, added March 23, 2009

The original picture was not quite correct. The bottom radii shown are not the same size as the one across the top. The radius of the three areas marked (Z) should be the same. For example, if you pull up sharply, the 1/2 outside loop and the exit radius should be the same.

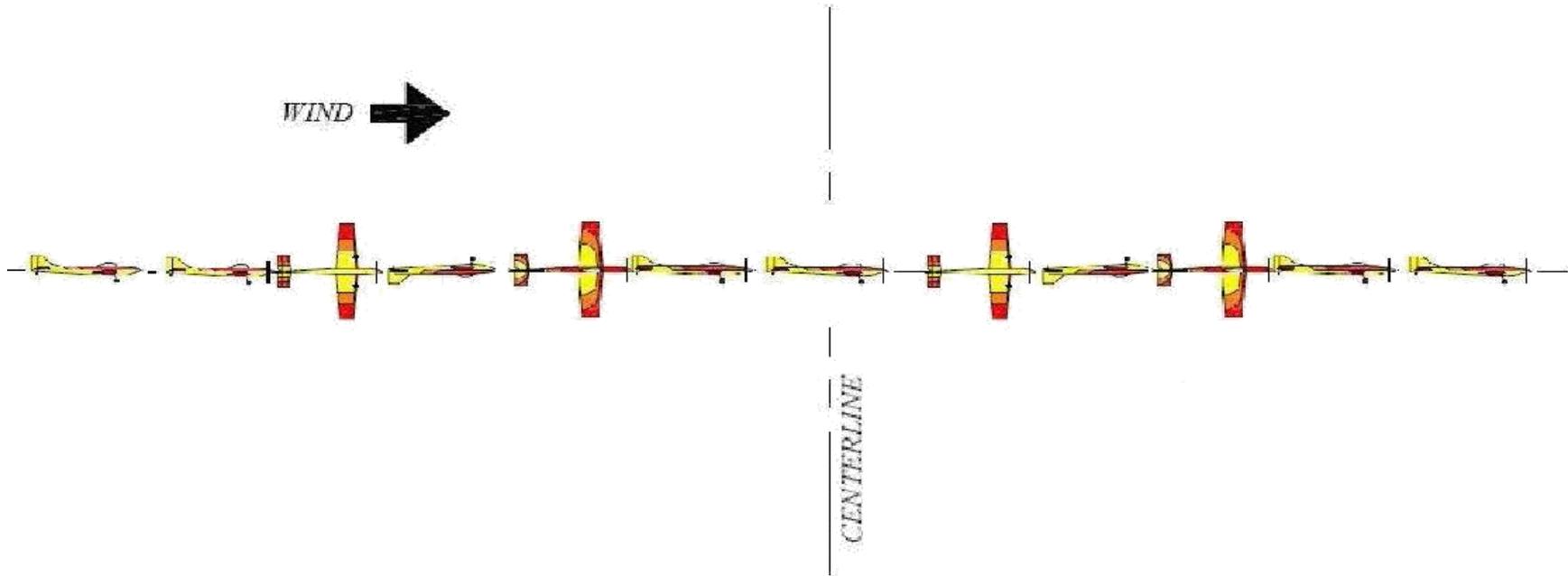
Downgrades for the radius:

You have three radii to fly, the entry, the 1/2 outside loop and the exit. Depending on the severity of the difference between the three, the downgrades should be from 1/2 point to 2 points per incident.

If the first one is a smooth 1/4 loop taking 100 feet, the 1/2 outside loop takes 200 feet and is smooth, these two would be pretty much identical so no down grade here. If the exit 1/4 loop is squared off, and only takes say, 40 feet, the down grade would be 2 points, it were such that it took 75 feet then the down grade would be 1/2 point. This is a judgment call as you view the maneuver. Please note **on the vertical 1/4 roll** in the two areas marked (Y), there is **NO vertical straight line**. The roll starts as soon as the plane is vertical and the 1/2 outside loop starts as soon as the 1/4 roll is complete. Likewise the down line 1/4 roll starts as soon as the plane is vertical

The center of the maneuver is located where the model starts the first 1/4 loop. See the picture.

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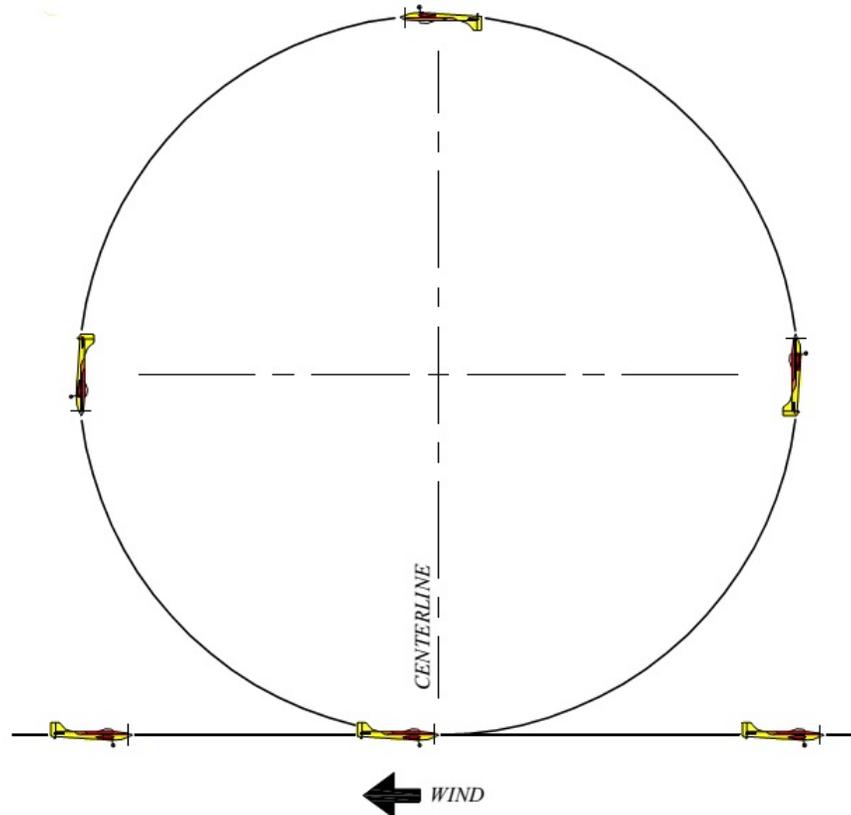


2 HORIZONTAL ROLLS: Model rolls at a uniform rate through two (2) complete revolutions in either direction. Center is upright portion of maneuver between two rolls.

Downgrades:

1. Changes in heading during rolls
2. Changes in altitude during rolls
3. Roll rate not constant
4. Model does not perform exactly two rolls

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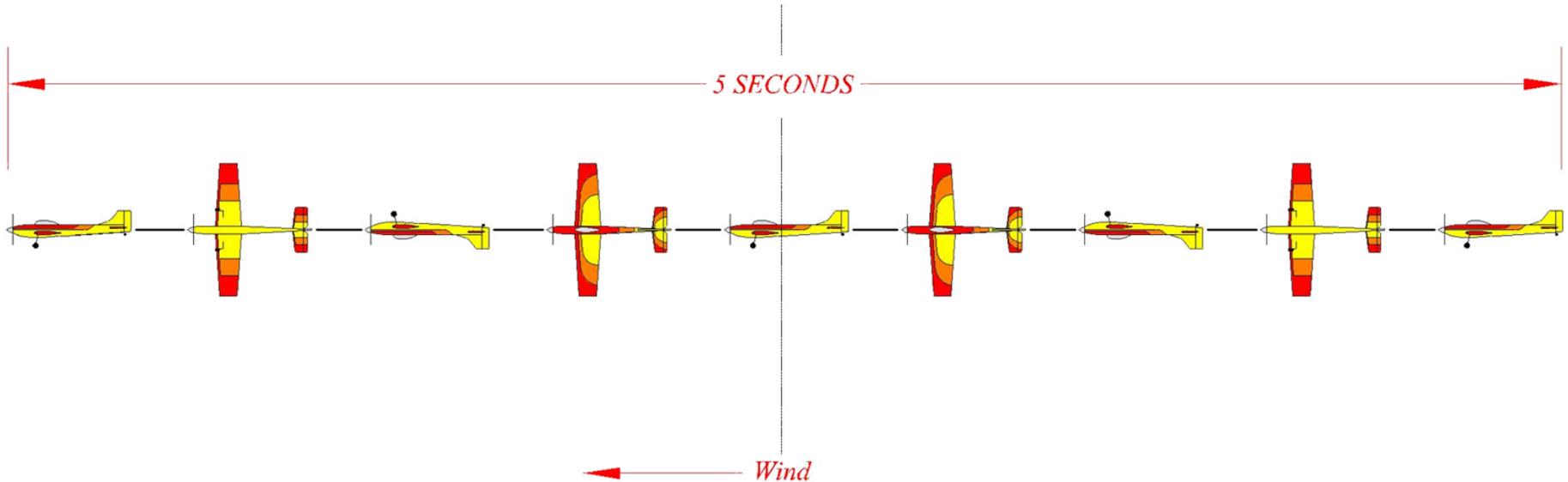


TWO INSIDE LOOPS: The model starts the maneuver flying straight and level, then pulls up into a smooth, round loop, followed by a second loop with a straight and level recovery finish.

Downgrades:

1. Loops not round and smooth.
2. Loops not superimposed.
3. Wings not level during loops.
4. Changes in heading during loops.
5. Exit not same heading and altitude as entry.

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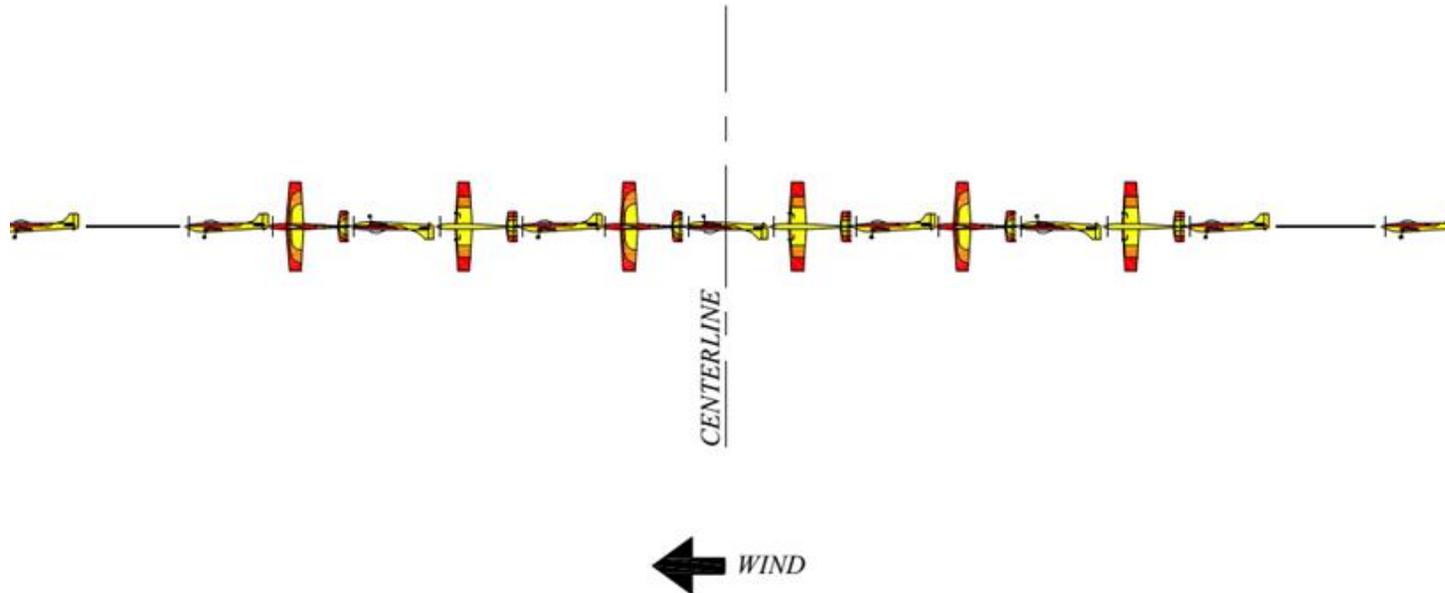


2 Rolls in Opposite Directions: Model rolls 360 degrees in either direction, then immediately after rolls 360 degrees in the opposite direction, rolls to take approximately five seconds.

Downgrades:

1. Changes in heading.
2. Changes in altitude.
3. Roll rate not constant.
4. Rolls not exactly 360 degrees.
5. Second roll does not start immediately after first roll.
6. Rolls take less than 4 or more than 6 seconds.

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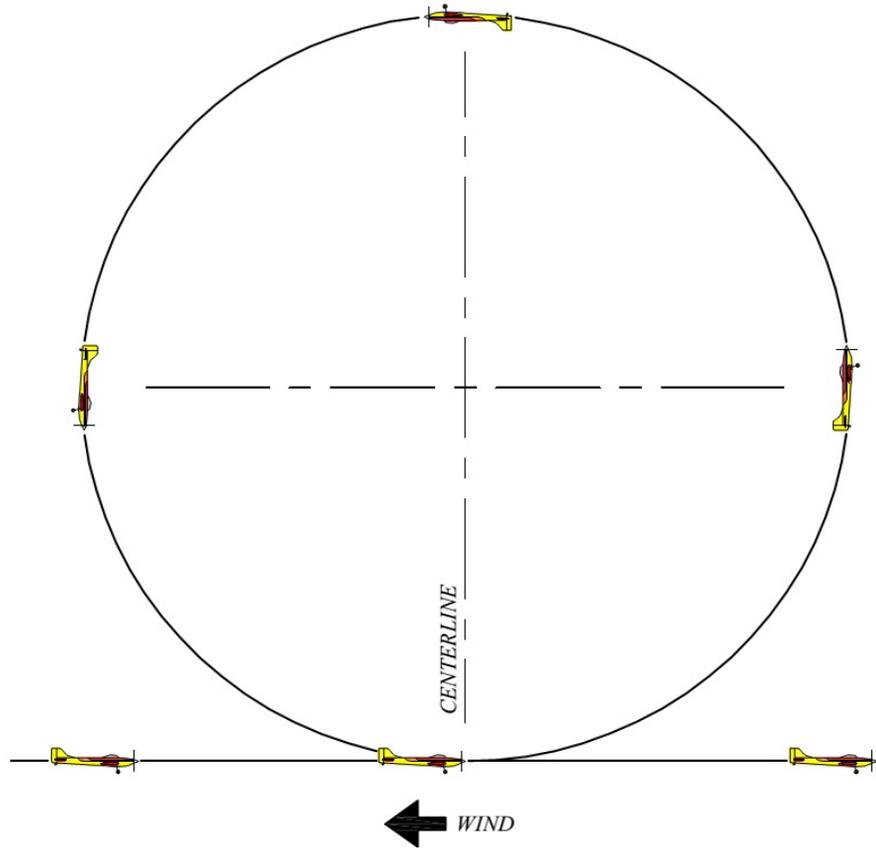


3 HORIZONTAL ROLLS: The model enters from a straight and level flight and rolls on its axis to the right or left until three complete rolls are performed. The recovery must be on the same heading and altitude as the entry.

Downgrades:

1. Model not level at the start of the rolls
2. The path traced out by the model is not a straight line, i.e. the plane does barrel rolls or suffers changes in heading
3. Roll rate not uniform throughout three rolls
4. Pause between rolls
5. Sudden changes in heading between rolls
6. The axis of the fuselage veers out at an angle to the flight path
7. Plane changes altitude during rolls
8. Plane does not do exactly three rolls
9. Plane is not level at end of rolls
10. Plane fails to do level flight at end of rolls

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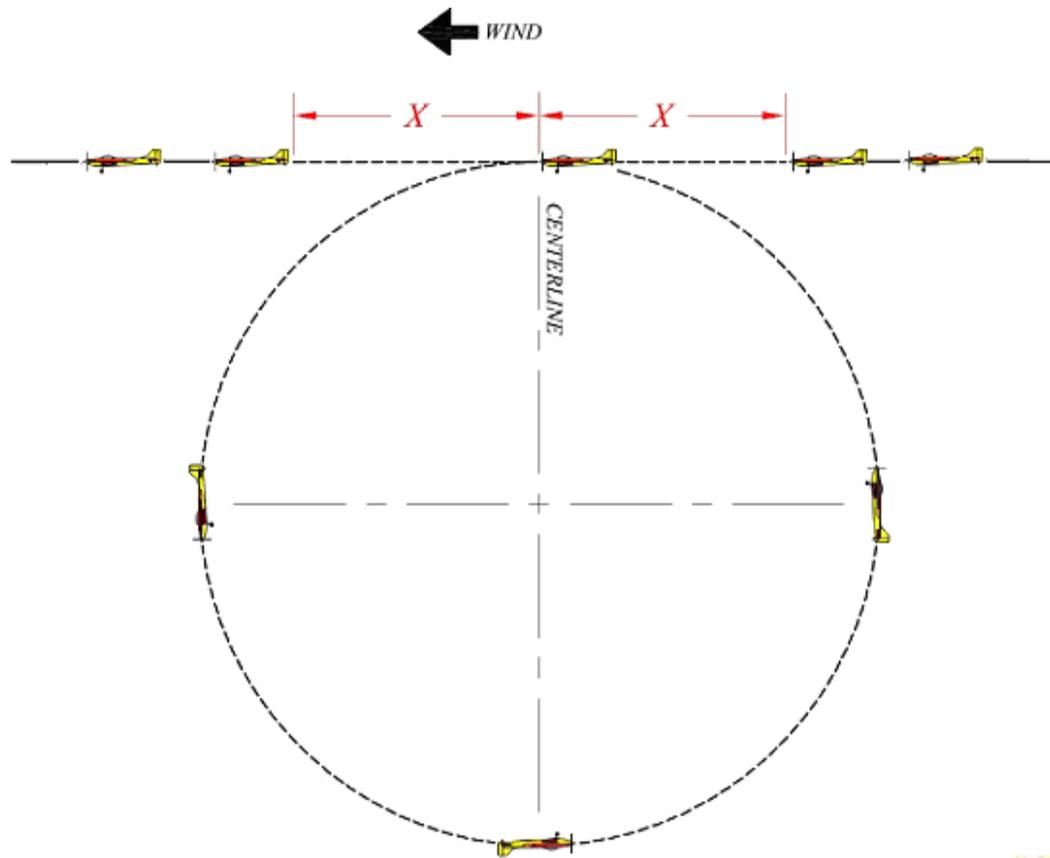


3 INSIDE LOOPS: The model starts the maneuver flying straight and level, then pulls up into a smooth, round loop, followed by a second loop, and a third loop in exactly the same path with a straight and level recovery finish.

Downgrades:

1. Loops not round and smooth
2. Loops not superimposed
3. Wings not level during loops
4. Changes in heading during loops
5. Exit not same heading and altitude as entry

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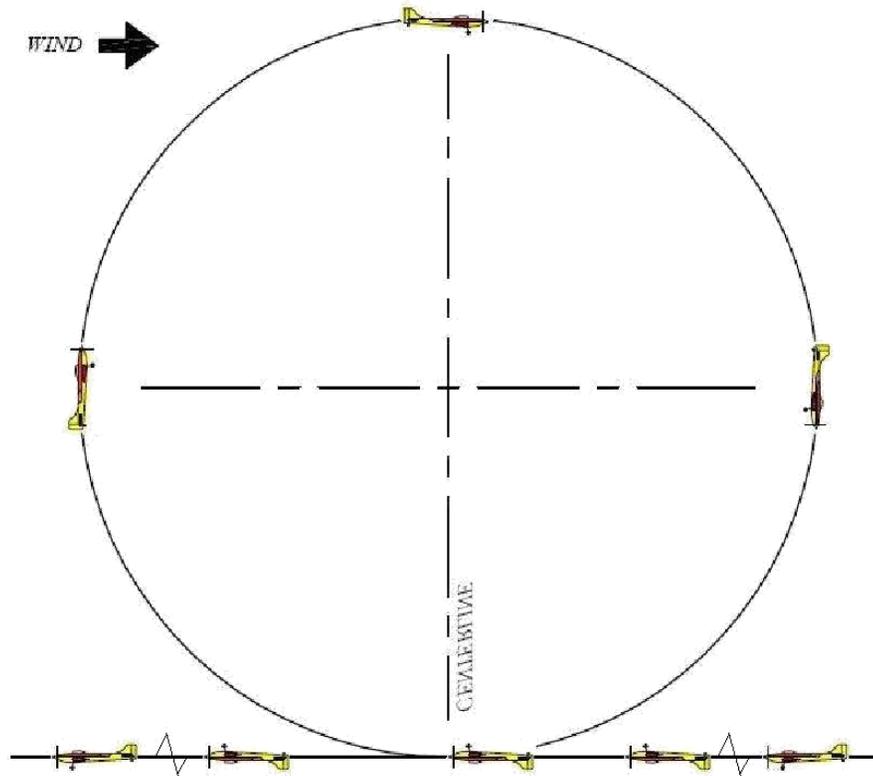


3 OUTSIDE LOOPS: Model pushes over and executes three consecutive outside loops. All loops should be round and superimposed.

Downgrades:

1. Loops not round and smooth.
2. Loops not superimposed.
3. Wings not level during loops.
4. Changes in heading during loops

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3 REVERSE OUTSIDE LOOPS: Model half rolls to inverted, pauses for greater than one (1) second and pushes up to execute an outside loop, performs 2 more outside loops on the same track as the first, pauses for greater than one (1) second then half rolls to level flight.

Downgrades:

1. Loops not round
2. Changes in heading during loops and rolls
3. Wings not level during loops
4. Model pauses less than one (1) second before and after loops
5. Pauses of level flight not equal
6. Exit not same altitude and heading as entry

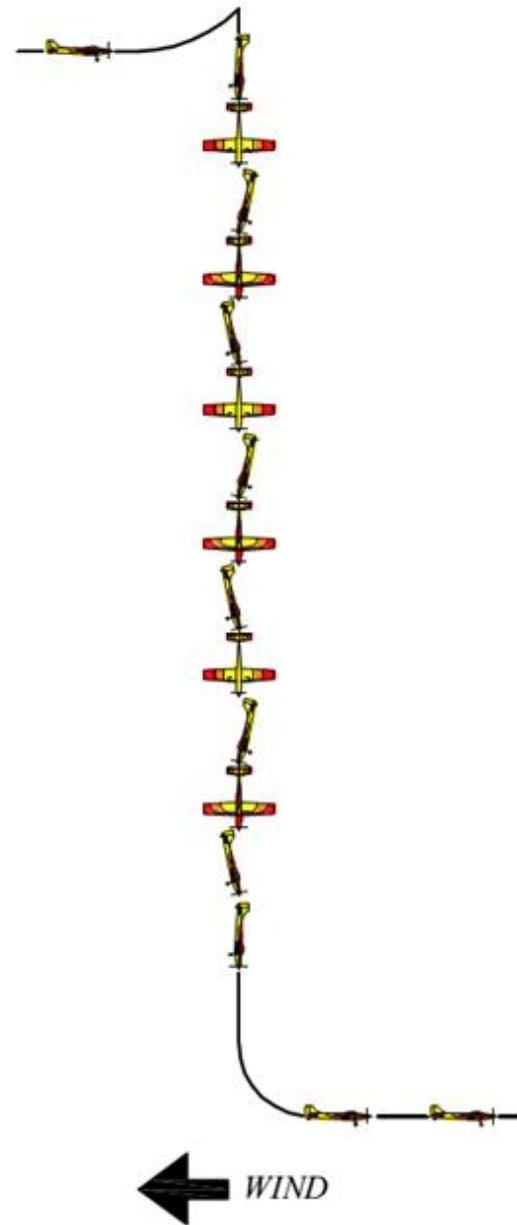
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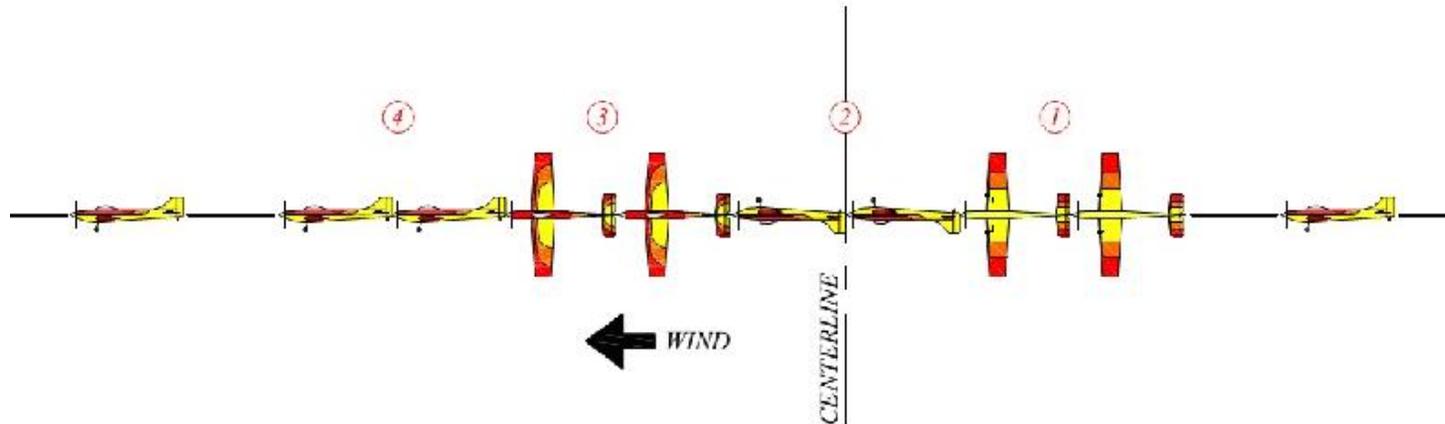
3 TURN SPIN: The plane establishes a heading by flying straight and level, pulls up into a stall and commences the spin through one, two, three turns and recovers to level flight on the same heading as the initial flight direction. The judge must watch carefully to be sure this is a spin and not a vertical roll or spiral dive in the spin, some part of the plane always intersects an imaginary vertical line along the path of descent. In the spiral dive, the plane circles round, but outside of, the imaginary vertical line.

Downgrades:

1. Initial heading not level
2. Commencement of first spin is sloppy or uncertain
3. Does not do exactly three turns. Less than two or more than four turns shall be scored zero
4. Does not recover on same heading as initial heading
5. If any of the three turns are spiral dives rather than spins, the score is zero
6. Rate of rotation in spin is excessively rapid
7. Does not finish level
8. Does not fly straight and level for 50 feet

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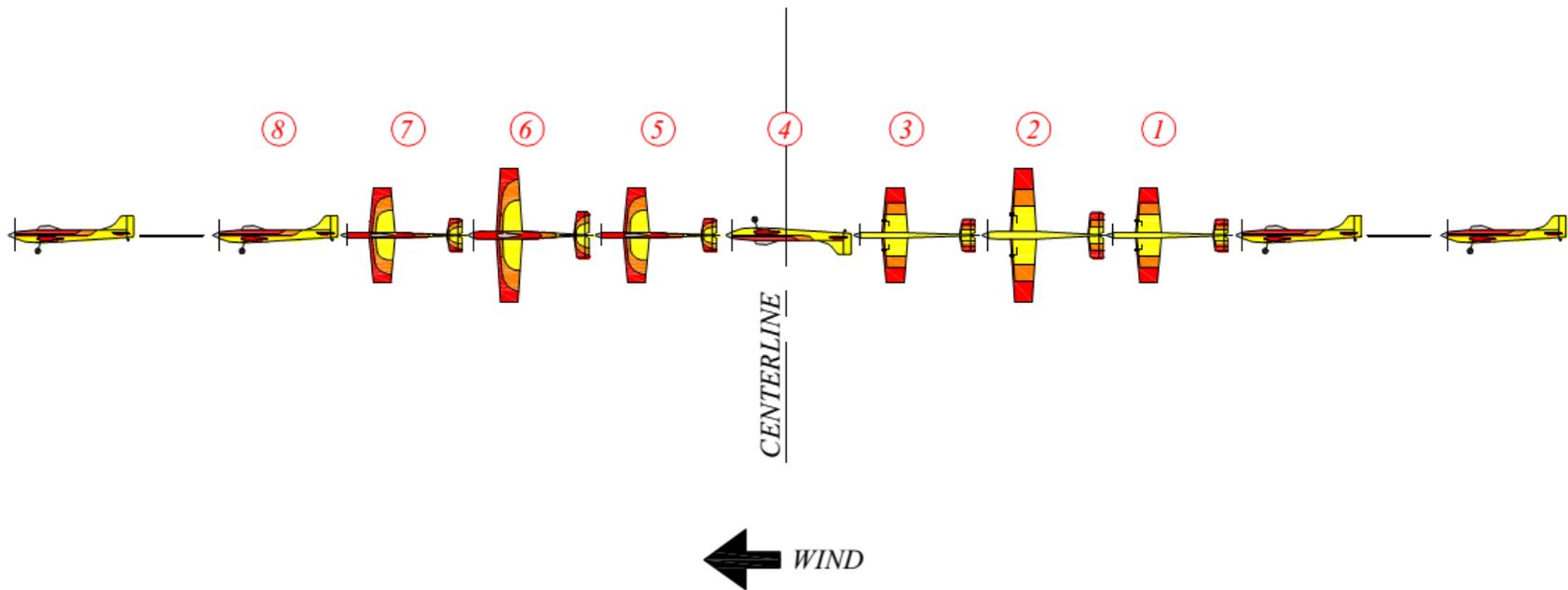


4 POINT ROLL: From a straight and level flight path, the model is rolled 90 degrees and holds this attitude, with the wings in a vertical position, long enough for it to be clearly defined. The model is then rolled another 90 degrees, in the same direction of rotation and holds the inverted attitude long enough for it to be clearly defined. This is followed by another 90 degree roll in the same direction, bringing the ship to another knife edge position. Following a similar pause in the roll, the ship finally rolls another 90 degrees to upright and level flight.

Downgrades:

1. Model not level at start of roll
2. The path traced by the model is not a straight line. (The plane does barrel roll segments or suffers changes in heading.)
3. Sudden correction in heading between roll segments.
4. Plane changes altitude during roll
5. Plane does not pause long enough between each segment of roll
6. Wings are not exactly vertical at 1/4 and 3/4 positions
7. Plane fails to do level flight at end of roll.

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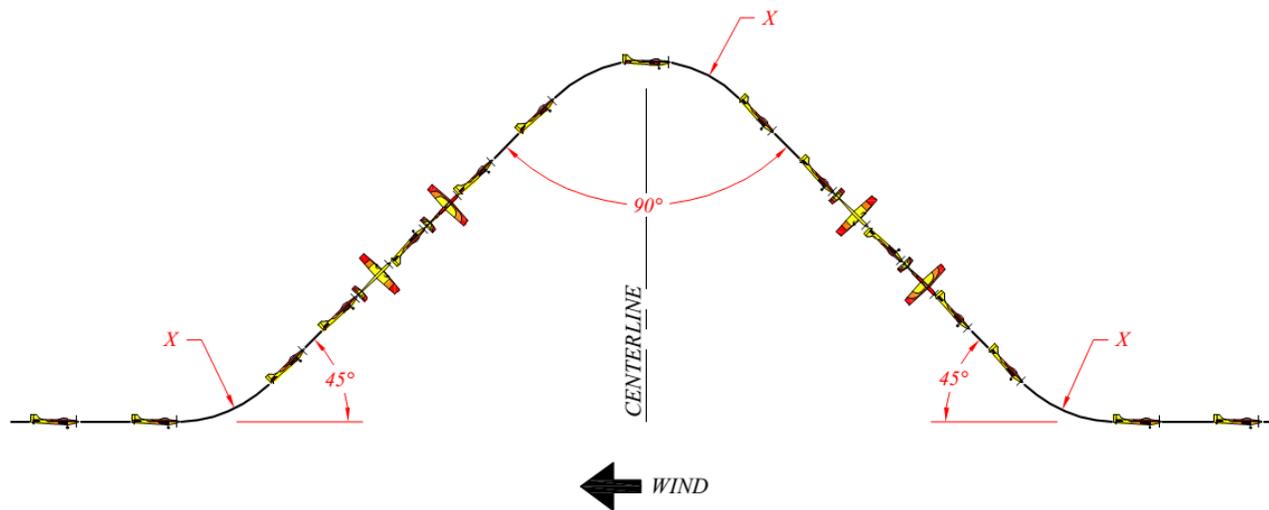


8 POINT ROLL: Model starts in level flight then rolls one complete rotation hesitating at each 1/8 revolution. Each 1/8 roll to be forty-five degrees at each hesitation. The wing will be parallel with 45 or 90 degrees to the horizon. Model recovers on same heading and altitude as entry.

Downgrades:

1. Model not level at start
2. Model does not hesitate after each 1/8 roll
3. 1/8 rolls more or less than 45 degrees
4. Model takes less than 4 or more than 6 seconds to complete roll
5. Time in each segment is not equal
6. Model not level at finish of maneuver
7. Model does not finish on same heading and altitude as entry

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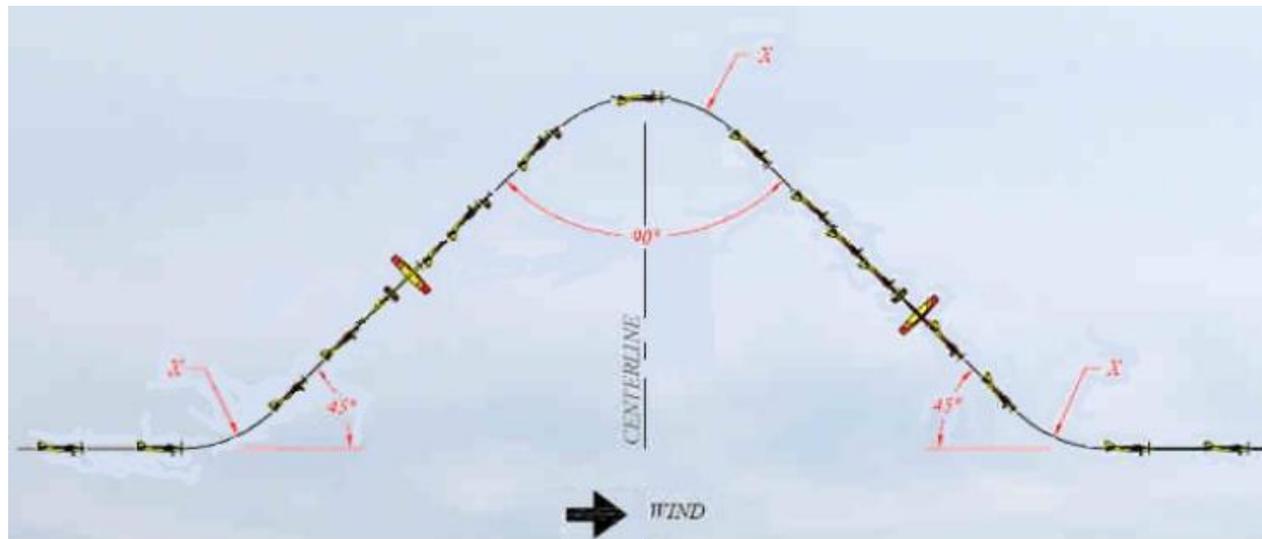


COBRA ROLL WITH FULL ROLLS: From upright, straight and level flight, the plane pulls up into a 45 degree climb, performs one complete roll at a moderate rate, continues the 45 degree climb for a moment, goes over the top in what amounts to one-fourth of an outside loop and heads down at a 45 degree angle. Another complete roll, equal in length and time to the first, is performed, and finally, the plane pulls out at the same altitude and heading as the beginning.

The maneuver may be downgraded for the following reasons:

1. Entry is not straight and level.
2. Climb is not at 45 degree angle to ground.
3. Roll path traced out by model is not a straight line (i.e., plane barrel rolls or suffers change in heading) continuing in 45 degree climb.
4. No momentary straight line between first roll and $\frac{1}{4}$ loop or between $\frac{1}{4}$ loop and second roll.
5. Flight path coming down is not at 45 degree angle to ground.
6. Second roll is not at same rate as first.
7. Roll path of second roll is not as described for first roll.
8. Pull out to level flight is not at same altitude and heading as entry.

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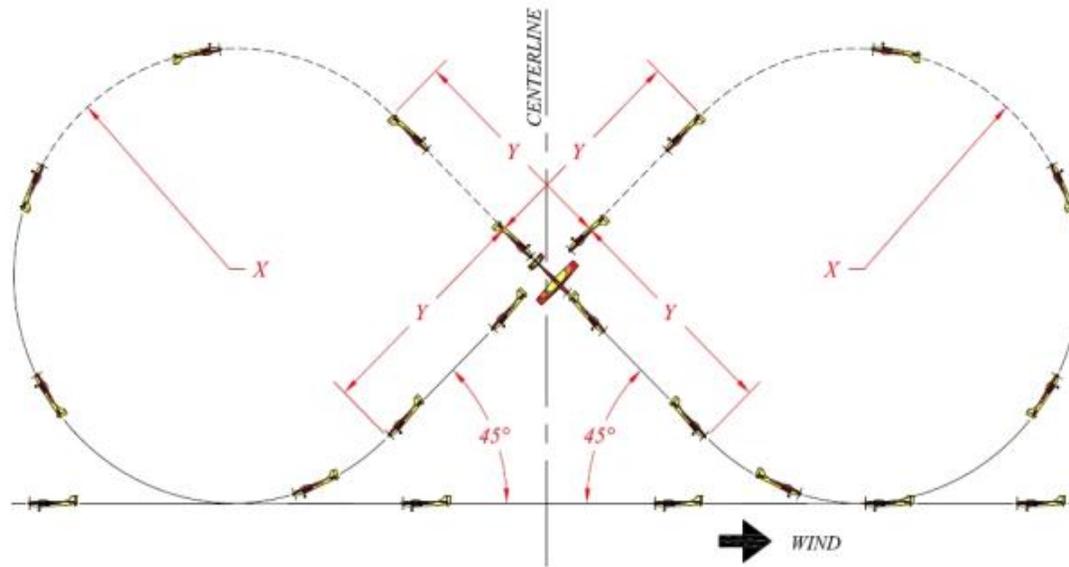


COBRA ROLL WITH ½ ROLLS: From upright straight and level flight, the plane pulls up into a 45 degree climb, performs one half roll at a moderate rate, continues the 45 degree climb for a moment, goes over the top in what amounts to one-fourth of an inside loop and heads down at a 45 degree angle. Another one half roll, equal in length and time to the first, is performed, and finally, the plane pulls out at the same altitude and heading as the beginning.

Downgrades:

1. Entry is not straight and level.
2. Climb is not 45 degree angle to ground.
3. Roll path traced out by model is not a straight line (I.e. plane barrel rolls or suffers change in heading) continuing in 45 degree climb.
4. No momentary straight flight between first roll and 1/4 inside loop or between 1/4 inside loop and second roll.
5. Flight path coming down is not at 45 degree angle to ground.
6. Second roll is not at same rate as first.
7. Roll path of second roll is not as described for first roll.
8. Pull out to level flight is not at same altitude and heading as entry.

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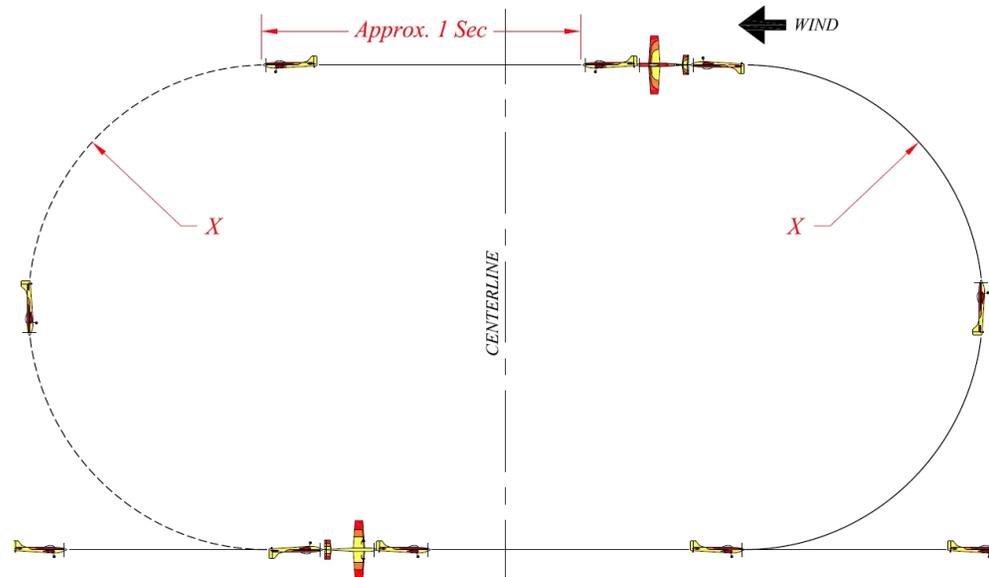


CUBAN EIGHT: The plane commences flying straight and level past center, pulls up into 5/8 of an inside loop until heading downward at 45 degrees, does a half roll followed by 3/4 of an inside loop until heading down at 45 degrees, does a half roll followed by straight and level recovery at the same altitude of entry.

Downgrades:

1. Entry is not straight and level
2. First roll not on 45 degree line
3. First loop not round or deviates to left or right
4. Second roll not on 45 degree line
5. Middle of second roll does not cross middle point of first roll
6. Second loop not round or deviates to left or right
7. Second loop not at same altitude
8. Second loop not same size as first loop
9. Maneuver not complete at same altitude and on same heading as entry
10. Plane fails to do straight and level flight at conclusion of maneuver

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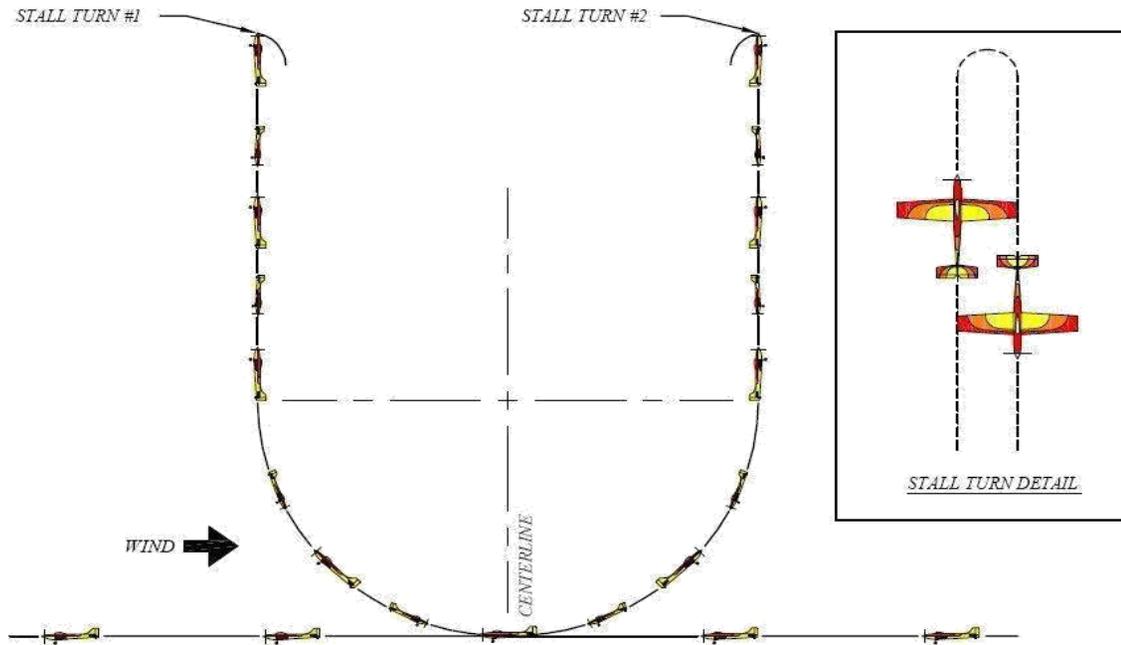


DOUBLE IMMELMAN: Model commences in straight and level flight, pulls into half an inside loop followed by a half roll to upright, does approximately 1 second of level flight followed by 1/2 outside loop, then followed by a half roll to upright, recovering in straight and level flight on the same heading and at the same altitude as the entry.

Downgrades:

1. Entry not straight and level
2. First half loop not round
3. Model deviates left or right during half loop
4. Half loop not completed exactly above starting point
5. Half roll does not start immediately after half loop
6. Roll is not on a straight line and 180 degrees heading from entry
7. Plane goes immediately into outside loop upon completion of half roll
8. Plane holds straight flight too long before going to outside loop
9. Half outside loop not round or same size as first half loop
10. Model deviates left or right during half loop
11. Half loop not completed exactly below starting point
12. Final half roll does not start immediately after half outside loop
13. Final half roll longer or shorter than first half roll
14. Model does not finish on same heading and at same altitude as entry
15. Plane fails to do straight and level flight at end of maneuver

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DOUBLE STALL TURN: Model pulls up into one-quarter (1/4) loop to a vertical track then performs a stall turn through 180 degrees. Model then performs one-half (1/2) loop to a vertical track and performs another stall turn then recovers with another one-quarter (1/4) loop to level flight. The length of the vertical segments is not a judging criterion.

Downgrades:

1. Model not flying straight and level at beginning and end of maneuver
2. Track of model does not become exactly vertical at points of turn.
3. Loop segments not round with same size and radius
4. Bottom of half loop not at same altitude as entry and finish
5. Model turns left or right during pull ups
6. Does not yaw tightly through 180 degrees
7. Return track more than one-half (1/2) wingspan from entry path
8. Return paths not parallel to entry paths
9. Maneuver not finished at same altitude as entry
10. Vertical segments not equal

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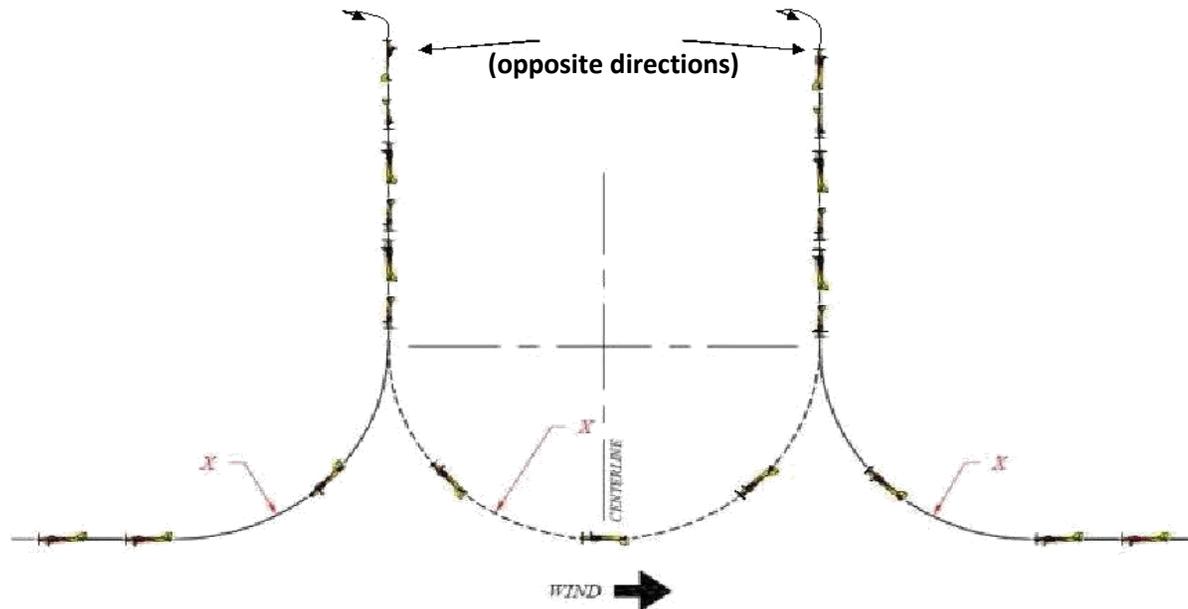


FIGURE M w/NO ROLLS: The model starts in straight and level flight, pulls up into a vertical attitude, performs a stall turn through 180 . The model then makes half an inverted loop pushing up again to vertical flight, performs second stall turn, and recovers on the same altitude and heading as the entry.

Downgrades:

1. Model not level at start
2. Does not become vertical
3. Changes heading during climb
4. Turn radius at top of stall turns greater than two wing spans -- downgrade 2 points.
5. Turns at top of stall turn are less than 180 degrees.
6. Diving and climbing paths not parallel.
7. Bottom of inverted position at different altitude than entry.
8. Altitude of second stall turn different to that of first stall turn.
9. Maneuver not finished at same altitude as entry.
10. Model not level at finish of maneuver.
11. Second stall turn is in same direction as first stall.

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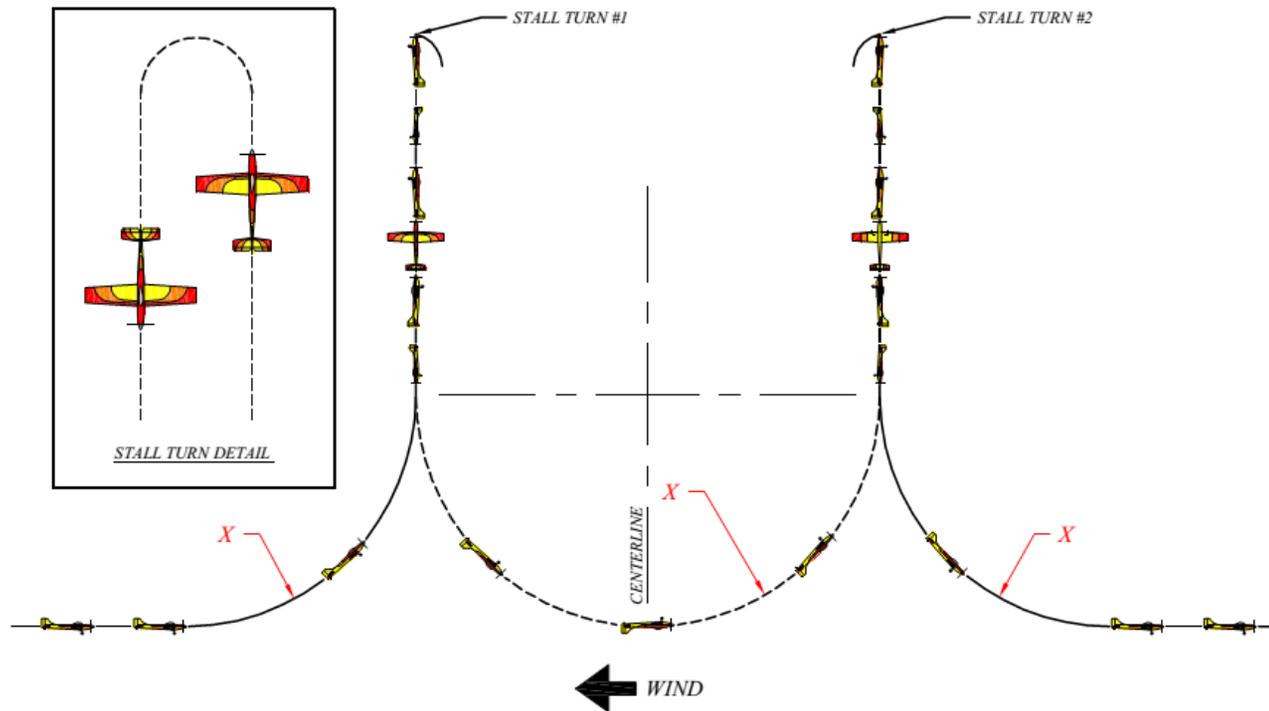
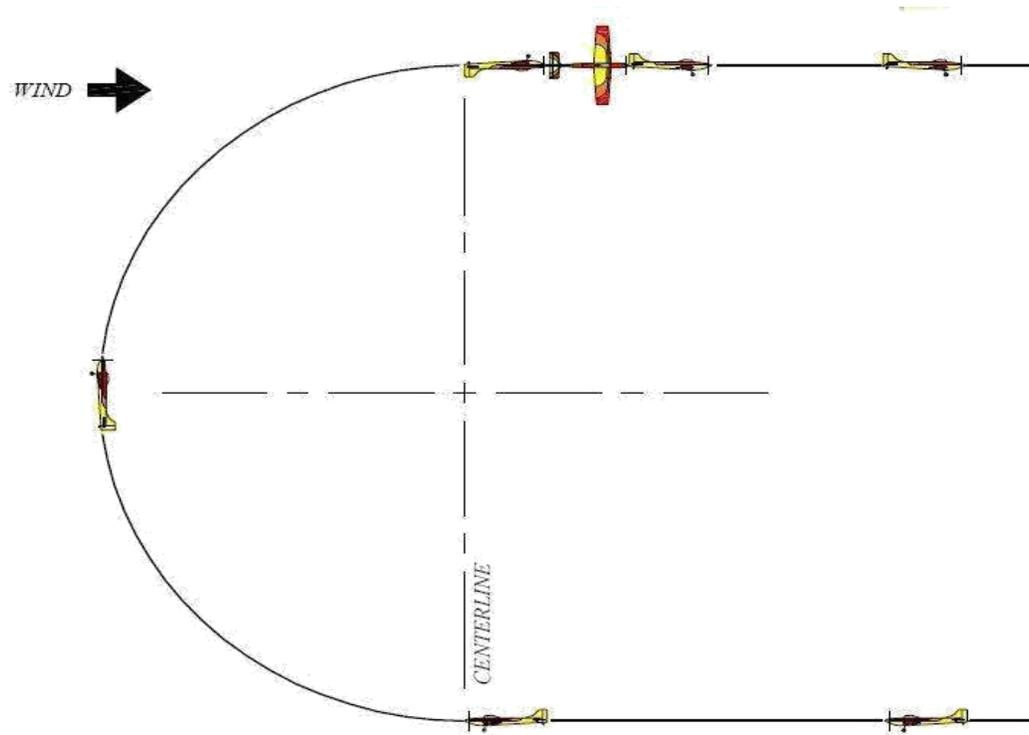


FIGURE M WITH $\frac{1}{4}$ ROLLS: Model pulls up into a vertical attitude, executes a quarter roll, stalls through 180° , $\frac{1}{4}$ turns again in the same direction as the first roll, does a $\frac{1}{2}$ outside loop to a vertical attitude again, $\frac{1}{4}$ rolls in the same direction as the first two, does another stall turn through 180° , $\frac{1}{4}$ rolls in the same direction as the other three and recovers to level flight. Viewed from the side the model executes a figure **M**.

Downgrades:

1. Model not vertical at start and finish of rolls and stall turns.
2. Stall turns not 180 degrees.
3. $\frac{1}{4}$ rolls not exactly 90 degrees.
4. Bottom of outside loop not level with entry.
5. Changes in heading during outside loop or rolls.
6. Stall turns not at same altitude.

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IMMELMANN TURN: The model starts the Immelmann flying straight and level, pulls up into half loop followed by a half roll and finishes flying straight and level exactly 180 degrees from the heading at entry.

Downgrades:

- | | |
|---|--|
| 1. Model not level at start | 2. Model deviates left or right during half loop |
| 3. Half loop not completed exactly above point of commencement of half loop | 4. Half roll does not commence immediately after half loop |
| 5. Plane deviates from a straight line during roll | 6. Model does not finish in level flight |
| 7. Model heading does not finish exactly opposite the direction of entry | 8. Half loop not round |

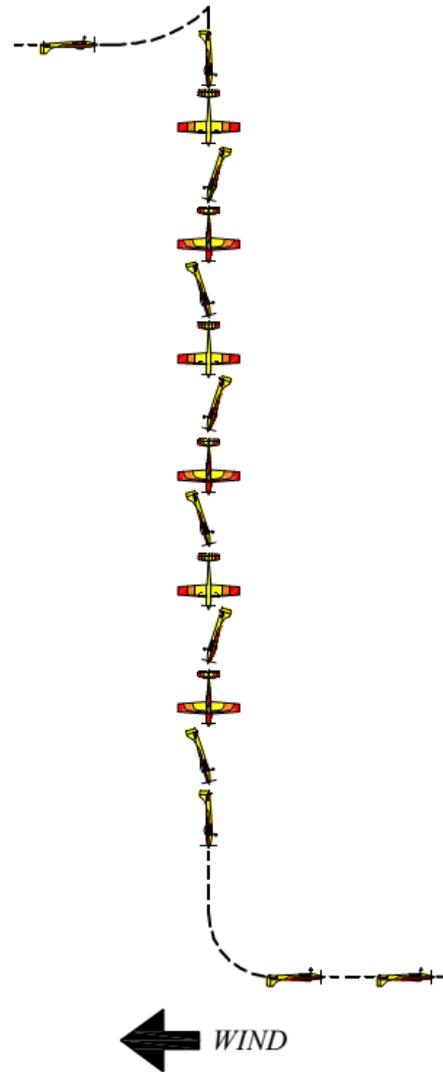
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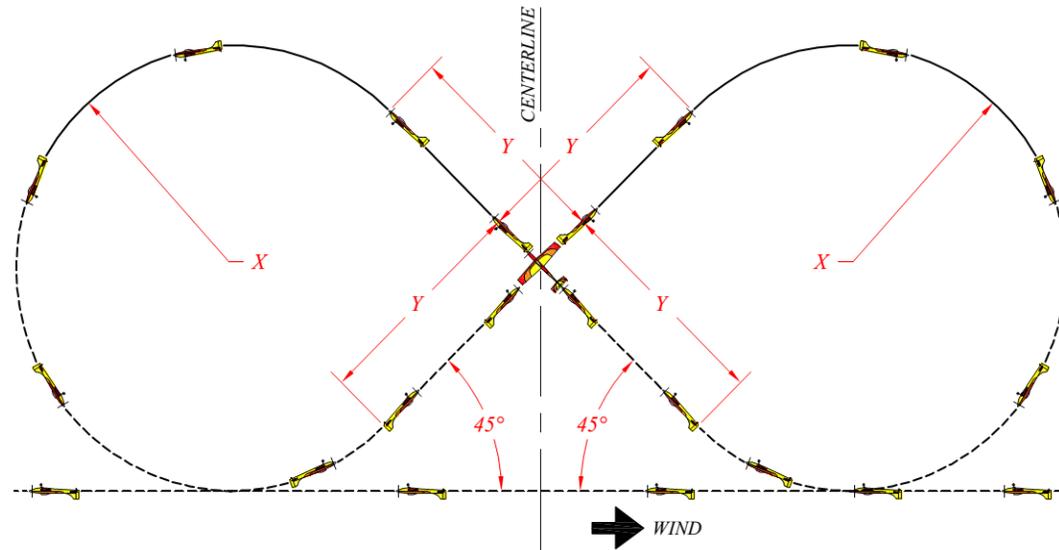
INVERTED THREE TURN SPIN: The plane establishes a heading by flying inverted straight and level, pushes up into a stall and commences the spin through three complete turns, then recovers to inverted level flight on the original heading. Judges must watch carefully to make sure plane is not in a spiral dive or vertical roll.

Downgrades:

1. Model not level at entry
2. Commencement of first spin is sloppy or uncertain
3. Spin rate not uniform
4. Does not do exactly three turns. Less than 2-1/2 or more than 3-1/2 turns should be scored zero
5. Does not recover on same heading as initial heading
6. If any of the three turns are spiral dives rather than spins, the score is zero
7. Rate of rotation in spin is excessively rapid
8. Does not fly straight and level at finish of maneuver

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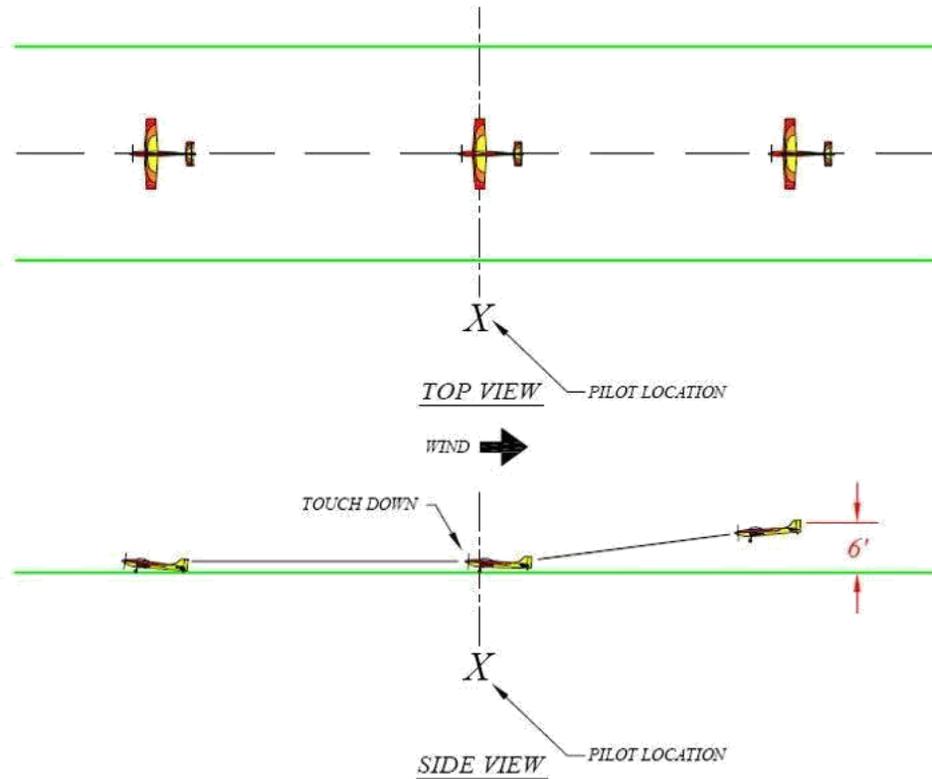


INVERTED REVERSE CUBAN EIGHT: The plane enters this maneuver in straight and level inverted flight, pushes up into a 45 degree climb, half rolls to upright and proceeds to outside loop until it is again climbing at a 45 degree angle. The plane then performs another half roll to upright flight that should cross the flight path of the first roll, then again proceeds to outside loop until it has reached straight and level inverted flight on the same heading and at the same altitude as the beginning.

Downgrades:

1. Entry (inverted) is not straight and level
2. First roll not on 45 degree line.
3. First loop not round or deviates to left or right.
4. Second roll not on 45 degree line.
5. Middle of second roll does not cross middle point.
6. Second loop not round or deviates to left or right.
7. Second loop not at same altitude
8. Second loop not same size as first loop
9. Maneuver not complete at same altitude and on same heading as entry.
10. Plane fails to do straight flight at conclusion of maneuver.

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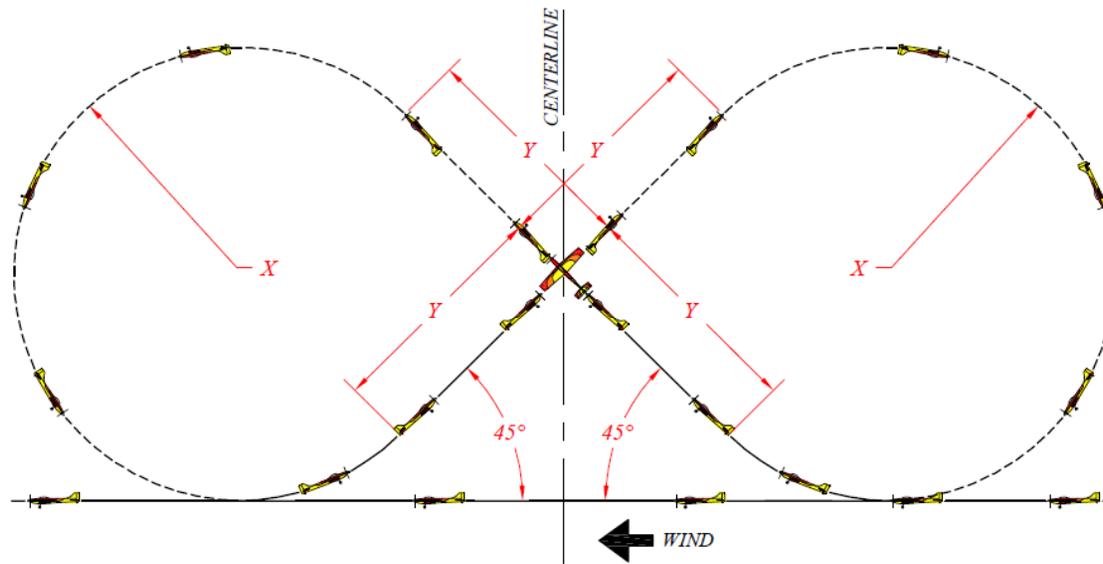


LANDING PERFECTION: When the contestant has his plane lined up and on heading for the final approach, and not less than six (6) feet off the ground, he must announce the start of the Landing maneuver. From this point on, the Landing will be judged.

Downgrades:

1. Approach during landing too steep
2. Gallops in pitch, yaw or roll during approach
3. Model impacts or thuds onto ground due to lack of flare
4. Model bounces on landing
5. Model turns left or right while rolling to a stop. Turns unnecessarily and spot location are adverse.
6. All landings judged only for 50 feet after touch down

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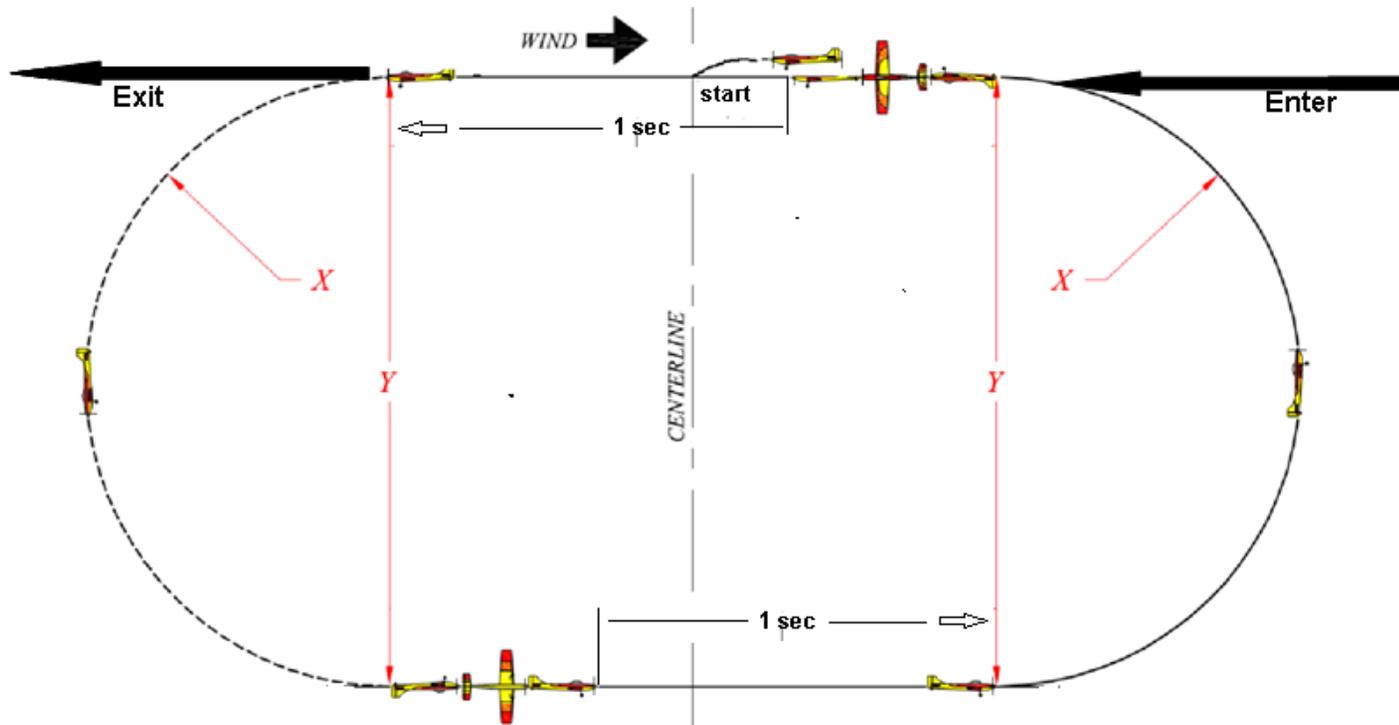


REVERSE CUBAN EIGHT: Plane commences in straight and level flight, pulls up into a 45-degree climb, half-rolls to inverted and proceeds to inside loop until it is again climbing at a 45-degree angle. Plane then does another half roll to inverted that should cross the flight path of the first roll, then again proceeds to inside loop until it has reached straight and level flight on the same heading and altitude as the beginning.

Downgrades:

1. Entry not straight and level
2. First roll not on 45 degree line
3. Loop not round or deviation to left or right
4. Second roll not on 45 degree line
5. Middle of second roll does not cross middle point of first roll
6. Second loop not round or deviates to left or right
7. Second loop not at same altitude as first loop
8. Second loop not same size as first loop
9. Maneuver not completed at same altitude and on same heading as beginning
10. Model fails to do straight and level flight at end of maneuver

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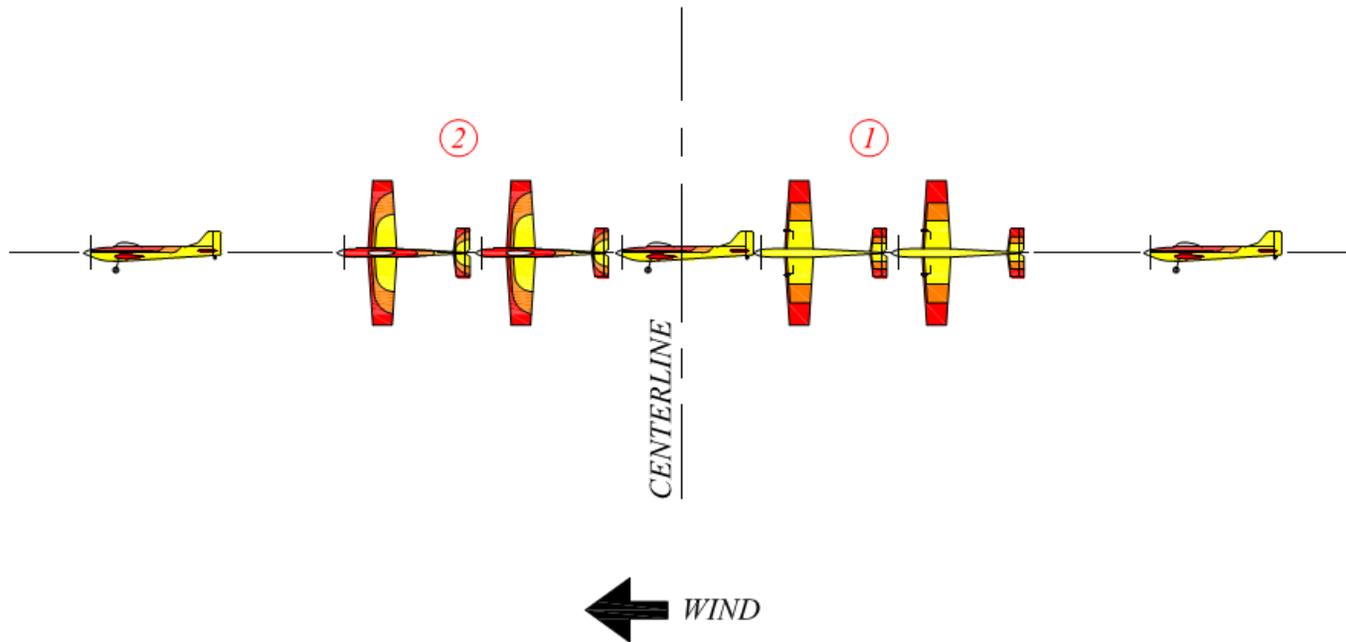


REVERSE DOUBLE IMMELMANN: Model pushes over and executes $\frac{1}{2}$ outside loop followed immediately by a $\frac{1}{2}$ roll, pauses for approximately one second, does a $\frac{1}{2}$ loop and immediately $\frac{1}{2}$ rolls to level flight.

Downgrades:

1. Changes in heading during $\frac{1}{2}$ loops and $\frac{1}{2}$ rolls.
2. $\frac{1}{2}$ rolls not immediately after $\frac{1}{2}$ loops.
3. Model pauses more than one second before $\frac{1}{2}$ inside loop.
4. $\frac{1}{2}$ loops not at same altitude.

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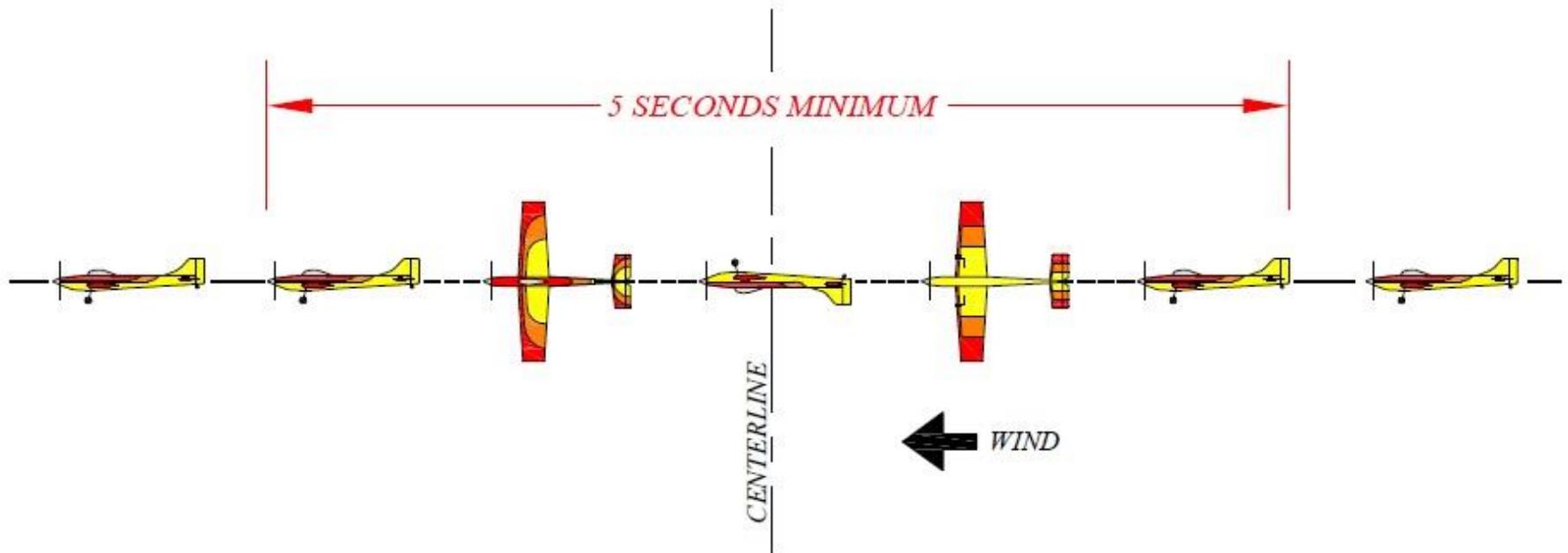


REVERSE KNIFE EDGE: Model rolls 90 degrees and hesitates, then rolls 180 degrees in opposite direction and hesitates, then rolls 90 degrees to finish in level flight. Maneuver takes about 5 seconds.

Downgrades:

1. $\frac{1}{4}$ rolls more or less than 90 degrees.
2. Model does not hesitate in the two knife edge positions.
3. Roll rate not constant.
4. Maneuver takes less than 4 seconds or more than 6 seconds.

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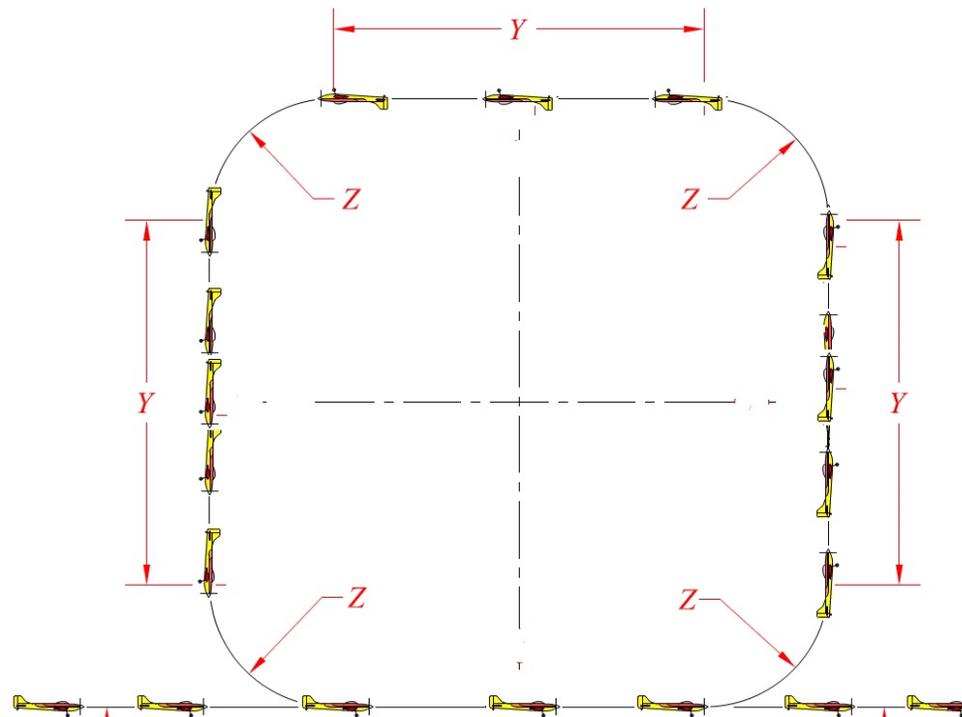


SLOW ROLL: Model commences from straight and level flight and the rolls slowly at a uniform rate through one complete rotation. The approximate time of the roll to be five seconds. Note: No downgrade for slight overtime.

Downgrades:

1. Model not level at entry
2. Plane deviates from a straight line during roll
3. Roll rate not uniform
4. Plane does not roll through exactly one revolution
5. Plane changes altitude during roll
6. Plane changes heading
7. Roll rate is too rapid resulting in less than five seconds elapse during roll
8. Plane is not level at finish of roll

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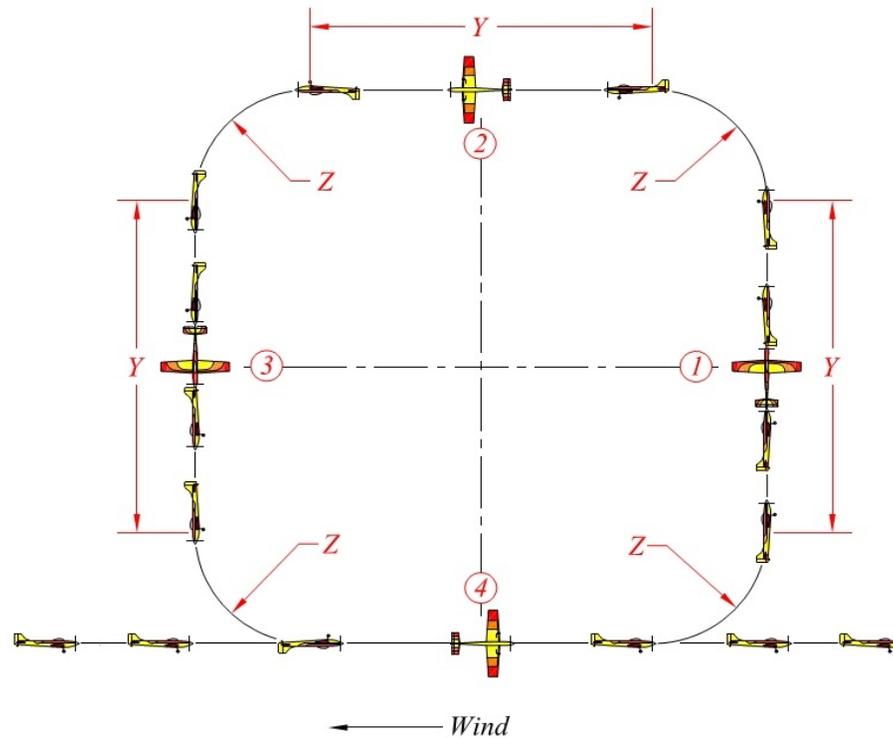


SQUARE LOOP: Model pulls up and executes a square loop. The model should rotate sharply at the corners.

Downgrades:

1. Loop not square.
2. Sides of square not same size
3. Changes in headings.
4. Wings not level.

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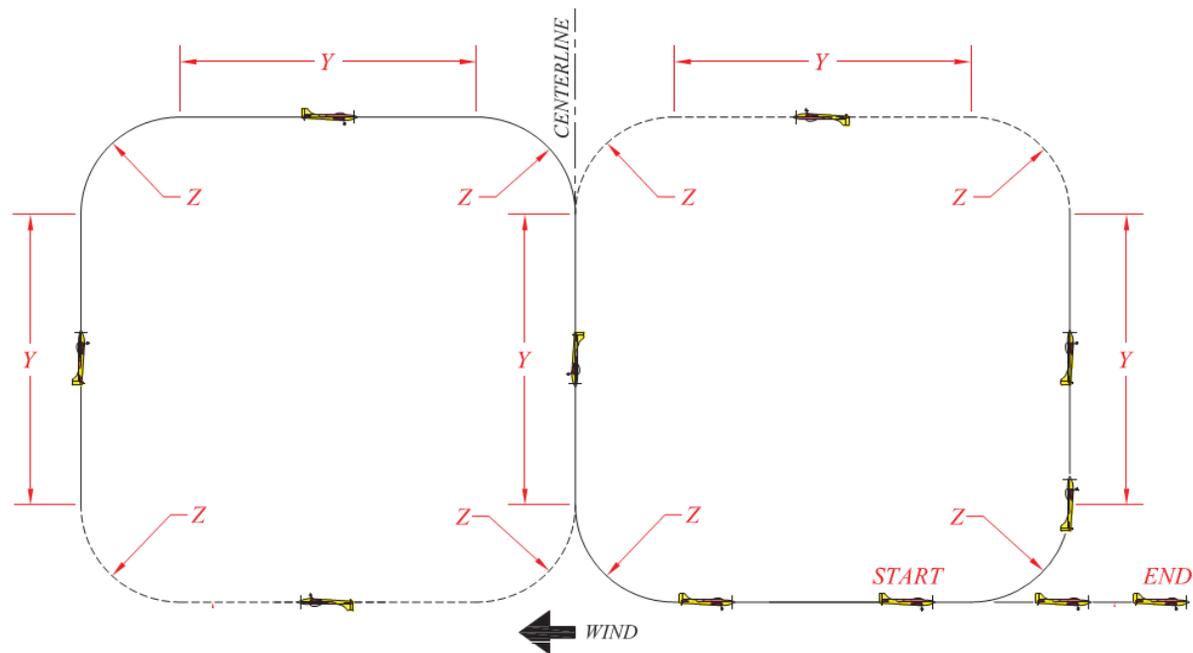


SQUARE LOOP WITH HALF ROLLS: Model pulls up and completes a square loop; in each side the model executes a $\frac{1}{2}$ roll.

Downgrades:

1. Loop not square.
2. Rolls not 180 degrees.
3. Wings not level during $\frac{1}{4}$ loops.
4. Changes in heading during rolls and loops.
5. Sides of square not of equal length.

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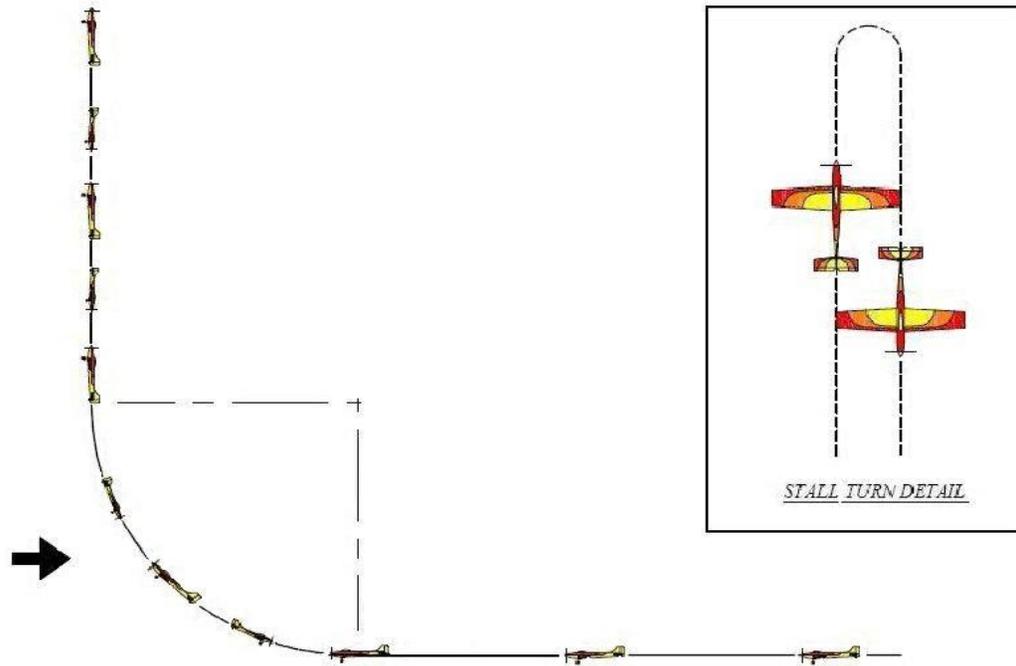


SQUARE HORIZONTAL EIGHT: Model pulls up and executes a square loop, when at the bottom of the third leg it does a complete square outside loop behind the inside loop, the model should rotate sharply at each corner and the straight paths should be at least 20 meters (65 ½ feet) long. *At the bottom of the 4th leg of the outside loop, the model pulls out to straight and level flight to complete the maneuver.*

Downgrades:

1. Loops not square.
2. Vertical downward paths do not coincide.
3. Loops not same size.
4. Changes in heading.
5. Wings not level.
6. Loops not at same altitude.
7. Sides of square not same size.

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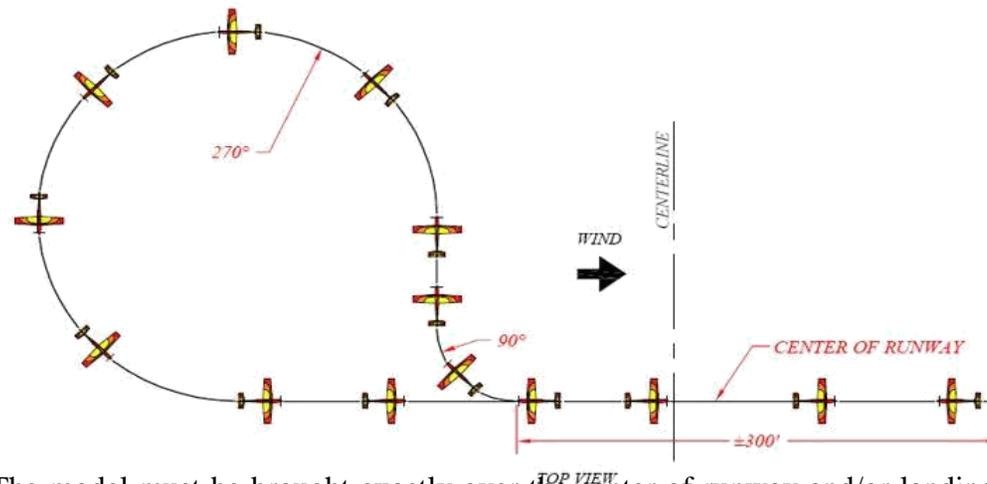


STALL TURN: The model starts from straight and level flight and noses up to a vertical position, yaws through 180 degrees, then dives along a parallel path and finishes the maneuver with the plane level at the same altitude as the entry.

Downgrades:

1. Model not level at start
2. Does not become exactly vertical
3. Turns left or right during pull up
4. Does not yaw tightly through 180 degrees
5. Return path more than two (2) wing-spans from entry path
6. Return path not parallel to entry path
7. Maneuver not finished at same altitude as entry
8. Plane not level at finish of maneuver
9. Model does not fly straight and level to complete maneuver

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STRAIGHT FLIGHT OUT: The model must be brought exactly over the center of runway and/or landing circle and flown in an absolutely straight path into the wind for a distance of approximately 300 feet before starting the Procedure Turn (Distance does not have to be accurate, however, judges may specify start of turn if they wish).

Downgrades:

- | | |
|---|--|
| 1. Does not fly over center of runway and/or landing circle | 2. Plane deviates left or right |
| 3. Does not hold constant altitude | 4. Turns before permission is given by judge |
| 5. Gallops in elevation. | |

PROCEDURE TURN: After the straight flight, the model must turn exactly 90 degrees to the left or right, whichever will take the plane away from the spectator line (direction to be specified by the Contest Director) then exactly 270 degrees to the right (or left) and cross over the point where the first turn commenced.

Downgrades:

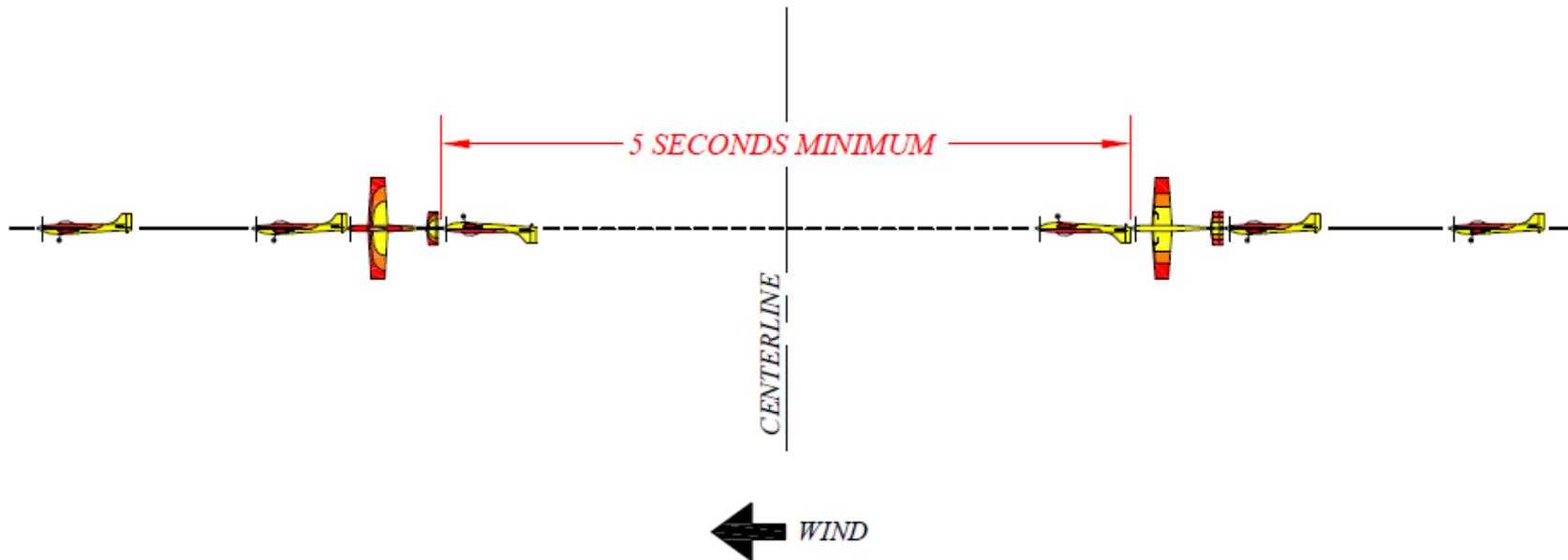
- | | |
|--|----------------------------------|
| 1. First turn not 90 degrees | 2. Second turn not 270 degrees |
| 3. Change in altitude during turn | 4. Turns not smooth and circular |
| 5. Does not head back over exact outgoing path | |

STRAIGHT FLIGHT BACK: The model should fly back toward the circle along the same line as the outgoing path and pass exactly over the circle.

Downgrades:

- | | |
|--|-----------------------------------|
| 1. Turns or wiggles during straight flight | 2. Change in altitude |
| 3. Gallops in pitch, yaw or roll | 4. Flight not along original path |
| 5. Does not pass over circle | |

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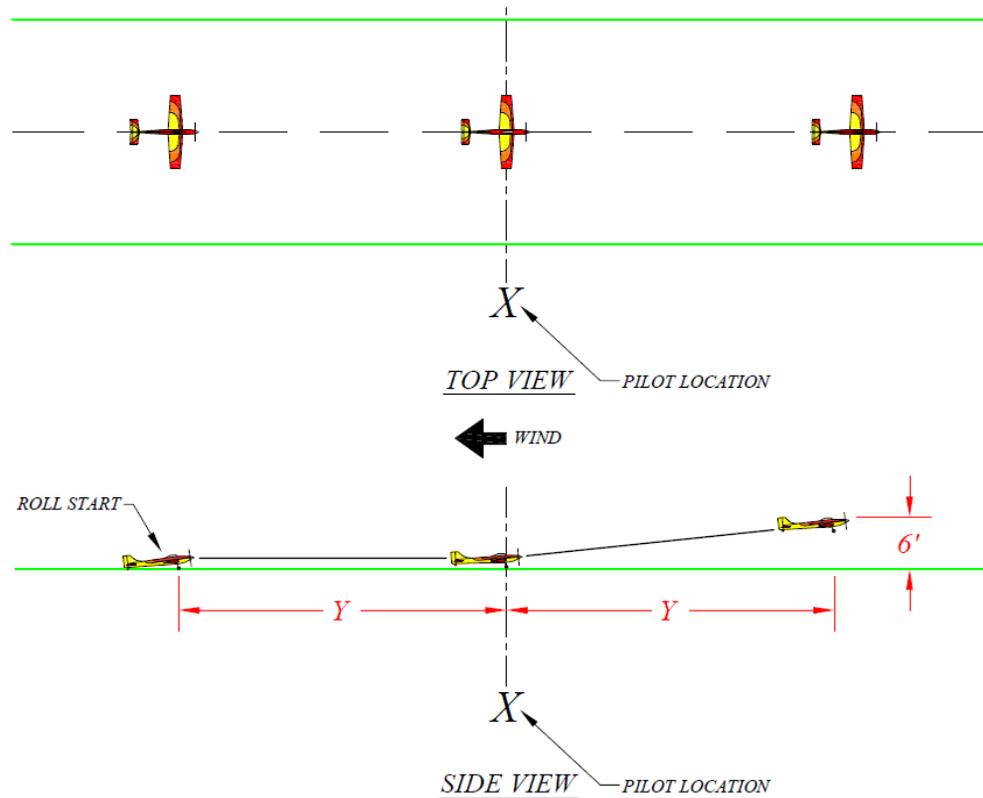


STRAIGHT INVERTED FLIGHT: Model performs one-half (1/2) roll to inverted and flies straight and level inverted for a minimum of five (5) seconds, then performs one-half (1/2) roll back to level flight. Half rolls may be in either direction.

Downgrades:

1. Half roll not level
2. Inverted flight not straight and level
3. Changes in heading during rolls and inverted flight
4. Path not parallel to flight line

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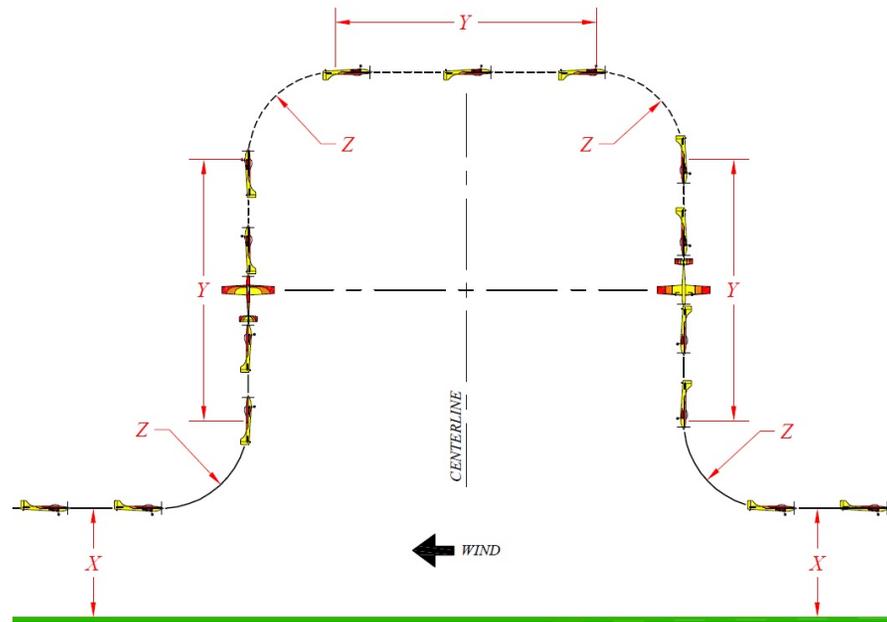


TAKEOFF: The model must start from a standstill. Model shall accelerate gradually and the takeoff run shall be in a straight line. Plane shall lift off gently and climb at a gradual angle, continuing in its straight flight path until at least six feet off the ground. Pilot shall call “Takeoff (or maneuver) complete” when model has gained at least six feet of altitude and is still climbing in a straight flight path.

Downgrades:

1. Pushing or assisting the model when released.
2. Change in heading during the takeoff run
3. “Jumping” from the ground
4. Retouching the ground after become airborne
5. Too steep a climb angle
6. Gallops in pitch, roll or yaw during climb

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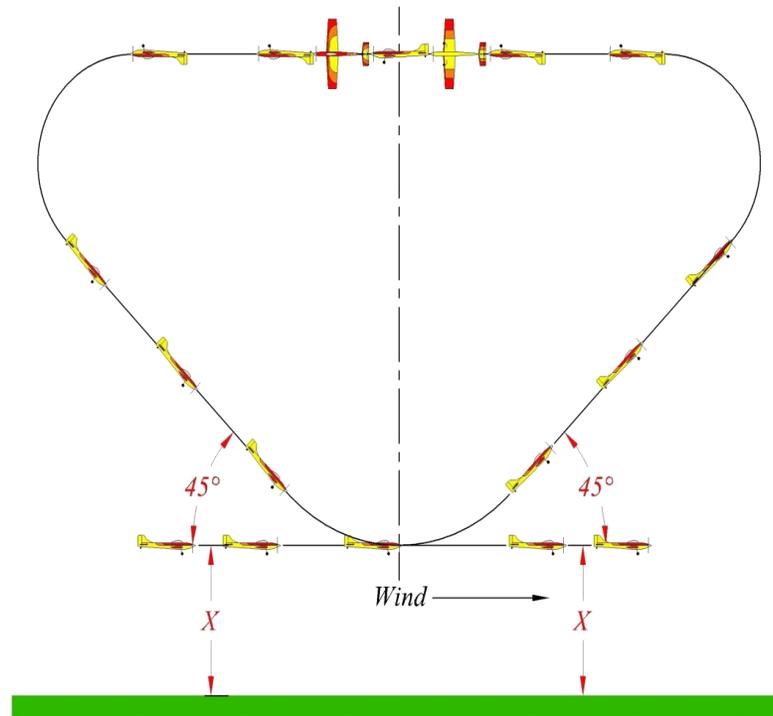


TOP HAT: Model starts in straight level flight, pulls up into vertical climb and makes a half roll, then levels out inverted on the same heading as entry. After short inverted flight, model dives vertically, performs a half roll and finally recovers in straight level upright flight on same heading and height as entry.

Downgrades:

1. Model does not start level
2. Model doesn't go exactly vertical before starting roll
3. Roll does not stop at exactly 180 degrees from entry
4. Model does not climb vertically for a brief period after completing roll
5. Inverted flight path at top is not level
6. Model does not fly inverted for the same distance as the vertical climb and roll
7. Model does not dive vertically briefly before starting ½ roll
8. Second half roll not started at the same altitude as that where the first half roll was completed
9. Second half roll not completed at same altitude as that where first roll started
10. Model does not dive vertically for a brief period after completing second half roll
11. Model deviates left or right of the entry path at any point in the maneuver
12. Model does not recover at same altitude and heading as entry

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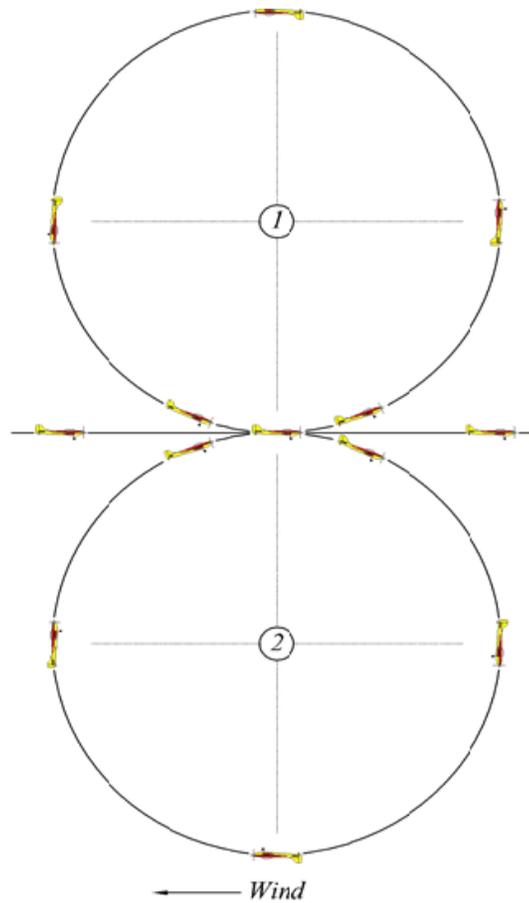


TRIANGLE ROLLING LOOP: Model pulls up into a 45-degree climb, holds the attitude for approximately one second, loops through 135 degrees, does one complete roll, loops through 135 degrees, holds the attitude for approximately one second and recovers in level flight at the same point that the maneuver started. The climbing and descending portions should be the same length.

Downgrades:

1. Climbing and descending paths not 45 degrees.
2. Climbing and descending paths not same length.
3. Roll not 360 degrees.
4. Model changes heading during loops and roll.
5. Model does not start and finish maneuver at same point.

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VERTICAL EIGHT: Model pulls up and executes a complete inside loop, at the bottom pushes over and completes an outside loop directly under the inside loop.

Downgrades:

1. Loops not round and same diameter.
2. Changes in heading during loops.

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