



# Senior Pattern Association

**2021-2022**

**Section III**

**Maneuver Descriptions**

Revised February 2, 2021

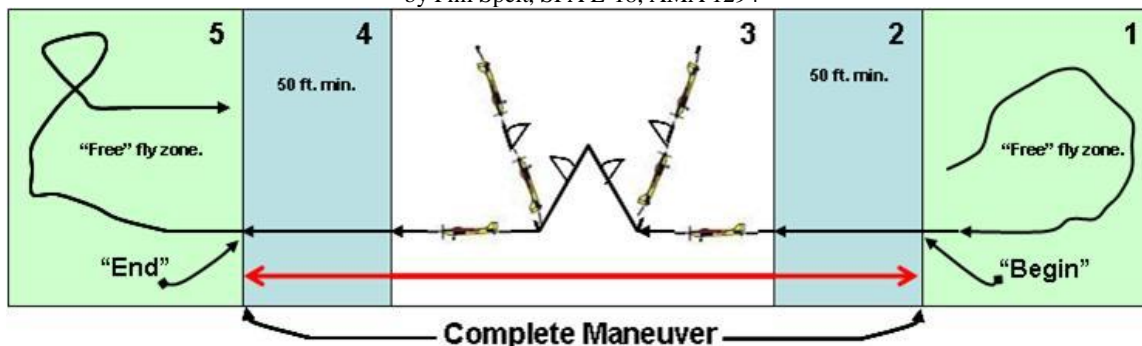
**NOTE: MANEUVER DESCRIPTIONS THAT FOLLOW ARE TAKEN VERBATIM FROM THE APPROPRIATE AMA RULE BOOKS FROM WHICH THE MANEUVERS WERE TAKEN. THE ONE EXCEPTION IS FOR THE LANDING, FOR WHICH EVERY APPEARANCE IN THE AMA RULE BOOK CONTAINED A REFERENCE TO A LANDING CIRCLE. CONSEQUENTLY, THE SPA BOARD HAS OPTED TO CONTINUE USING THE SAME DESCRIPTION WE HAVE BEEN USING, AS IT DESCRIBES WHAT WE CURRENTLY DO.**

**NOTE: MANEUVERS IN THIS GUIDE ARE LABELED WITH A REFERENCE TO THE AMA RULEBOOK FROM WHICH THEY WERE TAKEN. "1978-79 FAI" MEANS THE MANEUVER WAS TAKEN FROM THE FAI SECTION OF THE 1978-79 AMA RULEBOOK; SIMILARLY, "1978-79 AMA" INDICATES IT CAME FROM THE AMA SECTION OF THE 1978-79 RULEBOOK. COPIES OF THESE RULEBOOKS CAN BE FOUND ON THE SPA WEBSITE.**

**NOTE: MANEUVER DIAGRAMS ARE FOR ILLUSTRATIVE PURPOSES, ONLY. THE INTENT IS TO PRESENT THE OVERALL GEOMETRY OF THE MANEUVERS. IN MANY CASES THEY PRESENT ONE OPTION OUT OF SEVERAL THAT MIGHT BE USED. FOR EXAMPLE, THE SLOW ROLL PRESENTS ONLY ONE OF THE TWO POSSIBLE DIRECTIONS IN WHICH THE ROLL CAN BE PERFORMED. IN CASES WHERE THERE IS NO OPTION, AS IN SOME OF THE ROLLING MANEUVERS, THE DIRECTION OF THAT PART IS SPELLED OUT IN THE DESCRIPTION. A GOOD EXAMPLE OF THIS IS THE FIGURE M WITH 1/4 ROLLS, WHICH SPECIFIES THAT ALL ROLLS MUST BE IN THE SAME DIRECTION.**

# Anatomy of an SPA Maneuver

by Phil Spelt, SPA L-18, AMA 1294



SPA pilots are flying what is called “Precision Aerobatics,” in the official AMA publications -- the old-time way (pre turnaround) -- one maneuver at a time. 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.

## 2021-2022 Maneuver Listing for Each Class

SPA Basic 2021-2022		
		K
1. Takeoff (U)		1
	(Downwind Trim Pass)	
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
	(Fly By For Landing - 2 Allowed)	
11. Landing Perfection (U)		1
Total K Factor		18
Notes:		
• No EXTRA Fly-bys allowed		
• Maneuvers flown out of sequence will be scored ZERO (0)		

SPA Sportsman 2021-2022		
		K
1. Takeoff (U)		1
	(Downwind Trim Pass)	
2. Double Stall Turn (U)		3
3. Cuban 8 (D)		2
4. Double Immelmann (U)		2
5. 2 Point Roll (D)		2
6. 3 Inside Loops (U)		2
7. Slow Roll (D)		3
8. 1 Reverse Outside Loop (U)		2
9. 3 Horizontal Rolls (D)		3
10. 180 Degree Turn (U)		3
11. 3 Turn Spin (U)		2
	(Fly By For Landing)	
12. Landing Perfection (U)		1
Total K Factor		26
Notes:		
• No EXTRA Fly-bys allowed		
• Maneuvers flown out of sequence will be scored ZERO (0)		

SPA Advanced 2021-2022		
		K
1. Takeoff (U)		1
	(Downwind Trim Pass)	
2. Figure M (U)		3
3. Cuban 8 (D)		2
4. Reverse Double Immelmann (U)		2
5. 3 Horizontal Rolls (D)		3
6. 3 Reverse Outside Loops (U)		3
7. Slow Roll (D)		3
8. Square Loop (U)		3
9. 4 Point Roll (D)		4
10. Top Hat (U)		3
11. Knife Edge Flight (D)		3
12. Vertical Roll (U)		3
	(Fly By For Landing)	
13. Landing Perfection (U)		1
Total K Factor		34
Notes:		
• No EXTRA Fly-bys allowed		
• Maneuvers flown out of sequence will be scored ZERO (0)		

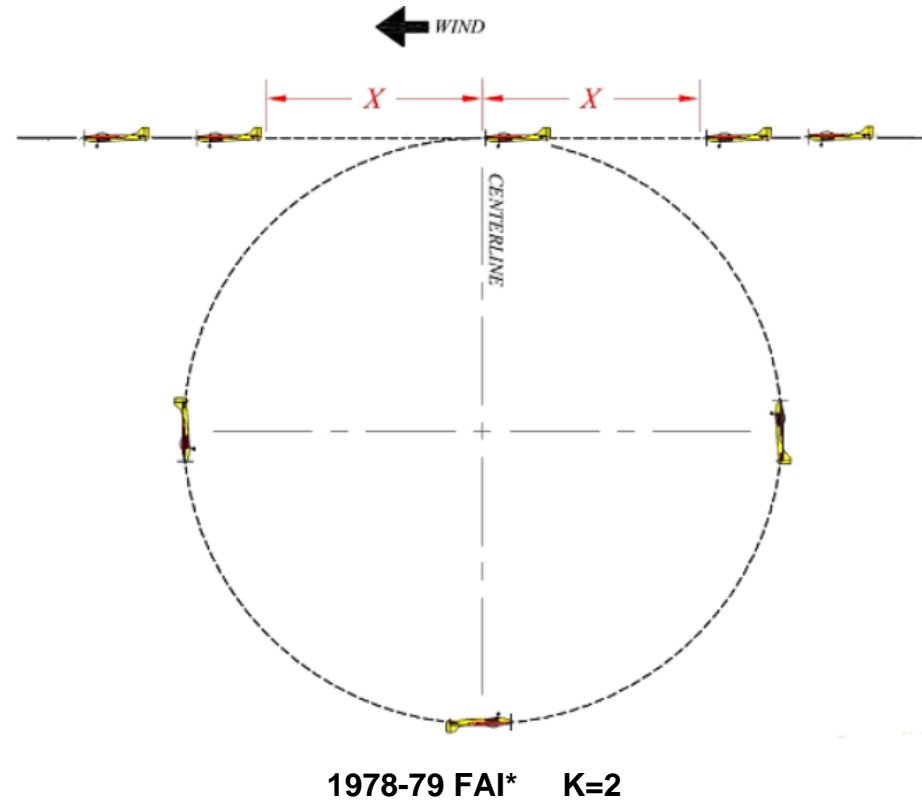
SPA Expert/Senior Expert 2021-2022		
	Use for Expert and Senior Expert	K
1. Takeoff (U)		1
	(Downwind Trim Pass)	
2. Figure M with ¼ Rolls (U)		5
3. 2 Rolls Opposite Directions (D)		3
4. Inverted Reverse Cuban 8 (U)		3
5. Slow Roll (D)		3
6. 3 Reverse Outside Loops (U)		3
7. Reverse Knife Edge (D)		4
8. Square Horizontal 8 (U)		4
9. 8 Point Roll (D)		4
10. Avalanche (U)		3
11. Triangle Rolling Loop (D)		4
12. Inverted 3 Turn Spin (U)		3
	(Fly By for Landing)	
13. Landing Perfection (U)		1
Total K Factor		41
Notes:		
• No EXTRA Fly-bys allowed		
• Maneuvers flown out of sequence will be scored ZERO (0)		

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## 1 OUTSIDE LOOP



1978-79 FAI\* K=2

Model pushes over and executes one outside loop. Loop should be round.

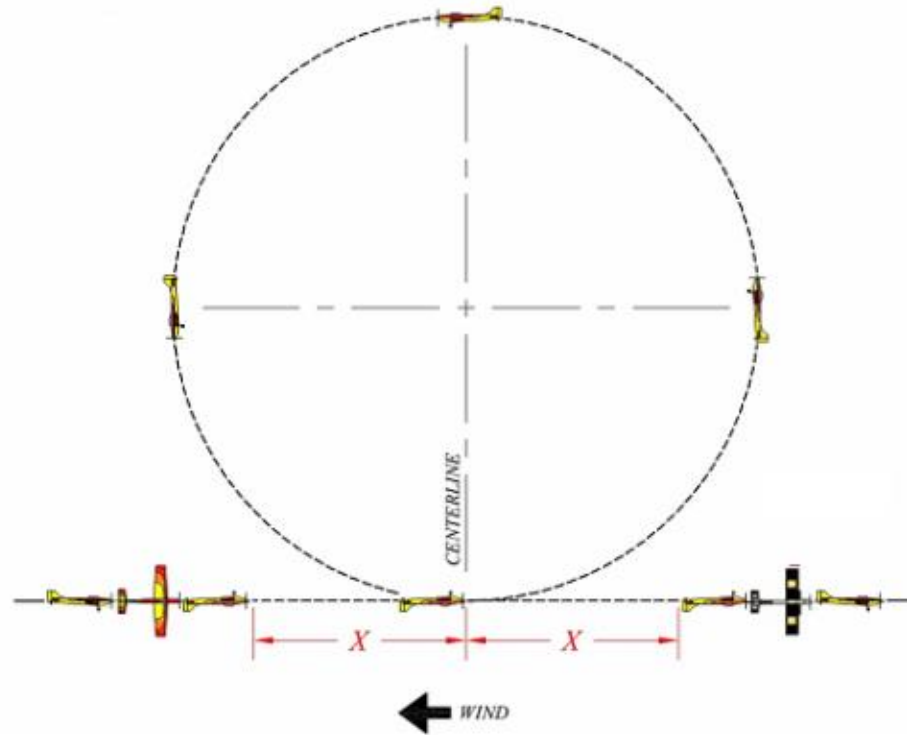
Downgrades

1. Loop not round
2. Wings not level during loop
3. Changes in heading during loops

\* **NOTE:** This maneuver was never included in the AMA Rulebooks. It was created by the SPA Pattern Committee from the 3 Outside Loops maneuver description in the FAI section of the 1978-79 Rulebook to decrease the difficulty of the maneuver for Basic pilots

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## 1 REVERSE OUTSIDE LOOP



**1978-79 FAI \* K=2**

Model half rolls to inverted, pauses for approximately one (1) second and pushes up to execute an outside loop, pauses for approximately one (1) second then half rolls to level flight.

Downgrades:

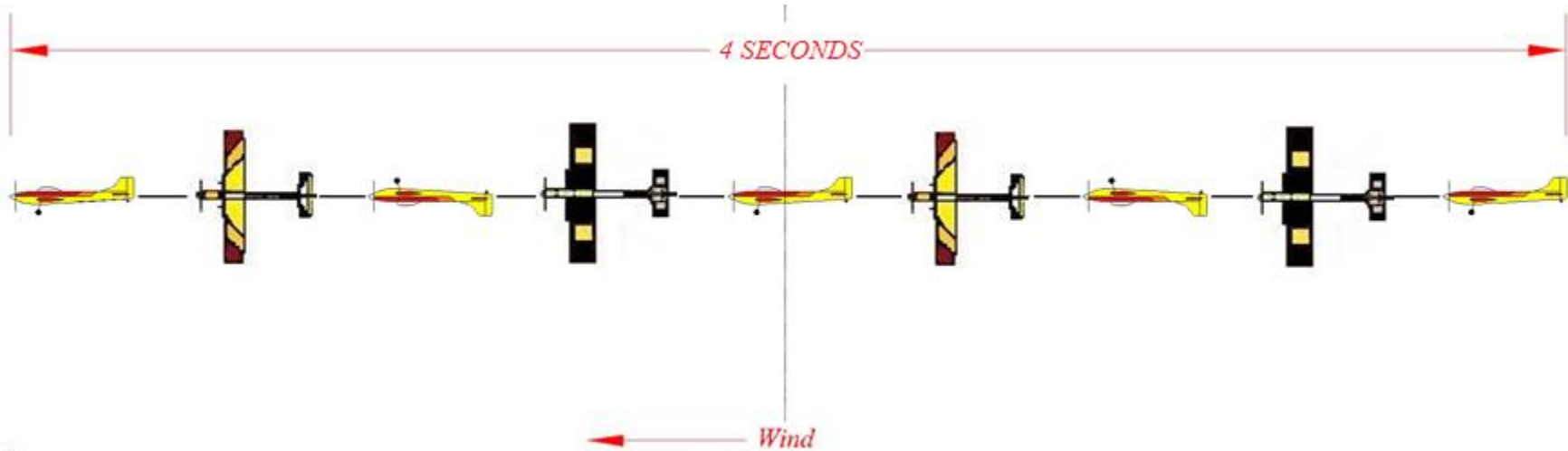
1. Loop not round
2. Changes in heading during loop and rolls
3. Wings not level during loop
4. Model pauses more than one (1) second before and after loops

**\* NOTE:** This maneuver was never included in the AMA Rulebooks.

It was created by the SPA Pattern Committee from the 3 Reverse Outside Loops maneuver description in the FAI section of the 1978-79 Rulebook to decrease the difficulty of the maneuver for Basic pilots

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## 2 HORIZONTAL ROLLS



1978-79 FAI \* K=2

Model rolls at a uniform rate through two (2) complete revolutions in either direction. Maneuver takes approximately 4 seconds.

### 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
5. Maneuver takes less than 3 or more than 5 seconds

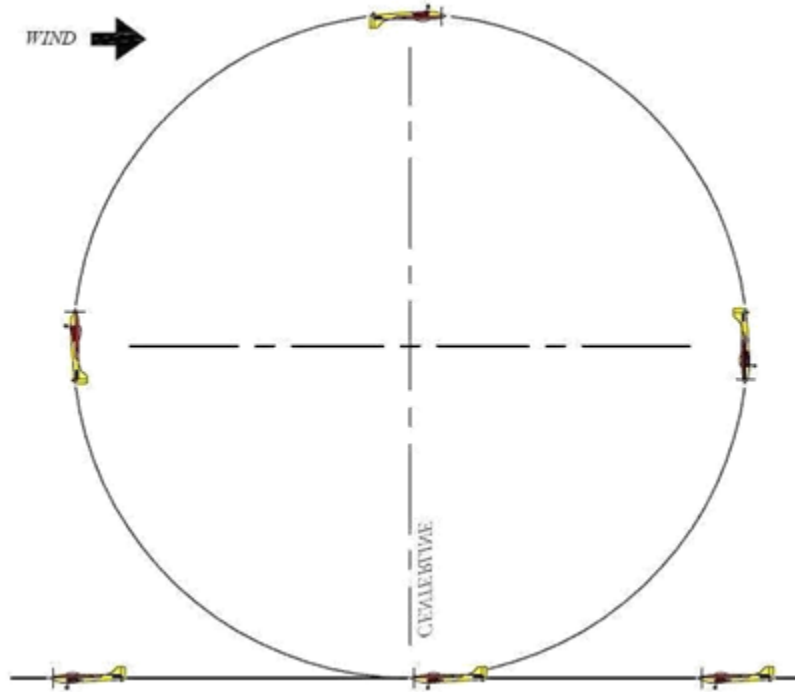
\* **NOTE:** This maneuver was never included in the AMA Rulebooks.

It was created by the SPA Pattern Committee from the 3 Horizontal Rolls description in the FAI section of the 1978-79 Rulebook to decrease the difficulty of the maneuver for Basic pilots

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## 2 INSIDE LOOPS



1978-79 FAI \* K=2

Model pulls up and executes two (2) consecutive loops; all loops shall be round and superimposed.

Downgrades

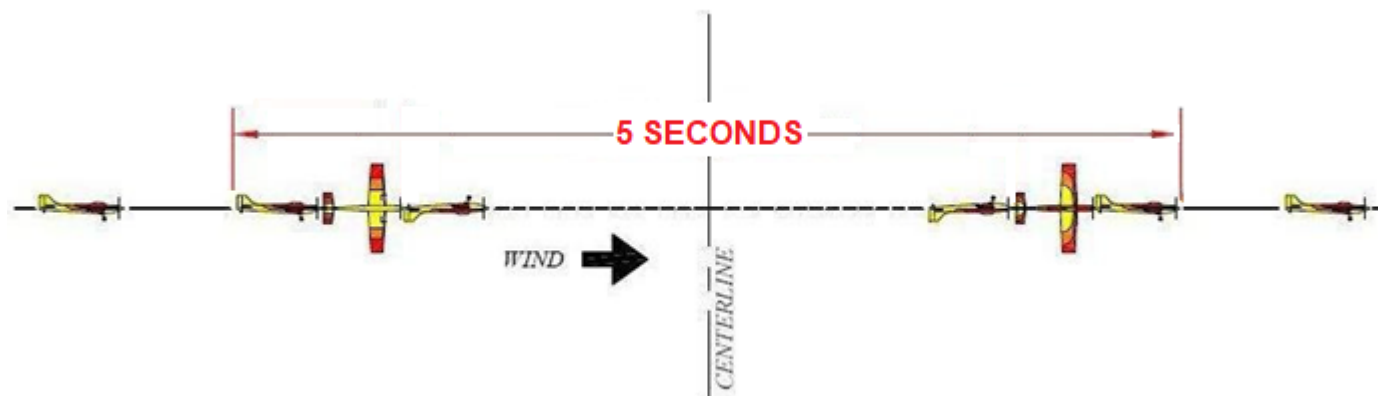
1. Loops not round
2. Loops not Superimposed
3. Wings not level during loops
4. Changes in heading during loops

\* **NOTE:** This maneuver was never included in the AMA Rulebooks.

It was created by the SPA Pattern Committee from the 3 Inside Loops description in the FAI section of the 1978-79 Rulebook to decrease the difficulty of the maneuver for Basic pilots

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## 2 POINT ROLL



### 1976-77 AMA K=2

The model starts in level flight, then rolls one complete rotation, hesitating at the inverted position. During hesitation, wings shall be parallel to the horizon. Model shall finish the maneuver in level upright flight. Approximate time of the roll shall be 5 seconds.

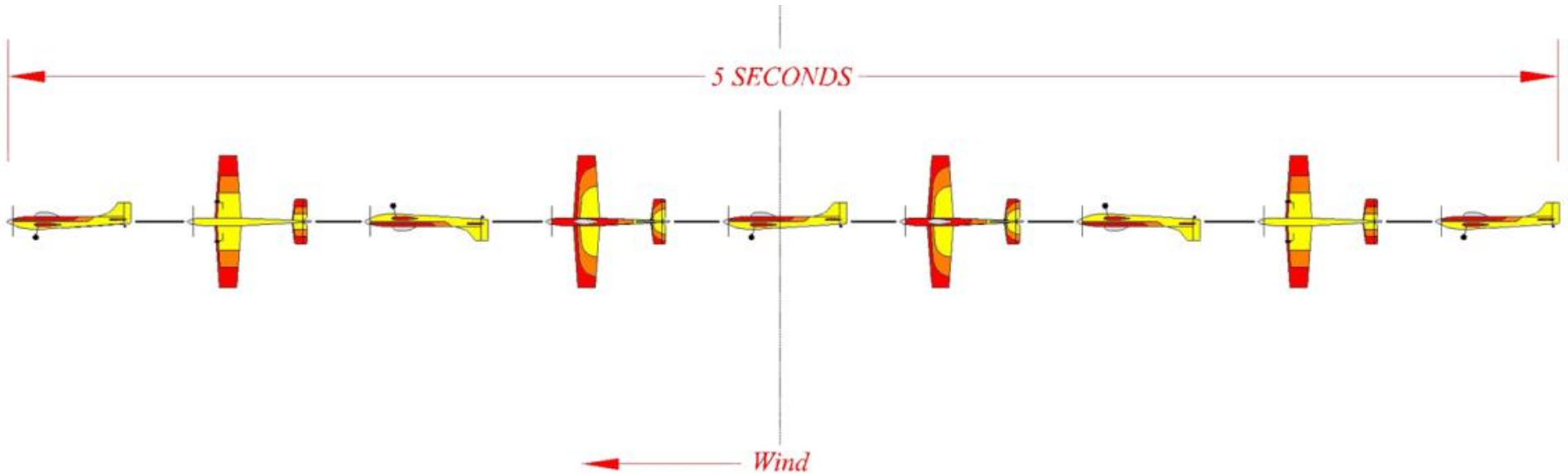
Basically, maneuver could be described as straight inverted flight, with half rolls into and out of the inverted portion being performed in the same direction of rotation.

#### Downgrades:

1. Model not level at start.
2. Half-rolls more or less than 180°.
3. Model does not hesitate after first half roll.
4. Roll rate not constant during each half-roll.
5. Model takes less than 4 or more than 6 seconds to complete maneuver.
6. Model not level at finish of maneuver.
7. Model does not finish on same heading and altitude as entry.

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## 2 ROLLS IN OPPOSITE DIRECTIONS



**1978-79 FAI K=3**

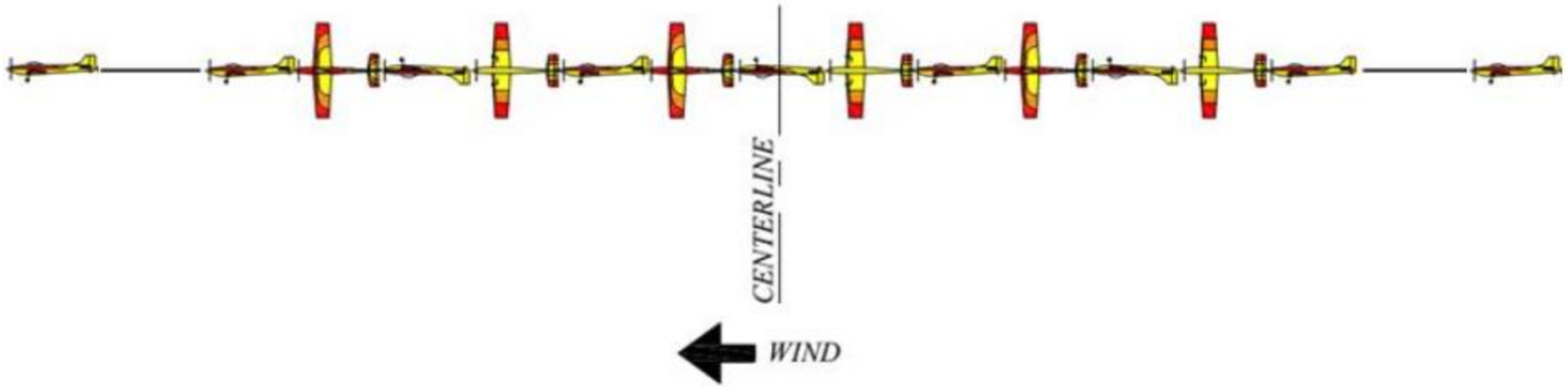
Model rolls 360 degrees in either direction, then immediately after rolls 360 degrees in the opposite direction, rolls to take approximately five seconds.

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



**1978-79 FAI K=3**

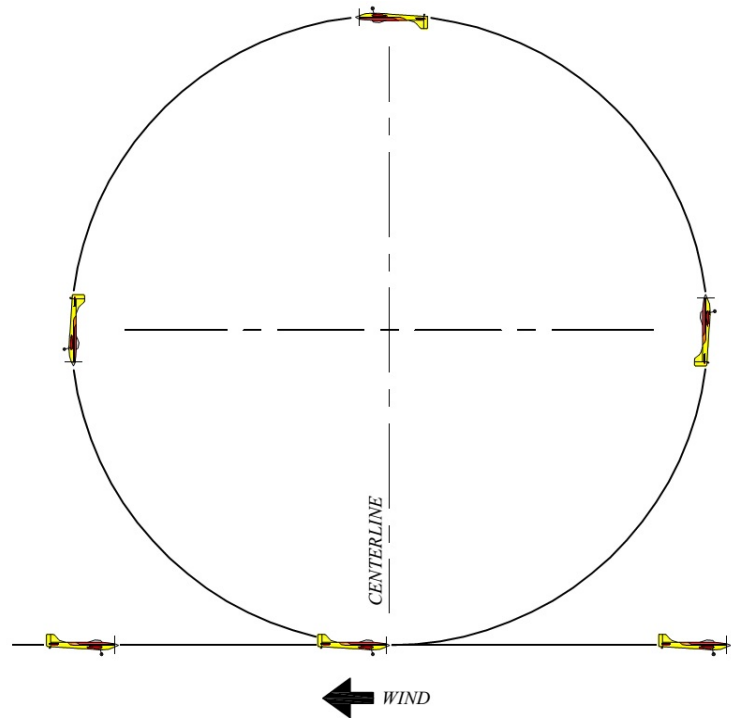
Model rolls at a uniform rate through three (3) complete revolutions in either direction; maneuver takes approximately 5 seconds

Downgrades:

1. Changes in heading during rolls
2. Changes in altitude during rolls
3. Roll rate not constant
4. Model does not do exactly three rolls
5. Maneuver takes less than 4 or more than 6 seconds

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### 3 INSIDE LOOPS



1978-79 FAI K=2

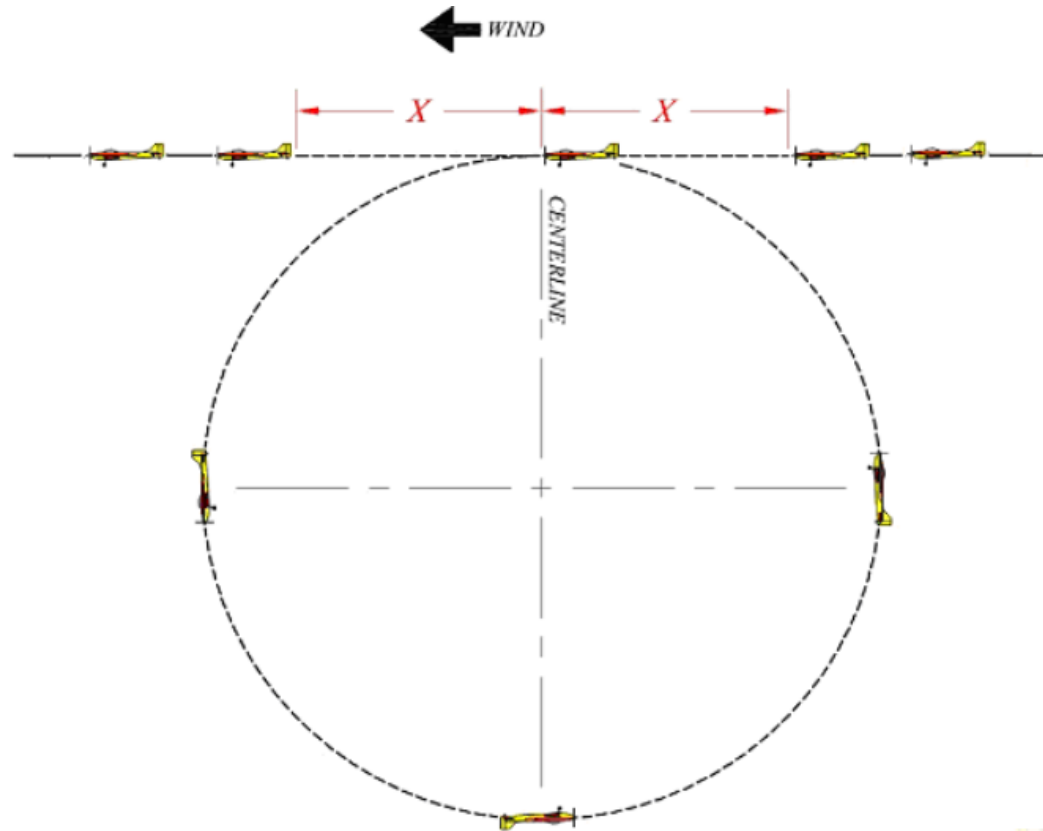
Model pulls up and executes three (3) consecutive loops; all loops shall be round and superimposed.

Downgrades

1. Loops not round
2. Loops not Superimposed
3. Wings not level during loops
4. Changes in heading during loops

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### 3 OUTSIDE LOOPS



**1978-79 FAI K=2**

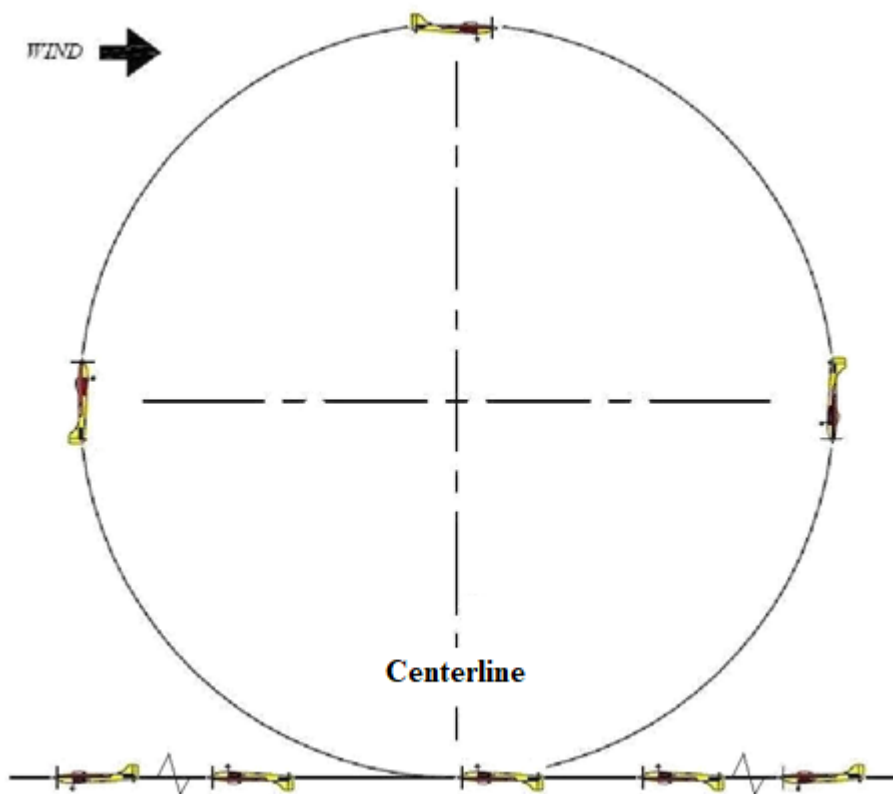
Model pushes over and executes three consecutive outside loops. All Loops should be round and superimposed

Downgrades

4. Loops not round
5. Loops not superimposed
6. Wings not level during loops
7. Changes in heading during loops

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### 3 REVERSE OUTSIDE LOOPS



#### 1978-79 FAI K=3

Model half rolls to inverted, pauses for approximately one (1) second and pushes up to execute three consecutive outside loops, pauses for approximately one (1) second then half rolls to level flight; all loops to be round and superimposed.

Downgrades:

1. Loops not round.
2. Loops not superimposed.
3. Changes in heading during loops and rolls.
4. Wings not level during loops.
5. Model pauses more than one second before and after loops.

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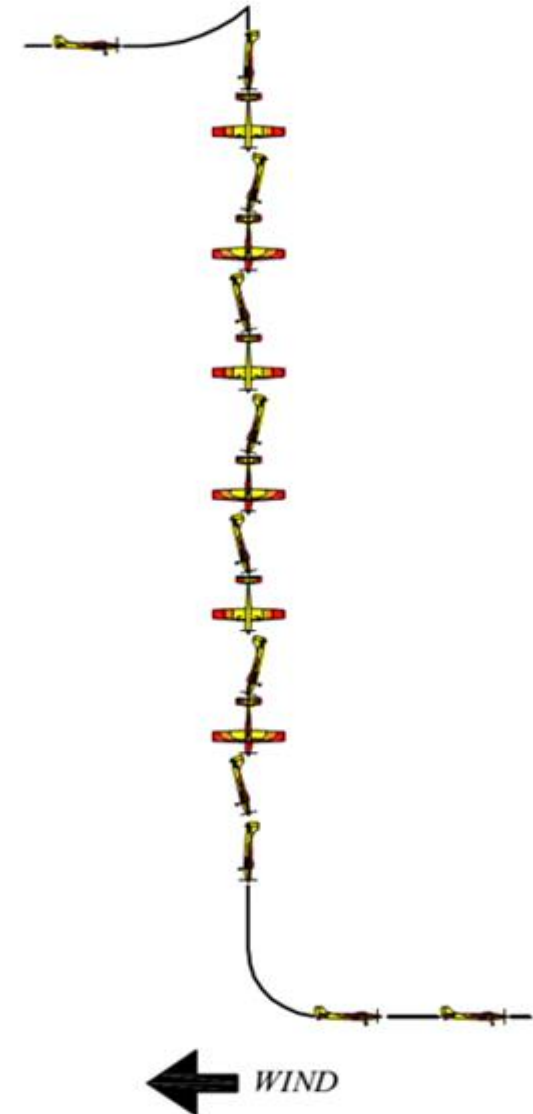
### 3 TURN SPIN

1978-79 FAI K=2

The model establishes a heading, power is reduced, the model is held in a slightly nose high attitude until it stalls and commences to spin. The model will autorotate through three (3) complete turns and recover on the same heading but at a different altitude.

Downgrades:

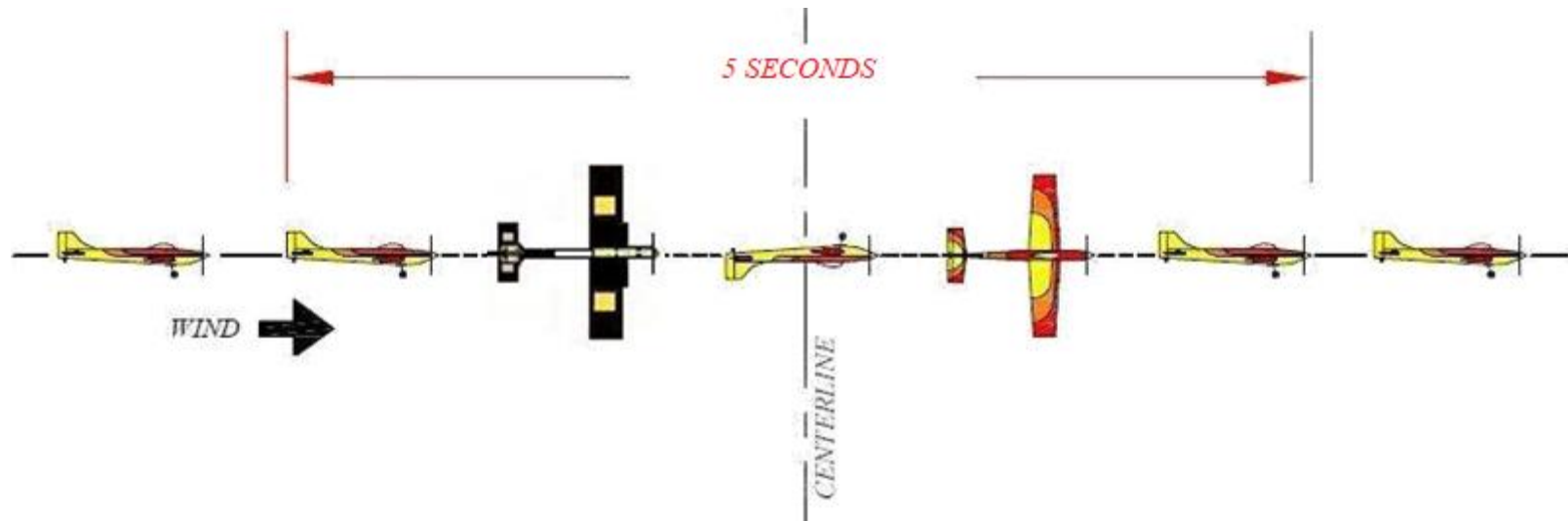
1. Entry not level
2. Does not make three turns; less than two or more than four score zero.
3. Does not finish on same heading
4. Wings not level during recovery
5. Spiral dive scores zero.



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## 4 POINT ROLL



1978-79 FAI K=4

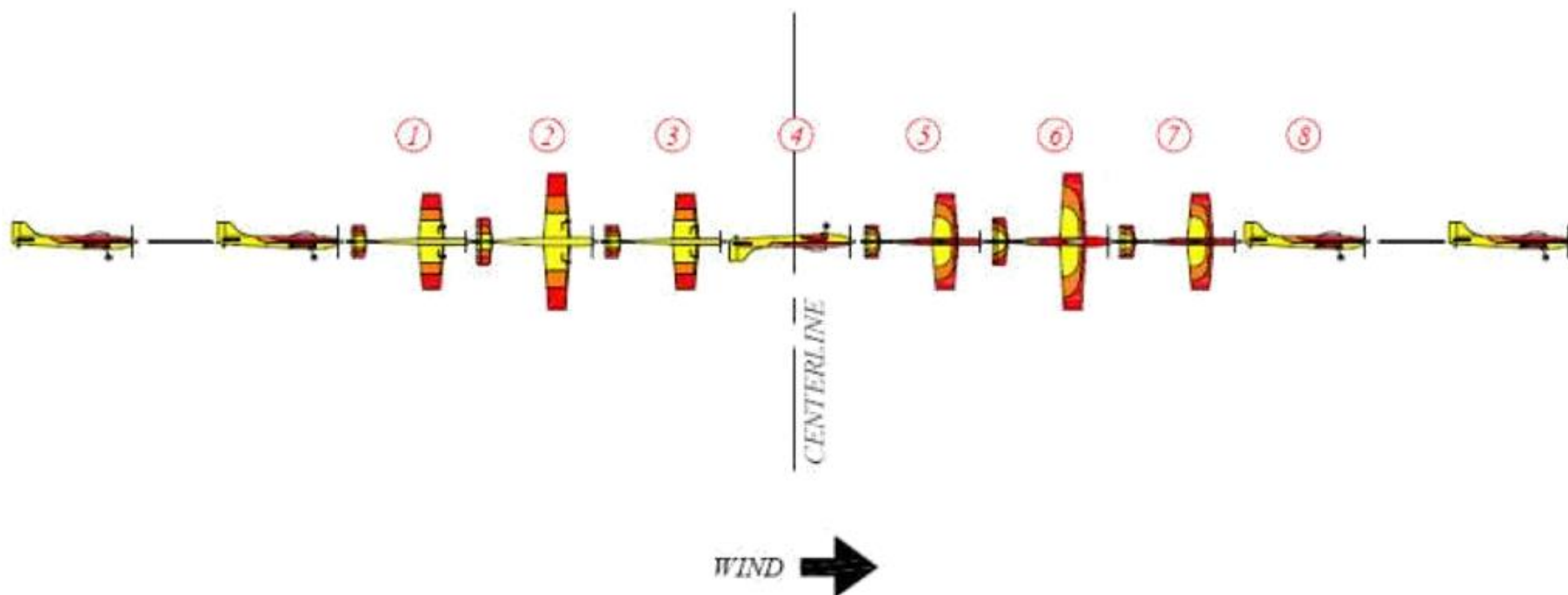
Model rolls through 360 degrees, hesitating at each 90 degree point; at each hesitation the wings are parallel or vertical to the horizon; maneuver takes approximately 5 seconds.

Downgrades:

1.  $\frac{1}{4}$  rolls less than 90 degrees.
2. Model does not hesitate after each  $\frac{1}{4}$  roll.
3. Roll rate not constant.
4. Roll takes less than 4 or more than 6 seconds.
5. Changes in altitude.

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## 8 POINT ROLL



**1978-79 FAI K=4**

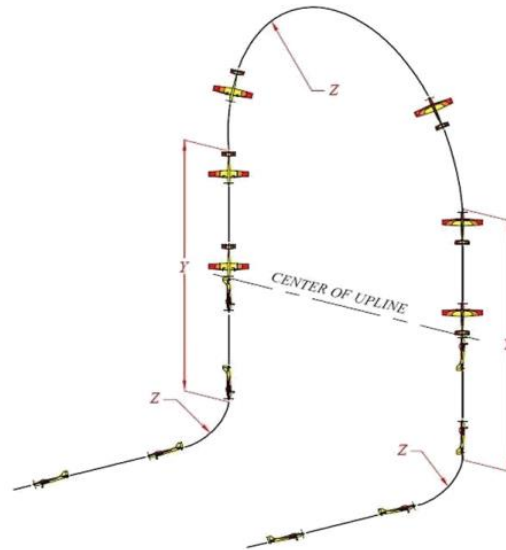
Model rolls through 360 degrees hesitating at each 45-degree point; the wings should be parallel, vertical to or 45 degrees to the horizon; maneuvers to take approximately 5 seconds.

Downgrades:

1. 1/8 rolls more or less than 45 degrees.
2. Model does not hesitate after each 45 degrees.
3. Roll rates are not constant.
4. Roll takes less than 4 or more than 6 seconds.

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## 180 DEGREE TURN



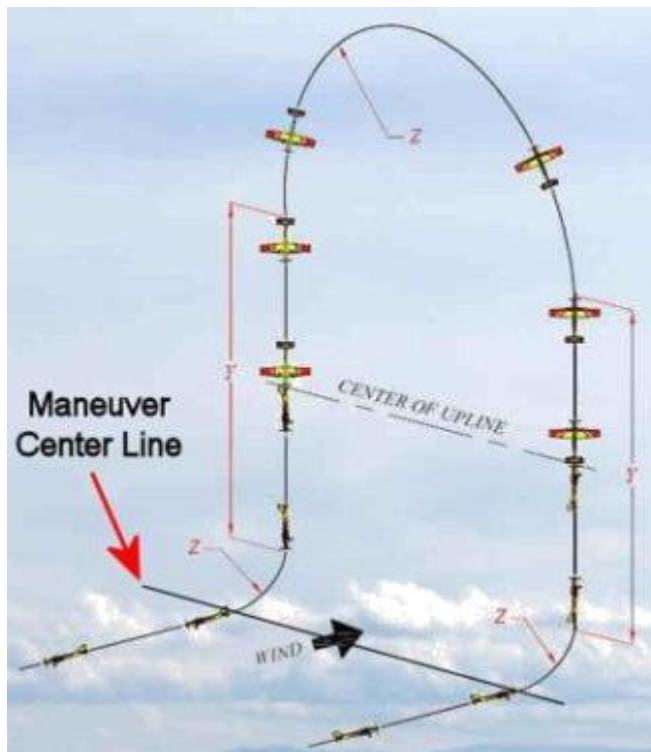
**1970 AMA K=3**

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:

1. Entry not straight and level
2. Pull up is not to exact vertical climb
3. Roll is more or less than 90 degrees
4. Path of roll is not straight vertical line
5. Half outside loop deviates left or right
6. Half hoop is not smooth and round
7. Second 90-degree roll path is not straight vertical line
8. Pull out to level flight is sudden or jerky
9. Pull out is not to same altitude and 180 degrees opposite heading
10. Plane fails to perform straight and level flight at end of maneuver

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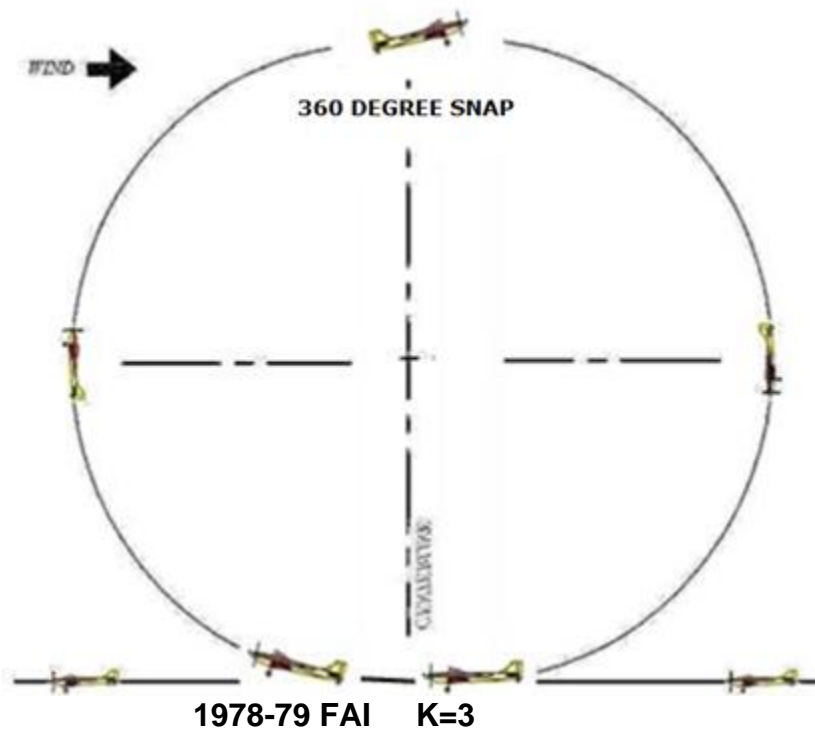
## 180-deg Turn, added March 23, 2009

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 was 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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# AVALANCHE



Model pulls up and completes a half loop, at the top it executes a complete snap roll \*\*, recovers and does another half loop to finish in level flight.

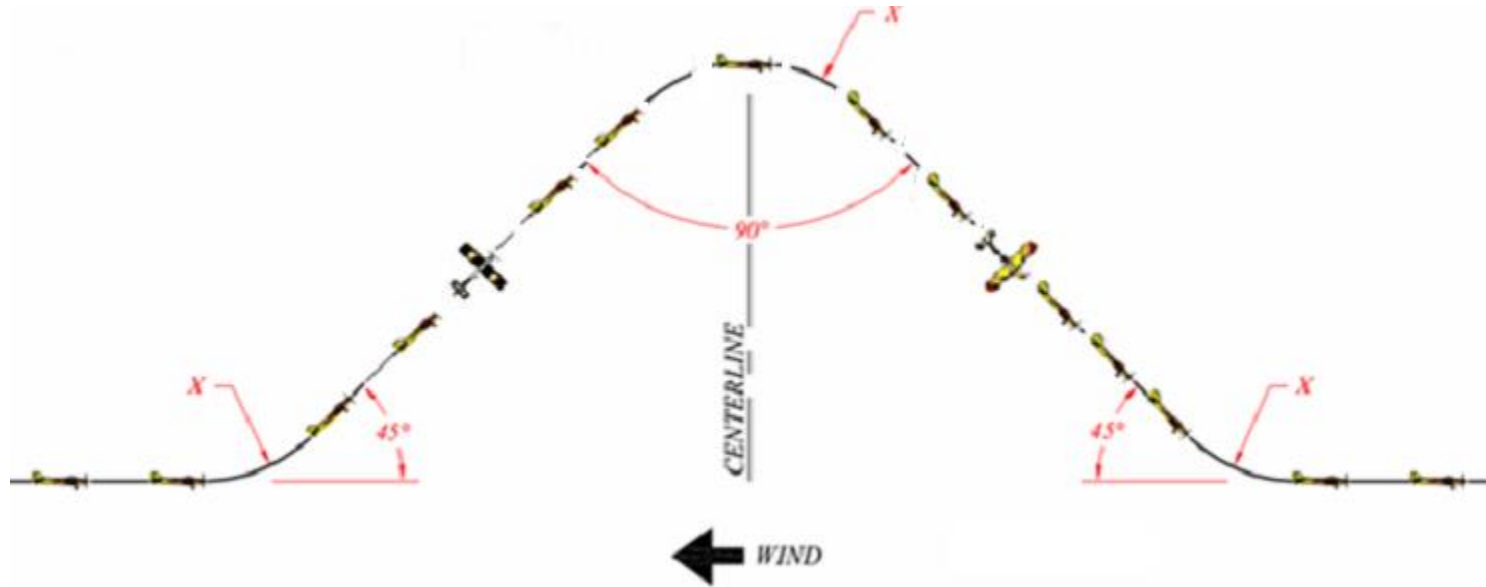
Downgrades:

1. Loop not round.
2. Changes in heading during loop.
3. Wings not level during loop.
4. Snap roll not 360 degrees.
5. Roll not snap roll.

**\*\* A snap roll is autorotation in the horizontal axis; the plane rolls very rapidly with a nose-high attitude; if the plane rolls along its axis it is not a snap roll.**

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## COBRA ROLL WITH FULL ROLLS



1970 AMA K=3

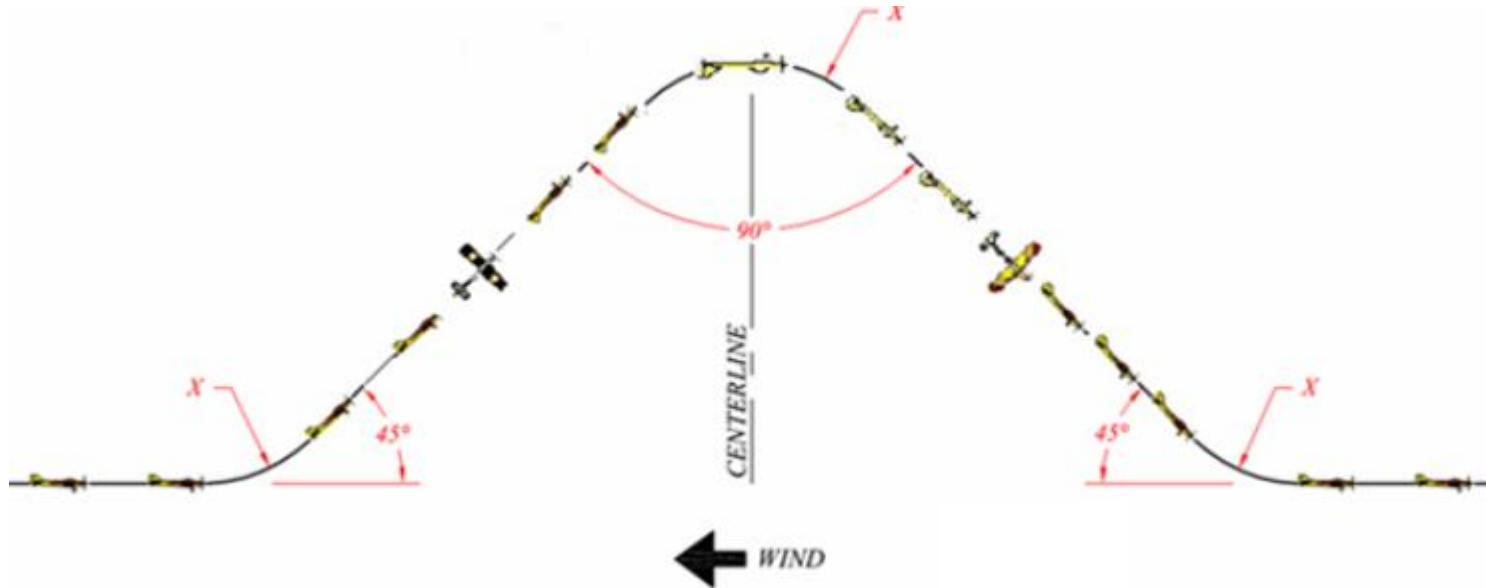
From upright, straight and level flight, the plane pulls up into a 45 degree climb, performs one complete roll at a moderate rate, continues the 45-degree climb for a moment, goes over the top in what amounts to one-quarter of an outside loop and heads down at a 45 degree angle. Another complete roll, 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.

Downgrades:

1. Entry is not straight and level.
2. Climb is not at 45 degrees to ground.
3. Roll path traced out by the model is not a straight line (i.e., planes barrel rolls or suffers changes in heading) continuing in 45 degree climb.
4. No momentary straight flight between first roll and  $\frac{1}{4}$  outside 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 1/2 ROLLS



1978-79 FAI K=2

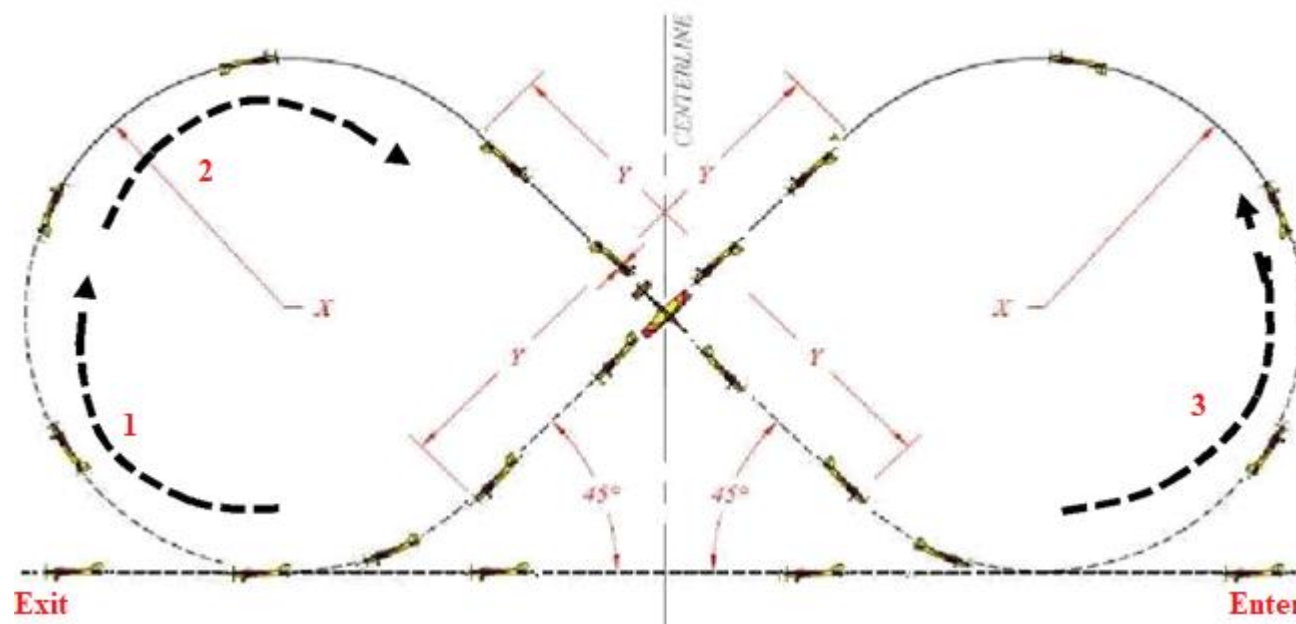
Model pulls up to a 45-degree angle, half rolls to inverted attitude, executes a 1/4 loop, half rolls to upright attitude and recovers in level flight.

Downgrades:

1. Initial climb is not 45 degrees.
2. Rolls not 180 degrees.
3. 1/4 loop not 90 degrees.
4. Descent not at 45 degrees.
5. Changes in heading during rolls and 1/4 loop.

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## CUBAN EIGHT



1978-79 FAI K=2

Model pulls up and executes an inside loop, when at 45 degrees inverted model does a half roll, followed by another inside loop, again when 45 degrees inverted the model does another half roll and recovers to level flight.

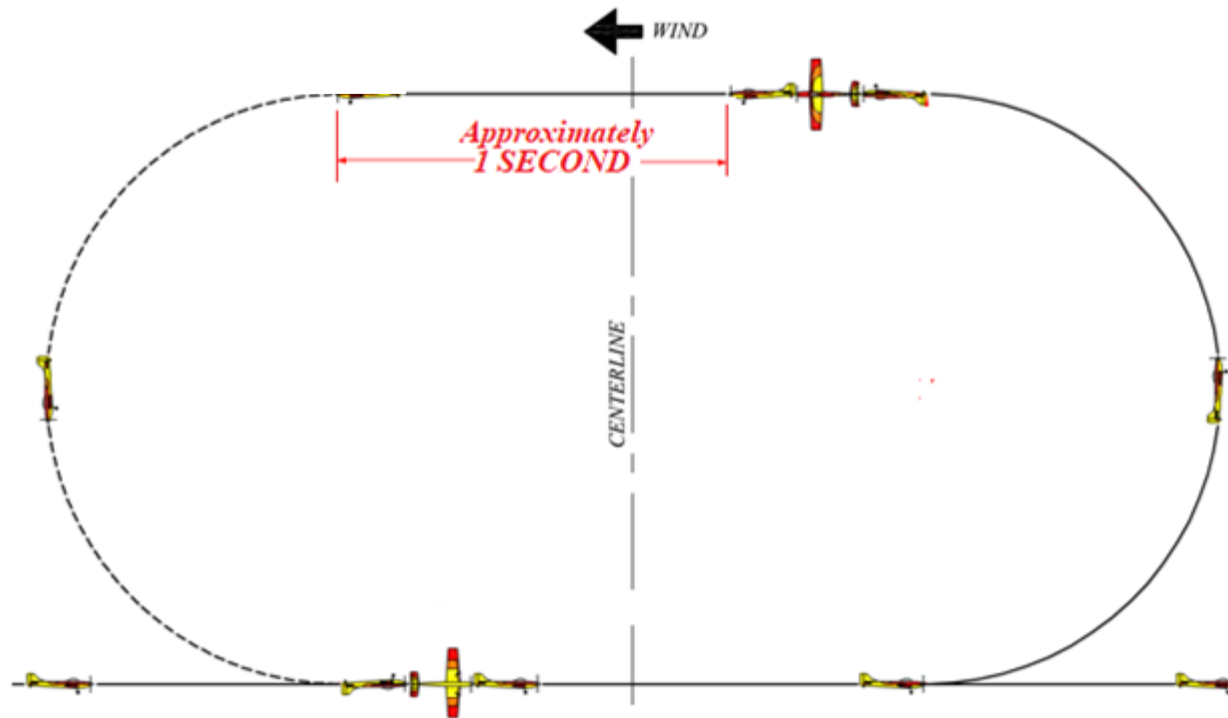
Downgrades:

1. Loops not round and same size.
2. Model not at 45 degrees before commencement of rolls.
3. Changes in heading in loops or rolls.
4. Rolls do not cross over at same point.

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## DOUBLE IMMELMANN



1978-79 FAI K=2

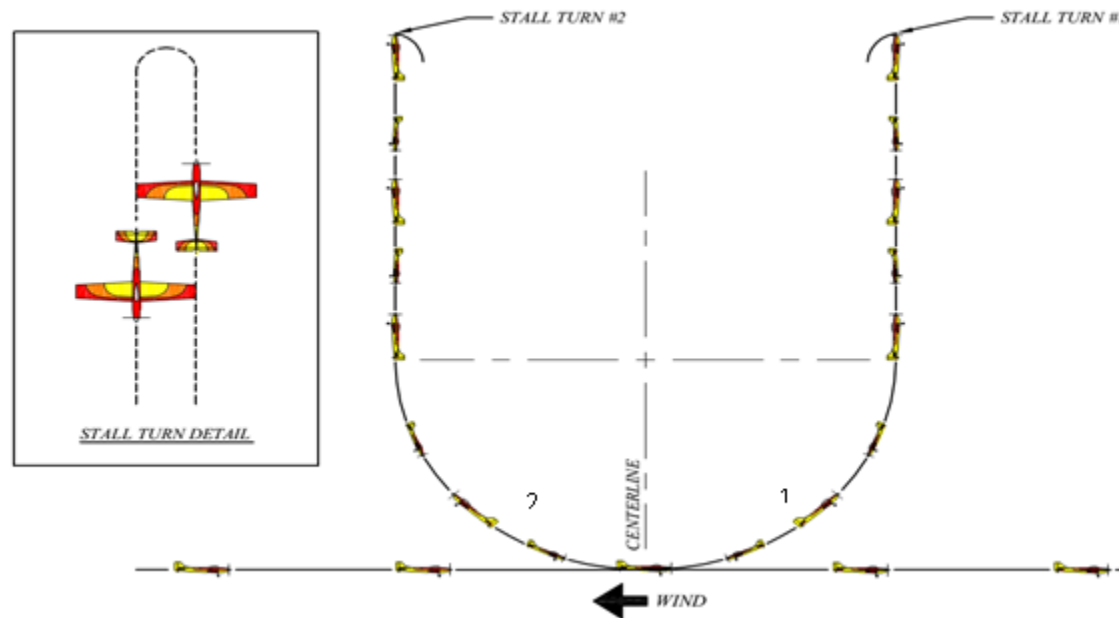
Model pulls up into a half inside loop, half rolls to upright, flies straight and level for approximately one second, does a half outside loop and half rolls to level flight.

Downgrades:

1. Half loops deviate left or right.
2. Half rolls not immediately after half loops.
3. Half rolls deviate left or right.
4. Model pauses more than one second before half outside loop.
5. Half loops not at same altitude.

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## DOUBLE STALL TURN



1978-79 AMA K=3

The model begins by performing a Stall Turn, as described above\*. At the bottom of the pull-out, the plane pulls up, thus completing half of an inside loop, at which point a second Stall Turn is executed, followed by a quarter-loop pull-out. The two Stall Turns shall be performed in opposite directions with regard to the ground.

Downgrades:

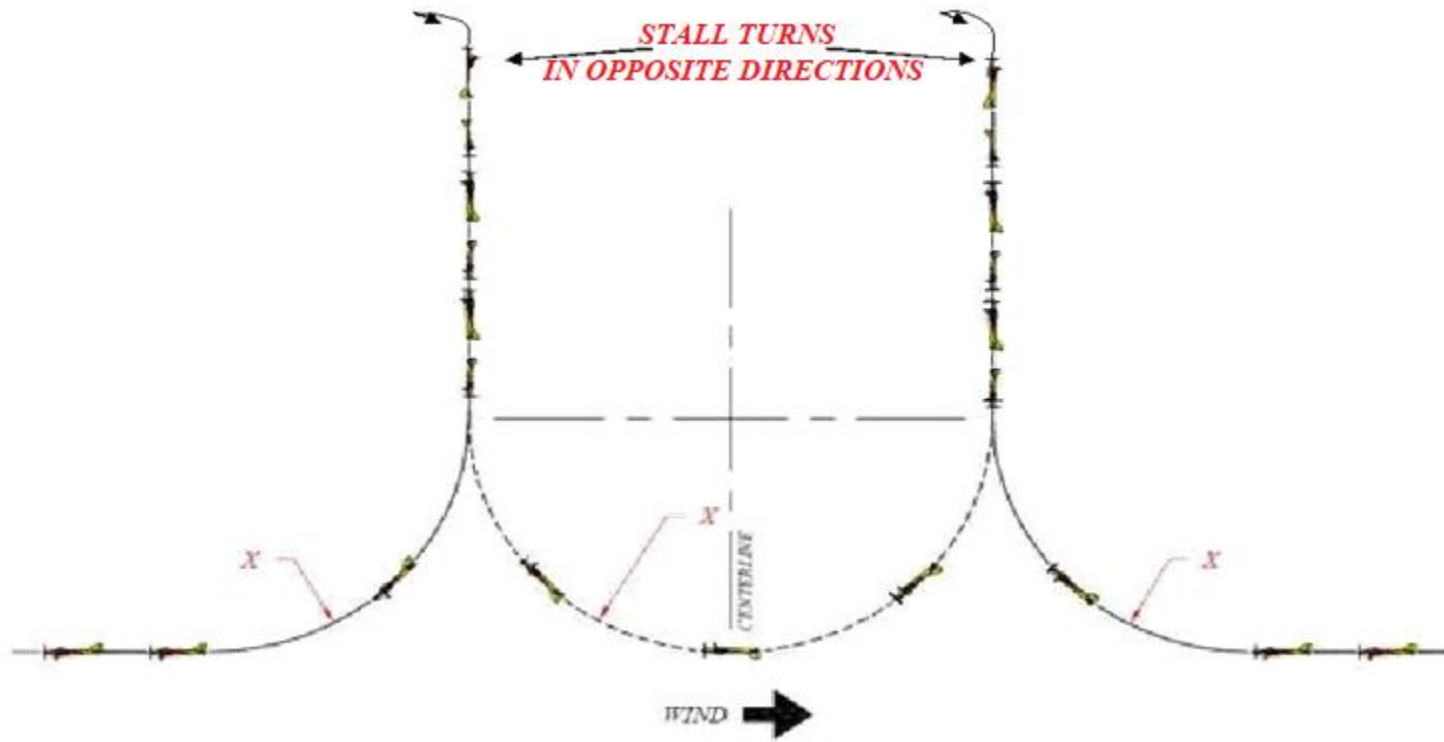
1. Model not flying straight and level at beginning and end of maneuver.
2. Model does not become exactly vertical at points of turn.
3. Half-inside-loop not round and consistent in heading.
4. Bottom part of loop not at same altitude as entry and finish.
5. Model turns left or right during pull-ups.
6. Does not yaw tightly through 180°.
7. Return paths more than two wingspans from entry path.
8. Return paths not parallel to entry path.
9. Maneuver not finished at same altitude as entry.

\*

This refers to the description of the Stall Turn in the AMA Rule Book; see [Stall Turn](#) elsewhere in this Guide.

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**FIGURE M**



**1978-79 FAI K=3**

Model pulls up into a vertical attitude and executes a 180-degree stall turn\*, in either direction, does a 1/2 outside loop, again executes a stall turn\*, in the opposite direction, and recovers in level flight.

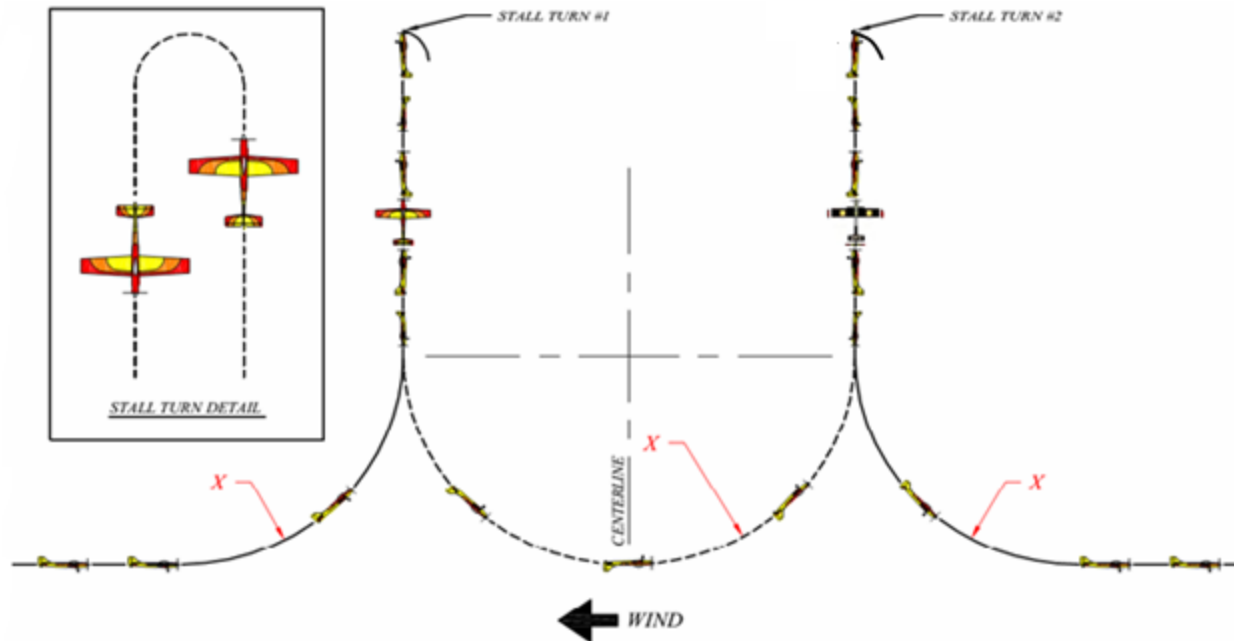
Downgrades:

1. Model not vertical before and after stall turns.
2. Stall turns not 180 degrees.
3. Climbing and diving paths not parallel.
4. Bottom of outside loop at different altitude to entry.
5. Altitude of second stall turn different to first.

\*This refers to the description of the Stall Turn in the AMA Rule Book; see [Stall Turn](#) elsewhere in this Guide.

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## FIGURE M WITH ½ ROLLS



1978-79 FAI K=5

Model pulls up into a vertical attitude, executes a ½ roll, a stall turn\* through 180 degrees, another ½ roll. Then executes a half inverted loop, followed by a third ½ roll, second stall turn\* and a fourth ¼ roll, recovering in level flight. The rolls may be in any direction but the stall turns must be in opposite directions. Viewed from the side, the model executes a figure M.

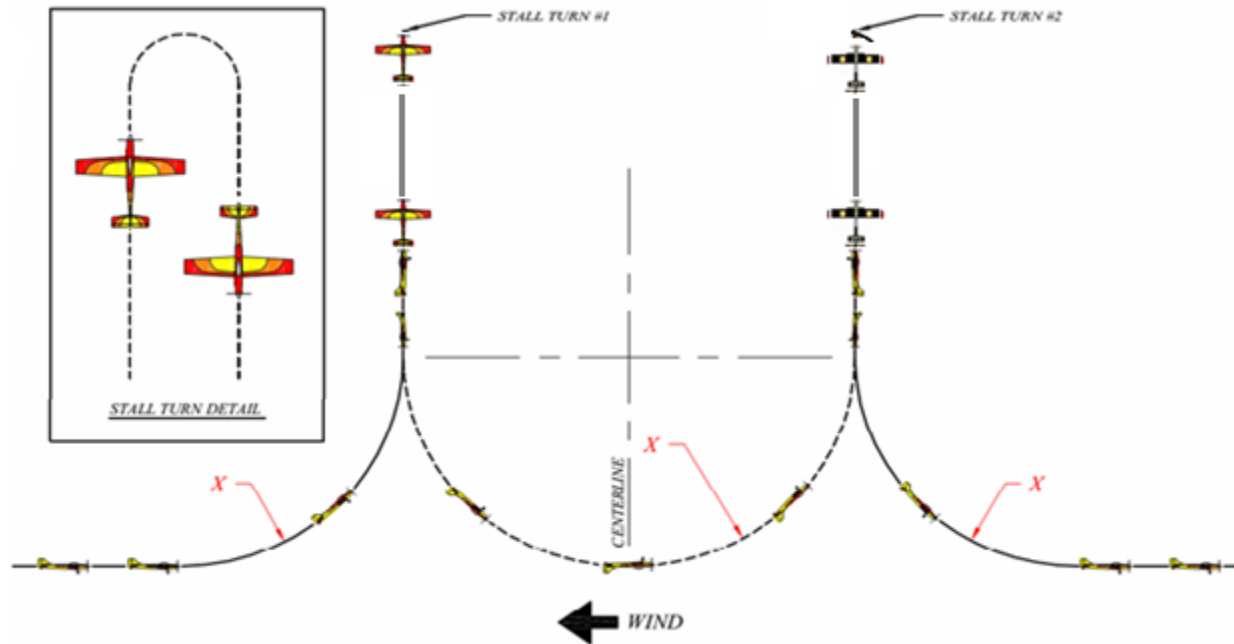
Downgrades:

1. Model not vertical at start and finish of rolls and stall turns.
2. Stall turns not exactly 180 degrees.
3. ½ rolls not exactly 180 degrees.
4. Bottom of outside loop not level with entry.
5. Changes in heading during ½ outside loop or rolls.

\*This refers to the description of the Stall Turn in the AMA Rule Book; see [Stall Turn](#) elsewhere in this Guide.

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## FIGURE M WITH ¼ ROLLS



1978-79 FAI K=5

Model pulls up into a vertical attitude, executes a ¼ roll, stall turns\* through 180 degrees, ¼ turns again in the same direction as the first roll, does a ½ outside loop to a vertical attitude again, ¼ rolls in the same direction as the first two, does an inverted stall turn\* through 180 degrees, ¼ rolls in the same direction as the other three and recovers to level flight. Viewed from the side, the model executes a figure M.

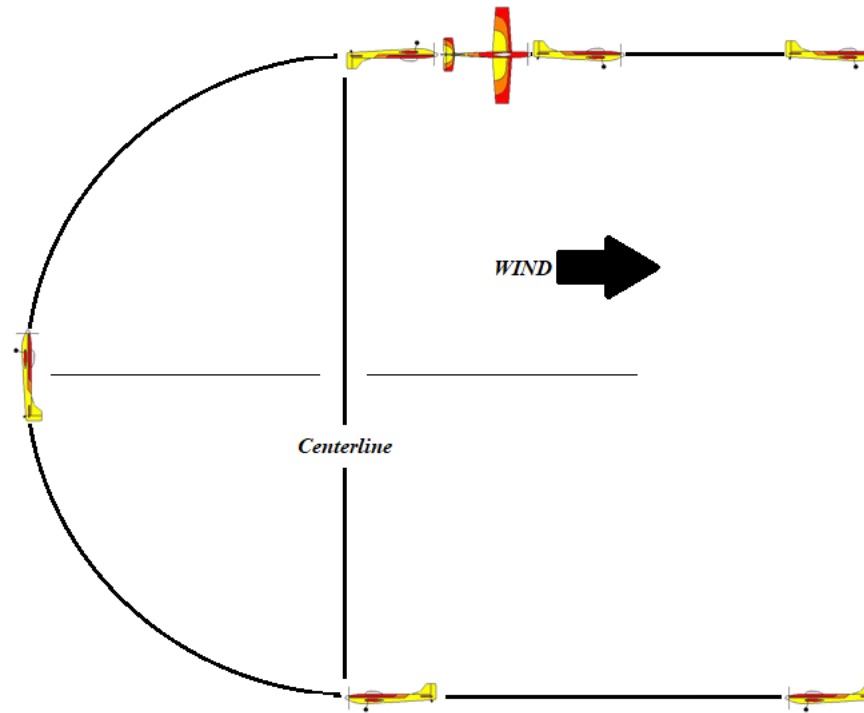
Downgrades:

1. Model not vertical at start and finish of rolls and stall turns.
2. Stall turns not 180 degrees.
3. ¼ rolls not exactly 90 degrees.
4. Bottom of outside loop not level with entry.
5. Changes in heading during ½ outside loop or rolls.
6. Stall turns not at same altitude.

\*This refers to the description of the Stall Turn in the AMA Rule Book; see [Stall Turn](#) elsewhere in this Guide.

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## IMMELMANN TURN



1978-79 AMA K=2

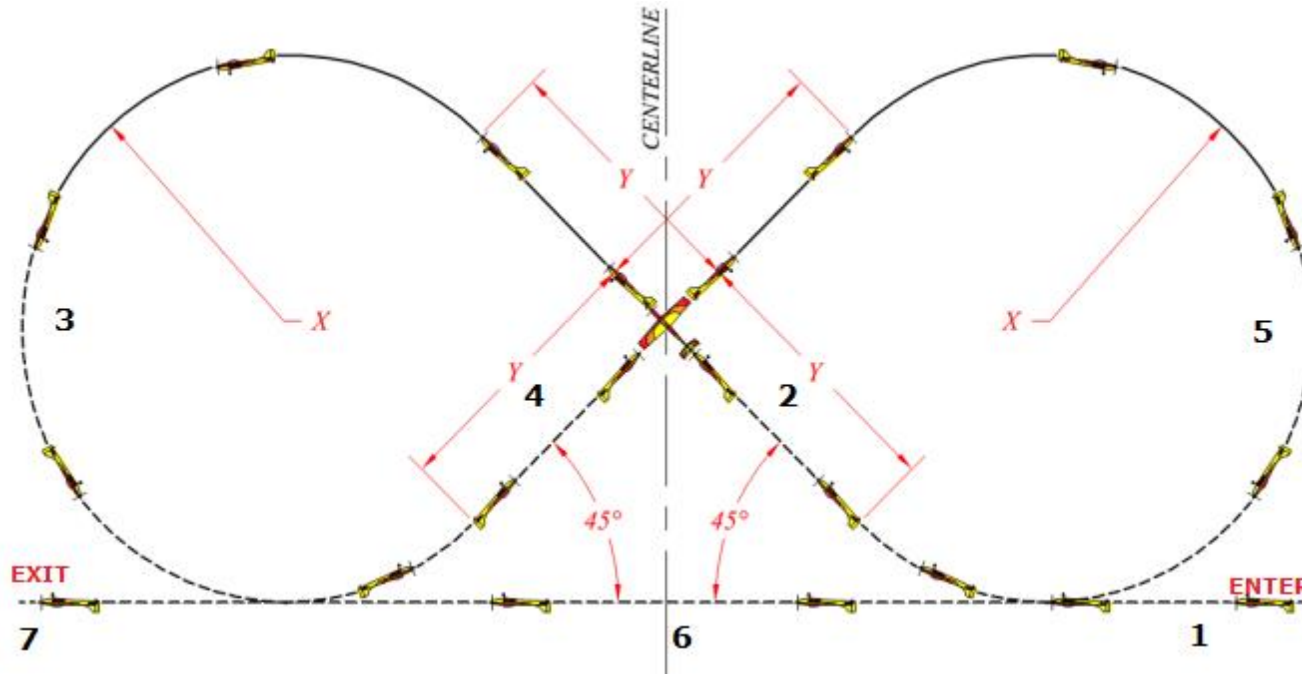
The model starts the Immelmann flying straight and level, pulls up into a half loop followed by a half roll and finishes flying straight and level exactly 180° from the heading at entry.

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 straight line during roll.
6. Model does not finish in level flight.
7. Model heading does not finish exactly opposite the direction of entry.

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## INVERTED REVERSE CUBAN EIGHT



1970 AMA K=3

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 of first loop.
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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## INVERTED (3 TURN) SPIN

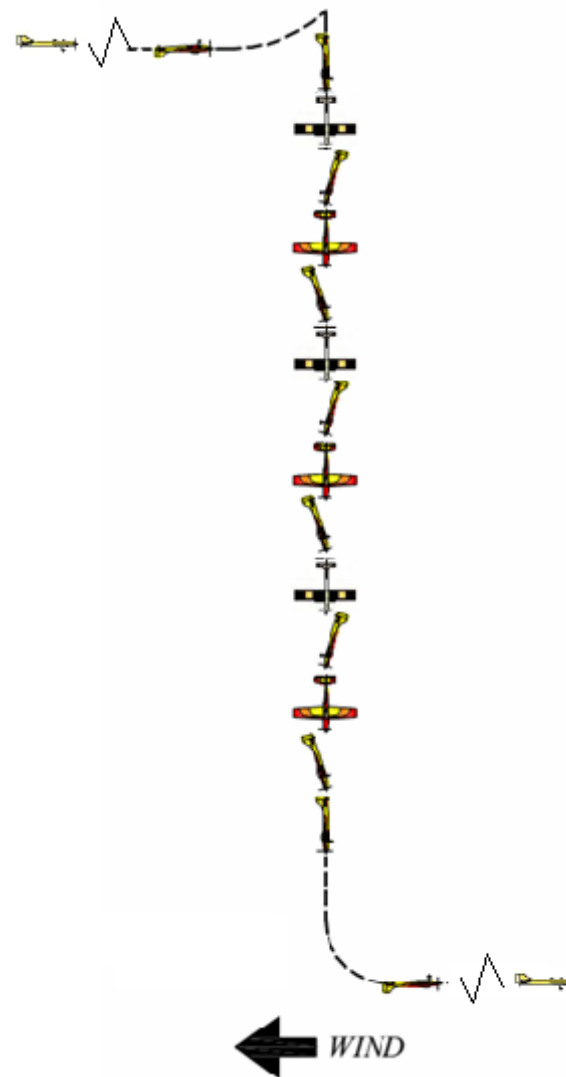
1978-79 FAI K=3

Model establishes a heading, half rolls to inverted, power is reduced, the model is held in a nose high until it stalls and commences to spin. The model will auto-rotate through three (3) complete turns and recover on the same heading at a different altitude, then half rolls to an upright position.

Downgrades:

1.  $\frac{1}{2}$  rolls not level.
2.  $\frac{1}{2}$  rolls not 180 degrees.
3. Wings not level during entry and exit.
4. Spiral dive scores zero.
5. Does not finish on same heading.
6. Does not make three (3) turns; less than 2 or more than 4 score zero.

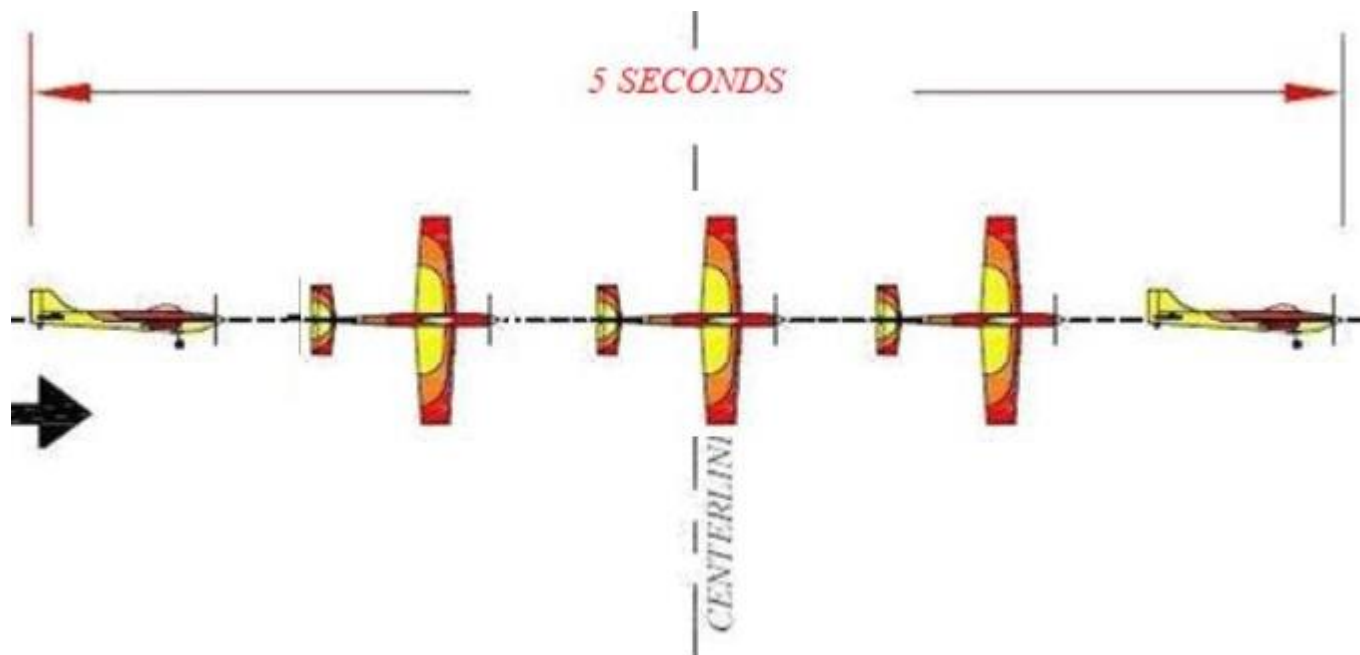
*If initial entry to a spin is not smooth, or the spin itself is jerky and uncertain this is **NOT** a reason for downgrading, it is an indication that the spin is a true spin. A spiral dive is indicated by its smoothness and increasing airspeed; during a spin the airspeed does not increase appreciably.*



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## KNIFE EDGE FLIGHT



**1970 AMA K=3**

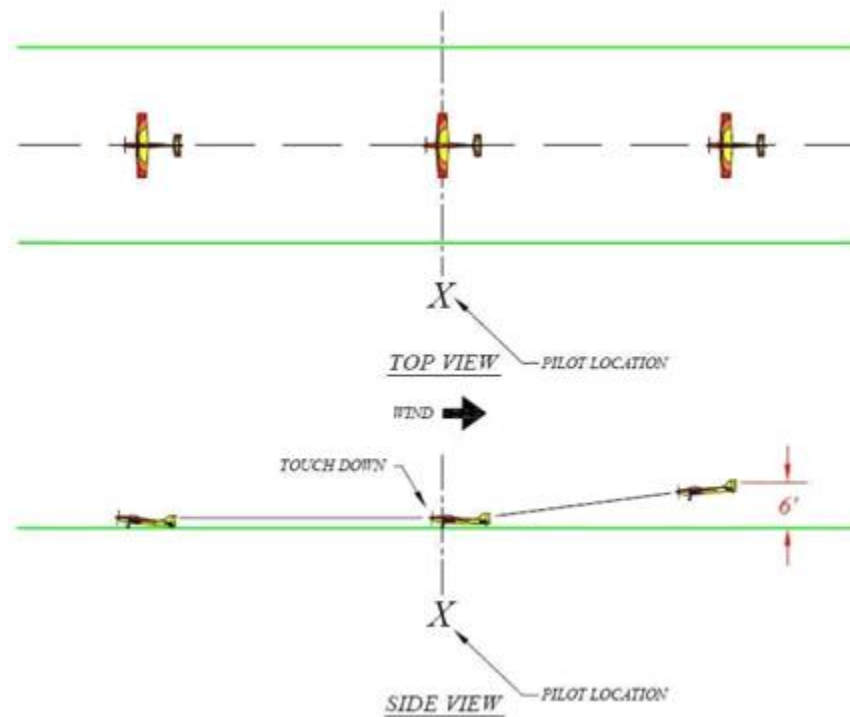
From straight and level flight path, model does a quarter roll (90 degrees) in either direction and hold this attitude for three full seconds. Model is then rolled back in the opposite direction to level, upright flight.

### Downgrades:

1. Model not level at start of roll.
2. The path traced by the model is not a straight line.
3. The axis of the fuselage veers out too much of an angle to the flight path.
4. Knife edge attitude not held for at least three seconds.
5. Wings not exactly vertical throughout the three seconds of knife edge flight.
6. Plane changes altitude or heading.
7. Recovery roll is in same direction as entry roll, zero points
8. Plane fails to do level flight after recovery roll.

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## LANDING PERFECTION



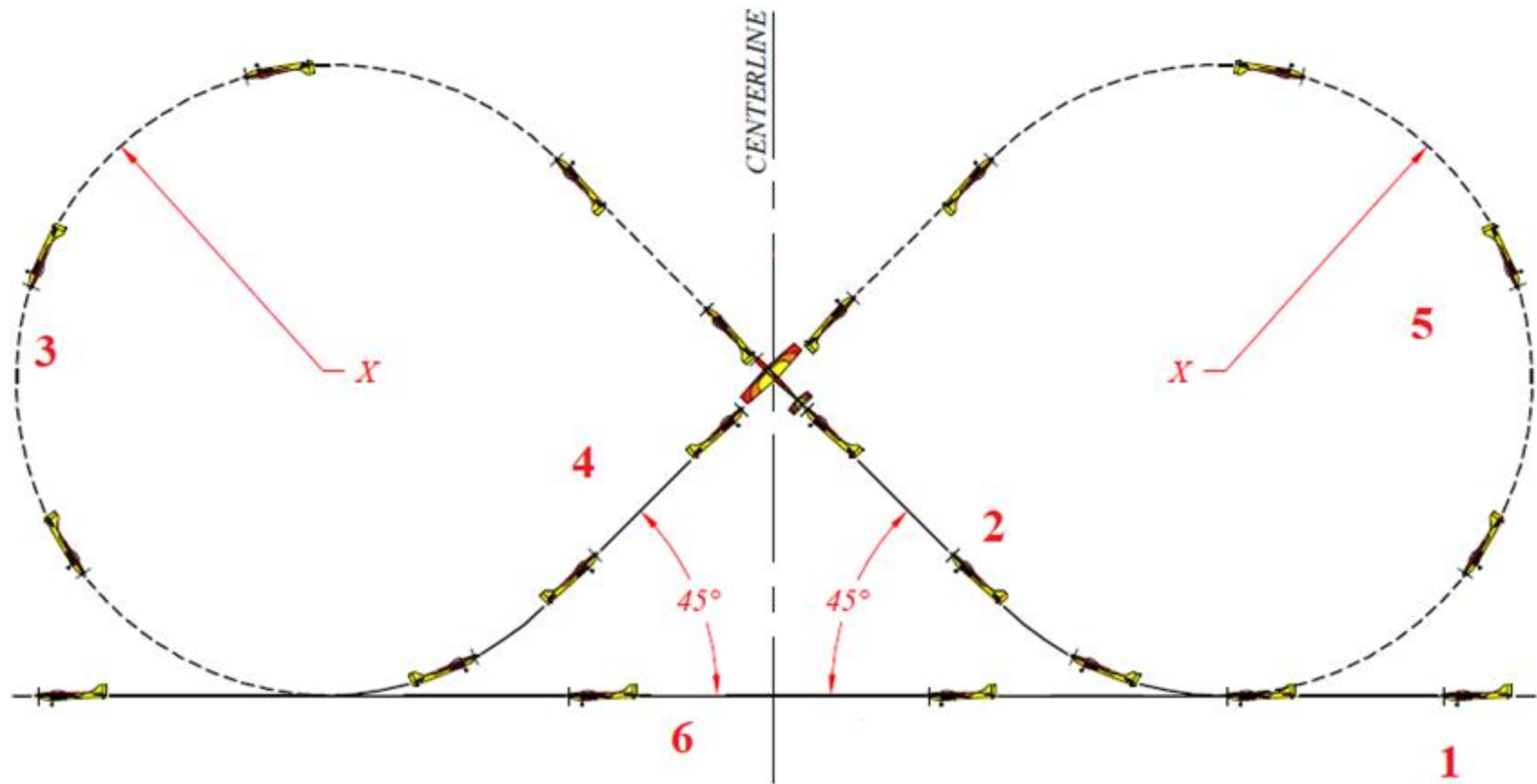
**NO REFERENCE K=1**

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 necessary to avoid running off the runway may be excused if wind direction and spot location are adverse.
6. All landings judged only for 50 feet after touchdown.

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## REVERSE CUBAN 8



1978-79 FAI K=2

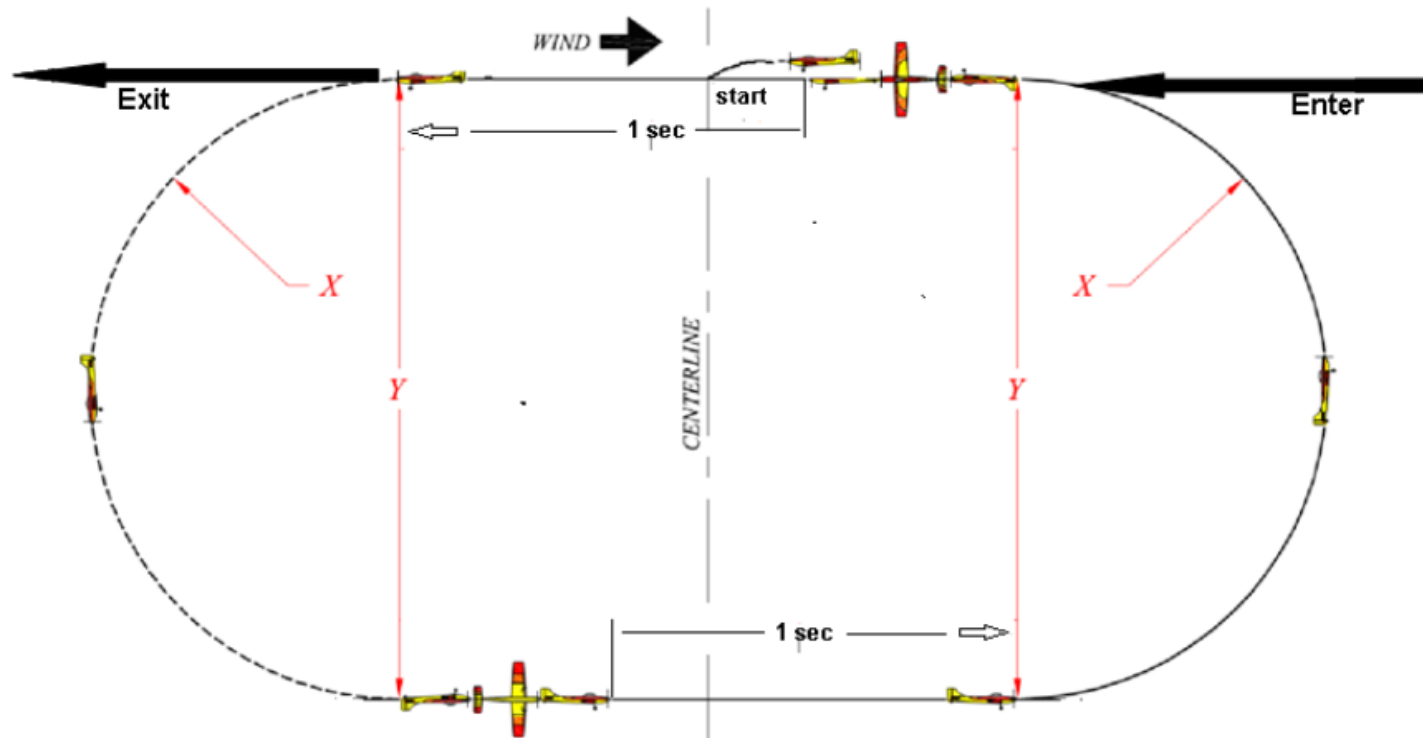
Model pulls up into a 45 degree climb, half rolls, executes a  $\frac{3}{4}$  loop, half rolls to inverted and loops back to level flight at the same point as entry.

Downgrades:

1. Loops not round and same size.
2. Model not at 45 degrees at commencement of rolls.
3. Changes in heading during loops and rolls.

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## REVERSE DOUBLE IMMELMANN



**1978-79 FAI K=2**

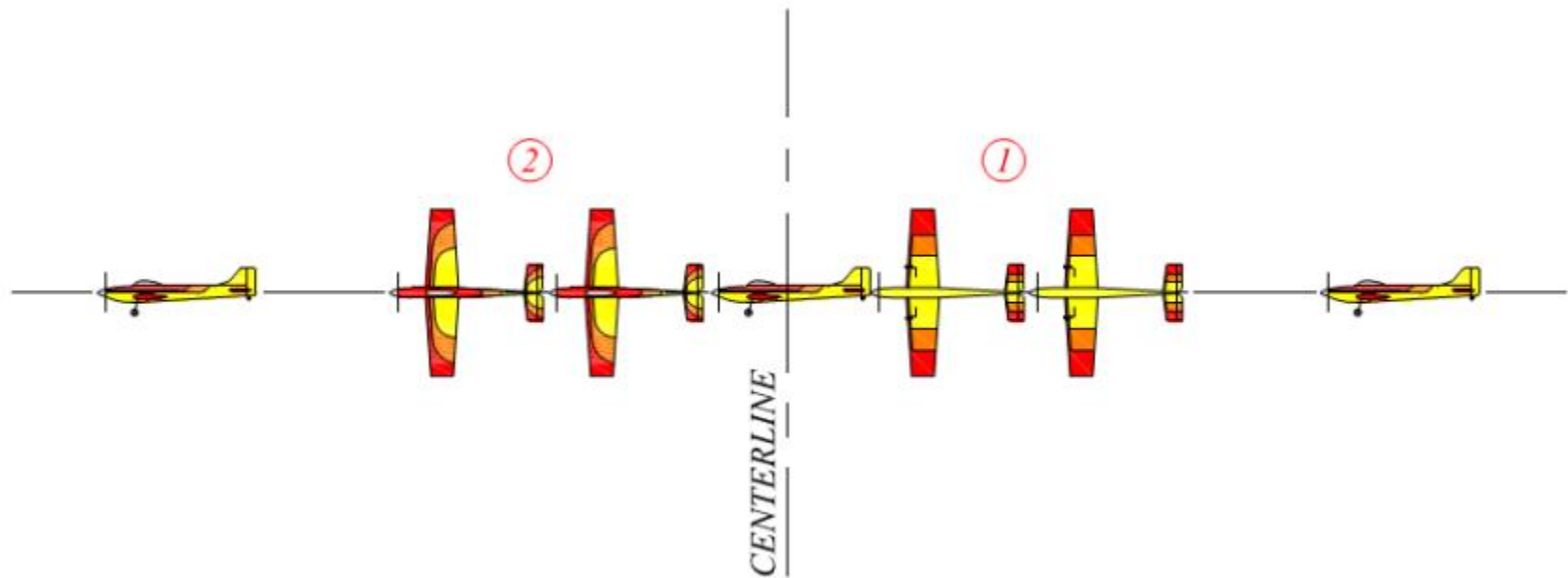
Model pushes over and executes  $\frac{1}{2}$  outside loop followed immediately by a  $\frac{1}{2}$  roll, pauses for approximately one second, does a  $\frac{1}{2}$  loop and immediately  $\frac{1}{2}$  rolls to level flight.

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



**1978-79 FAI K=4**

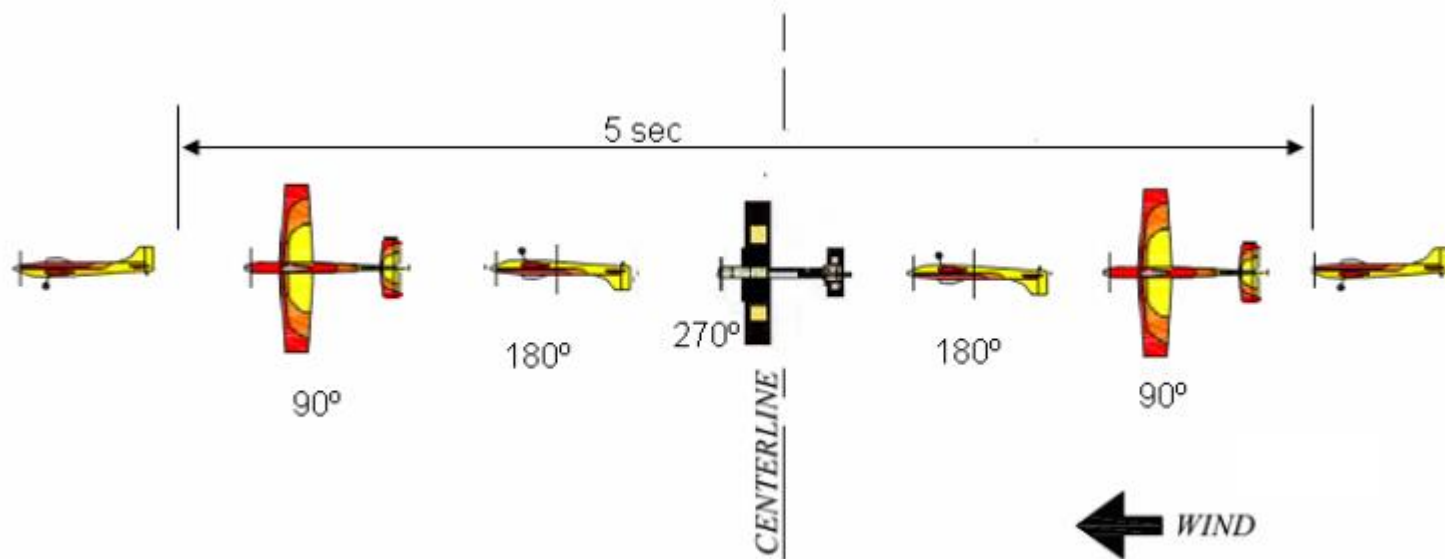
Model rolls 90 degrees and hesitates, then rolls 180 degrees in opposite direction and hesitates, then rolls 90 degrees to finish in level flight. Maneuver takes about 5 seconds.

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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## REVERSE POINT ROLL



**1978-79 FAI K=4**

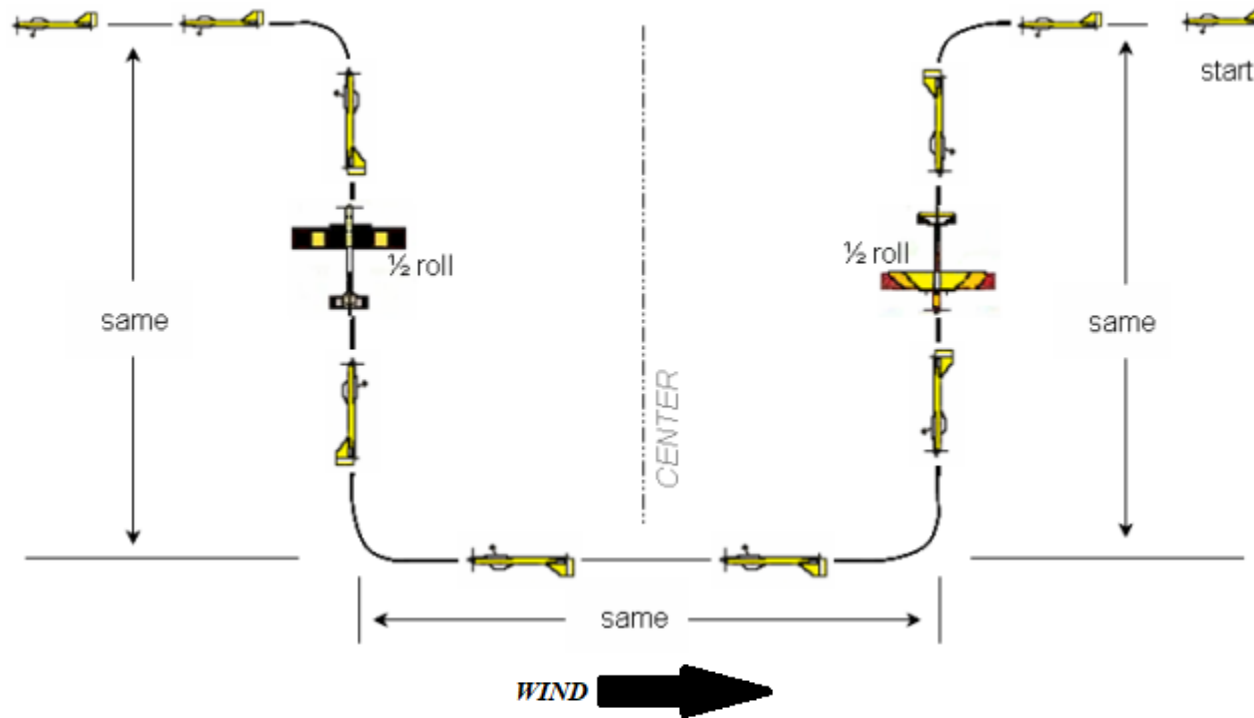
Model rolls through 270 degrees, hesitating at each 90-degree point, then rolls 270 degrees in **opposite** direction, hesitating at each 90-degree point to finish in level flight. Maneuver takes approximately 5 seconds.

Downgrades:

1. 1/4 rolls more or less than 90 degrees.
2. Model does not hesitate at each 90-degree point.
3. Roll rate not constant.
4. Roll takes less than 4 or more than 6 seconds.

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## REVERSE TOP HAT



1978-79 FAI K=4

Model pushes into vertical downward attitude, half rolls and loops to level inverted flight, flies inverted for the same distance as the downward path, loops upward to vertical attitude, half rolls and pushes over to level flight.

Downgrades:

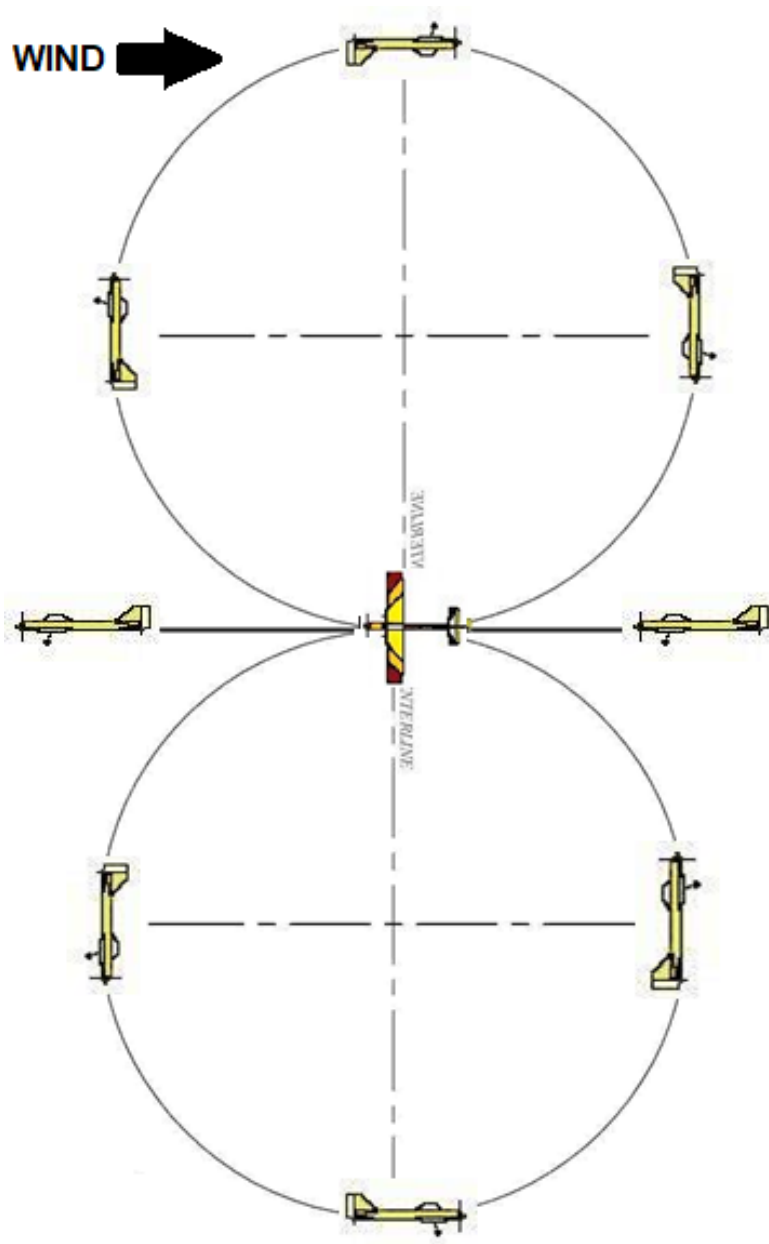
1. Model not vertical at start and finish of half rolls.
2. Rolls not exactly 180 degrees.
3. Model does not fly straight and level inverted.
4. Vertical and horizontal legs not approximately the same length.
5. Rolls not the same length and rate.
6. Changes in heading during maneuver

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# **ROLLING EIGHT**

**1978-79 FAI K=2**





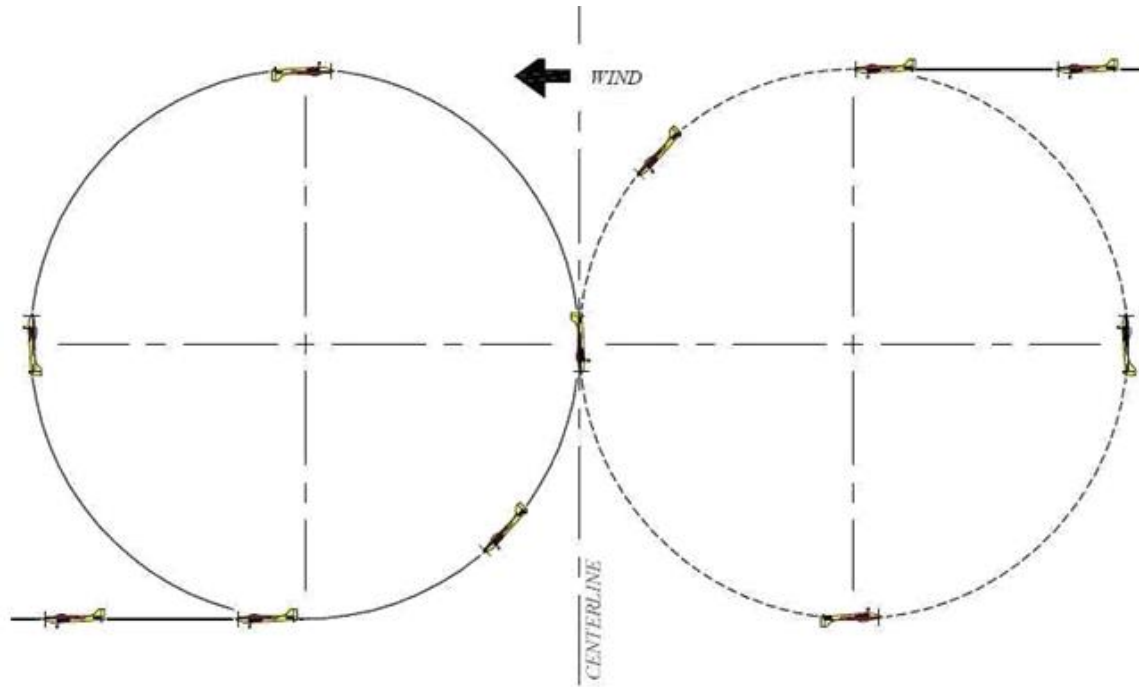
Model pulls up from level flight, completes an inside loop, at the bottom executes a half roll, makes a second inside loop, directly under the first, and half rolls back to level flight.

Downgrades:

1. Loops not round.
2. Second loop not directly under the first.
3. Model not level at start and finish of half rolls
4. Changes in heading during loops.
5. Wings not level during loops.

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## RUNNING EIGHT



### 1978-79 AMA K=2

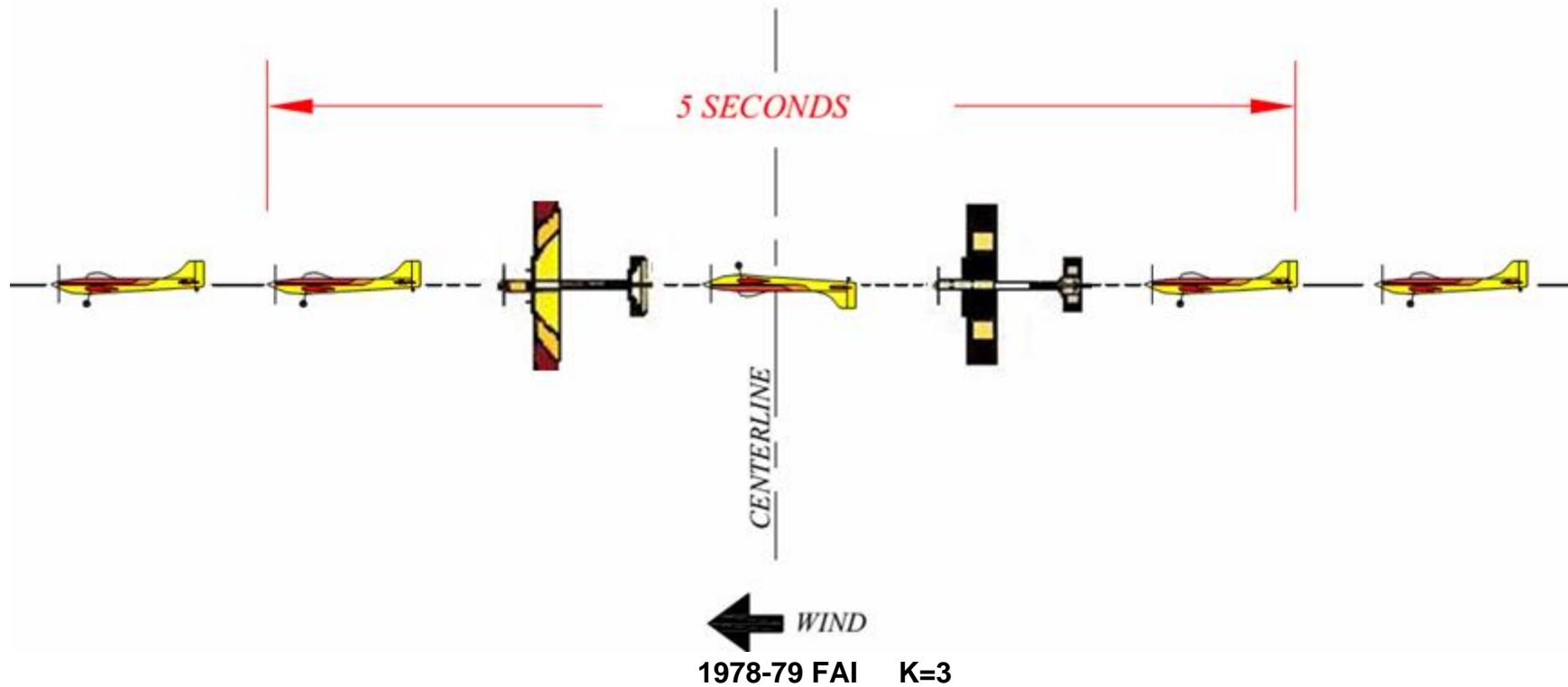
Model starts in level flight and completes 1-1/4 outside loops, model then does 1-1/4 inside loops finishing at bottom. The model passes through the intersection three times, then recovers on the same heading but at a lower altitude than entry.

Downgrades:

1. Model not level at start.
2. First loop not round.
3. First loop deviates left or right.
4. Model does not become vertical at intersection.
5. Second loop not round.
6. Second loop deviates left or tight.
7. Does not become vertical at intersection.
8. Second loop not at same altitude as first loop.
9. Second loop not same diameter as first loop.
10. Second and third intersections do not coincide with first.
11. Model not level at finish of maneuver

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## SLOW ROLL



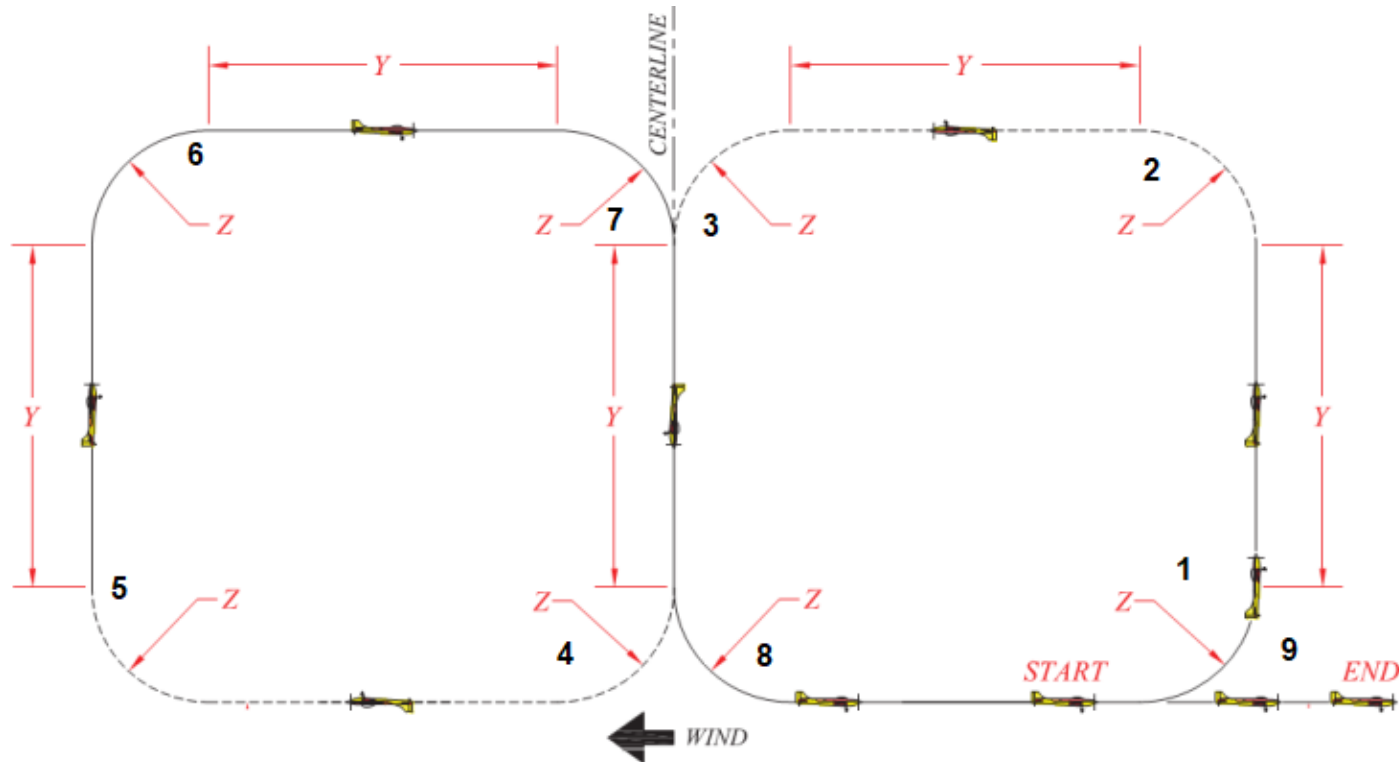
Model rolls slowly through one complete revolution, in either direction; maneuver takes approximately five seconds

Downgrades:

1. Changes in heading.
2. Changes in altitude.
3. Roll rate not constant.
4. Model does not roll exactly 360 degrees.
5. Roll takes less than 4 or more than 6 seconds.

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## SQUARE HORIZONTAL EIGHT



1978-79 FAI K=4

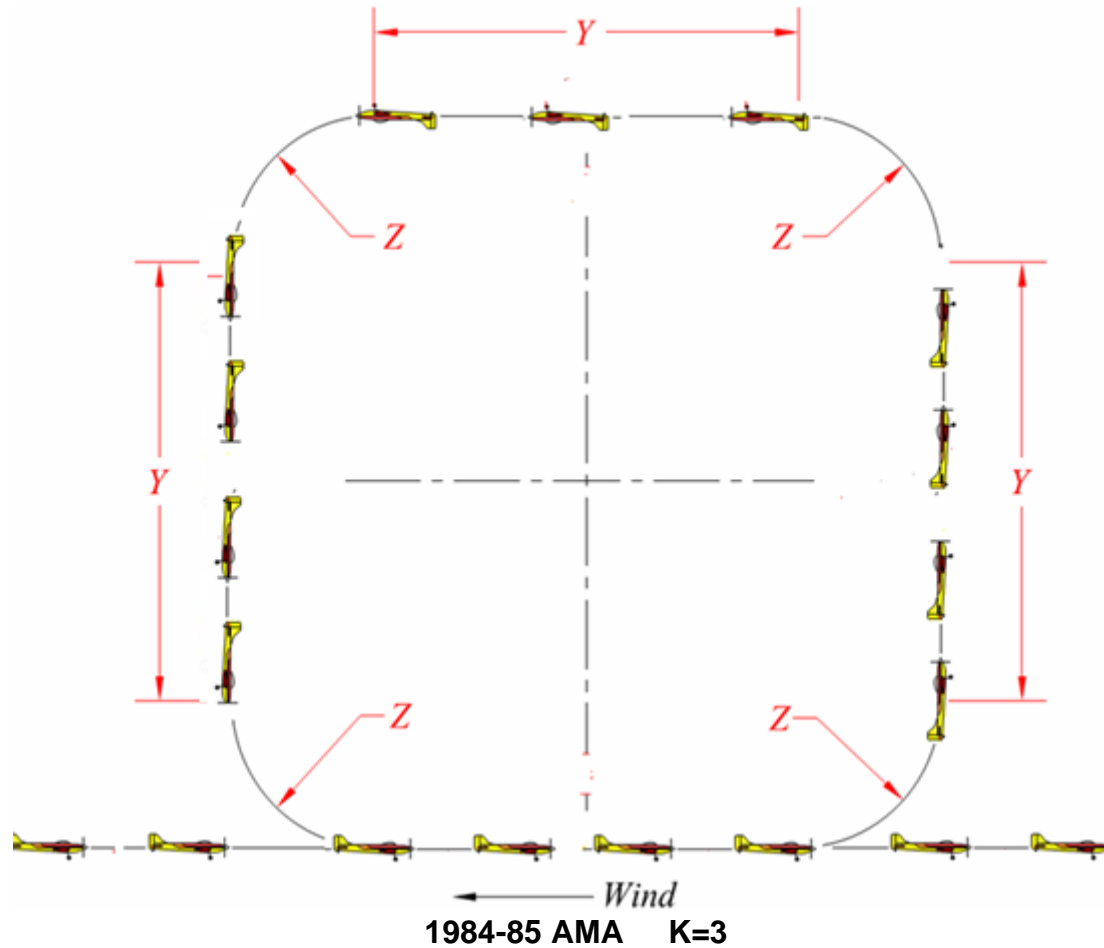
Model pulls up and executes a square loop, when at the bottom of the third leg it does a complete square outside loop behind the inside loop, the model should rotate sharply at each corner and the straight paths should be at least 20 meters (65 ½ feet) long. *At the bottom of the 4th leg of the outside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

Downgrades:

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

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## SQUARE LOOP



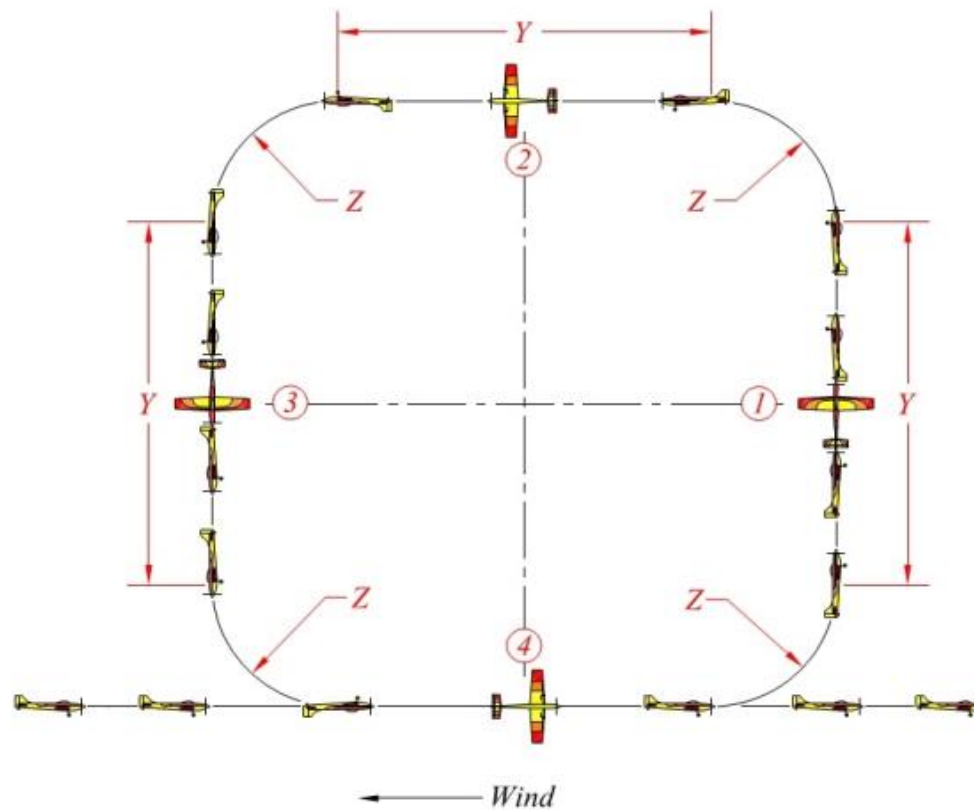
Model pulls up and executes a square loop. The model should rotate sharply at the corners.

Downgrades:

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

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## SQUARE LOOP WITH ½ ROLLS



**1978-79 FAI K=5**

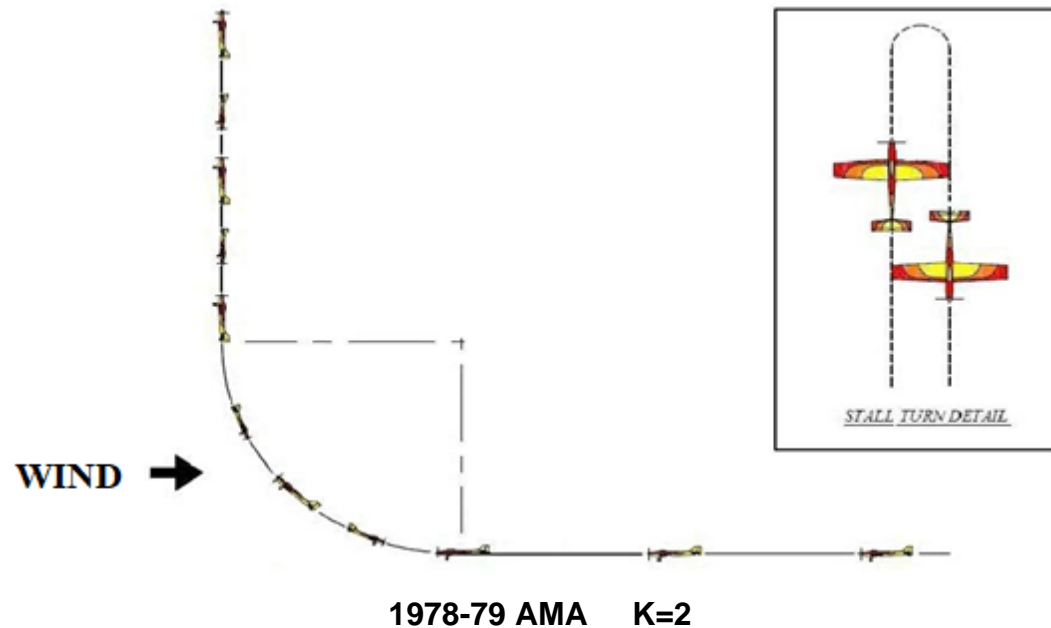
Model pulls up and completes a square loop; in each side the model executes a ½ roll.

Downgrades.

1. Loop not square.
2. Rolls not 180 degrees.
3. Wings not level during ½ loops.
4. Sides of square not of equal length

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## STALL TURN



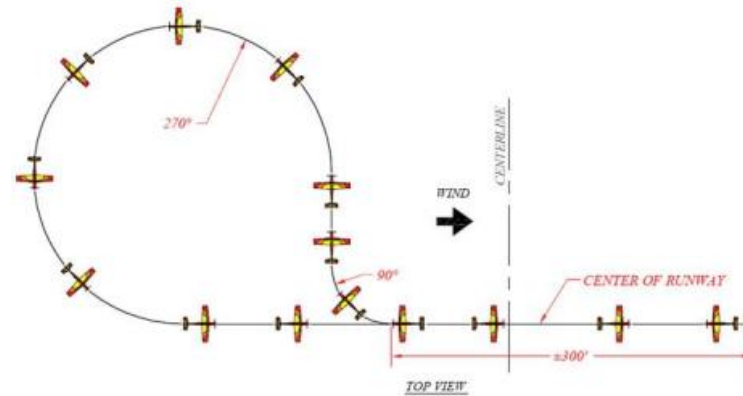
The model starts from straight and level flight and noses up to a vertical position, yaws through 180 degrees, then dives along a parallel path and finishes the maneuver with the plane level at the same altitude as the entry.

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°.
5. Return path more than two 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, PROCEDURE TURN, STRAIGHT FLIGHT BACK



## 1978-79 AMA

**STRAIGHT FLIGHT OUT: (K=1)** The model must be brought exactly over the center of runway and/or landing circle and flown in an absolutely straight path parallel with the flight line 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: (K=2)** 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. Left (or Right) turn not 90 degrees.
2. Right (or Left) 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: (K=1)** The model should fly back toward the circle along the same line as the outgoing path and pass exactly over the circle.

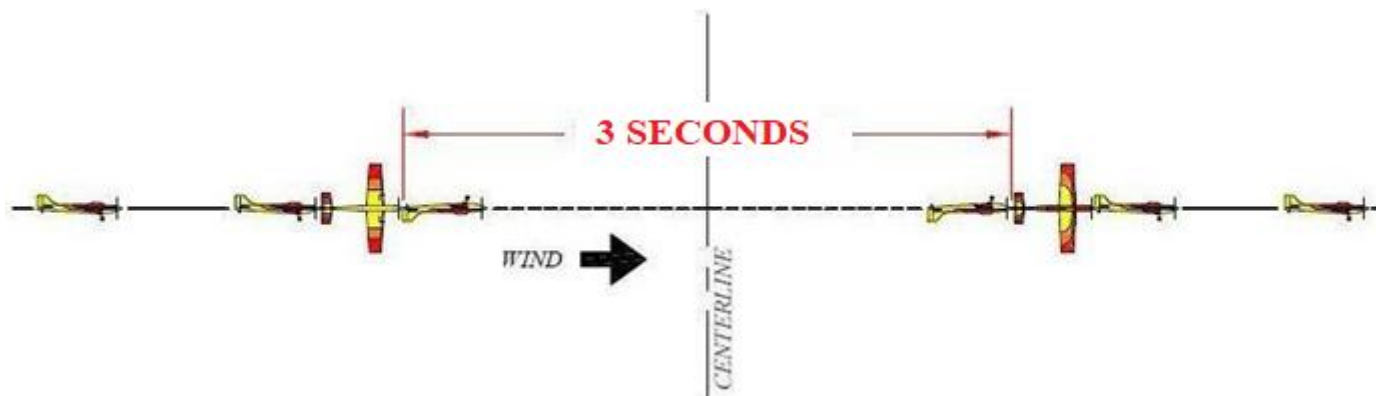
Downgrades:

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



**1978-79 AMA K=2**

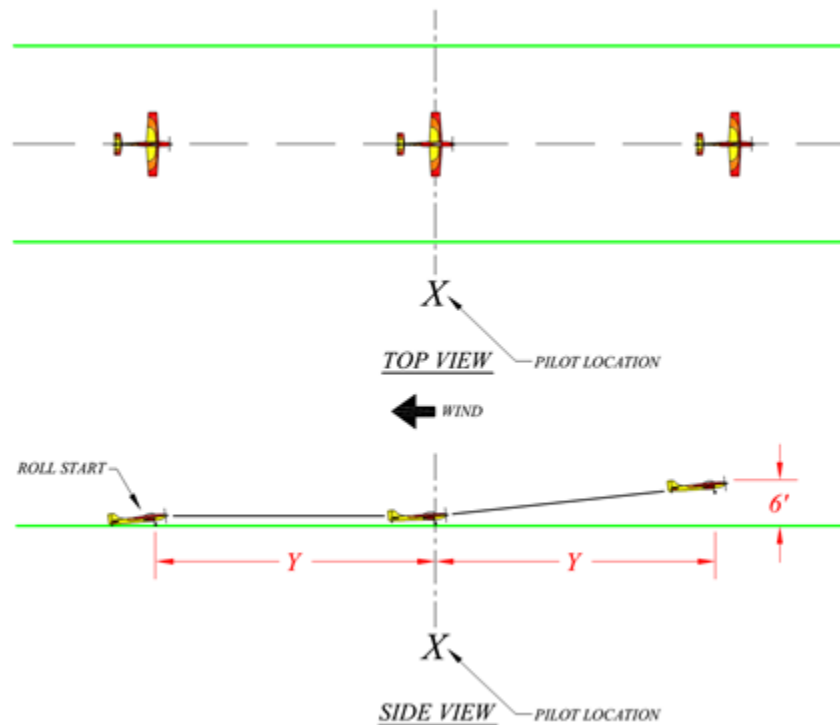
The model starts in straight, level, upright flight, then rolls 180° (roll approximately one (1) second), stops in the inverted position, proceeding in straight level inverted flight for approximately three (3) seconds, then rolls 180° (in same direction and roll rate as first roll) back to level, straight, upright flight for completion of maneuver.

Downgrades:

8. Model not level at start.
9. Half-rolls more or less than 180°.
10. Roll rate not constant during each half-roll.
11. Model takes less than 4 or more than 6 seconds to complete maneuver.
12. Model does not maintain same heading and altitude throughout maneuver.

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## TAKE-OFF



### 1978-79 FAI K=1

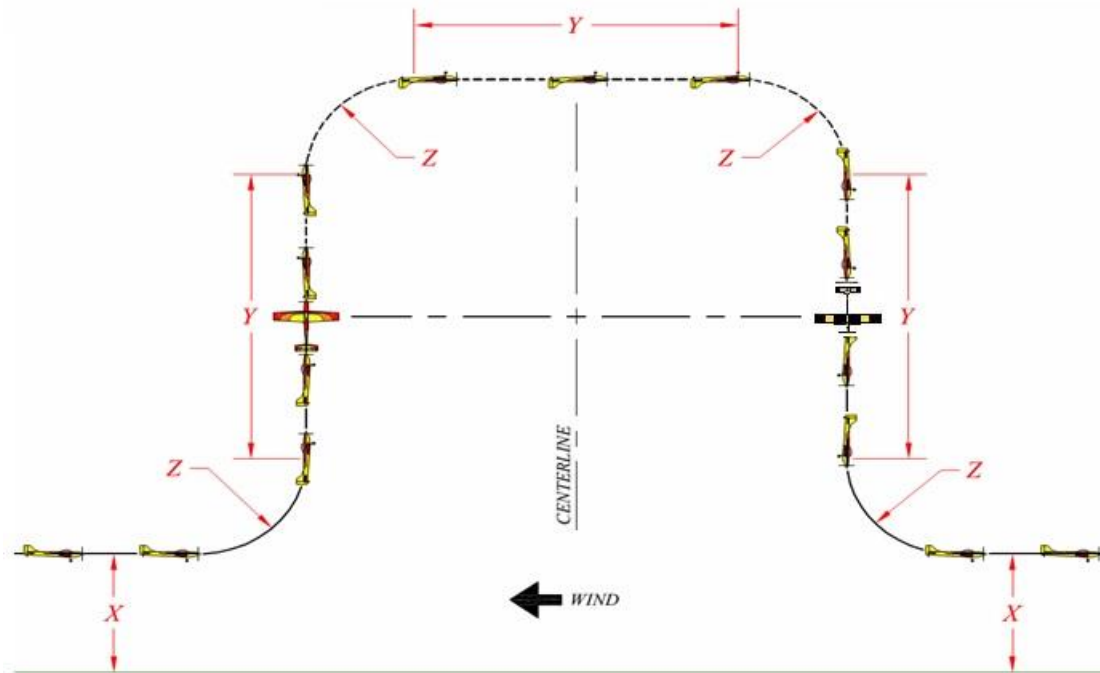
The model must stand still on the ground with the engine running, without being held, and must then take off. The take-off run should be straight, the model lifts gently from the ground and climb at a gradual angle. The take-off is completed when the model is approximately two meters (6½ feet) from the ground

Downgrades:

1. The model does not stand still when released.
2. Changes heading during take-off and climb.
3. Model jumps from ground.
4. Retouches ground after becoming airborne.
5. Too steep a climb angle.
6. Gallops in elevation during climb.
7. Wings not level at any time.

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## TOP HAT



**1978-79 FAI K=3**

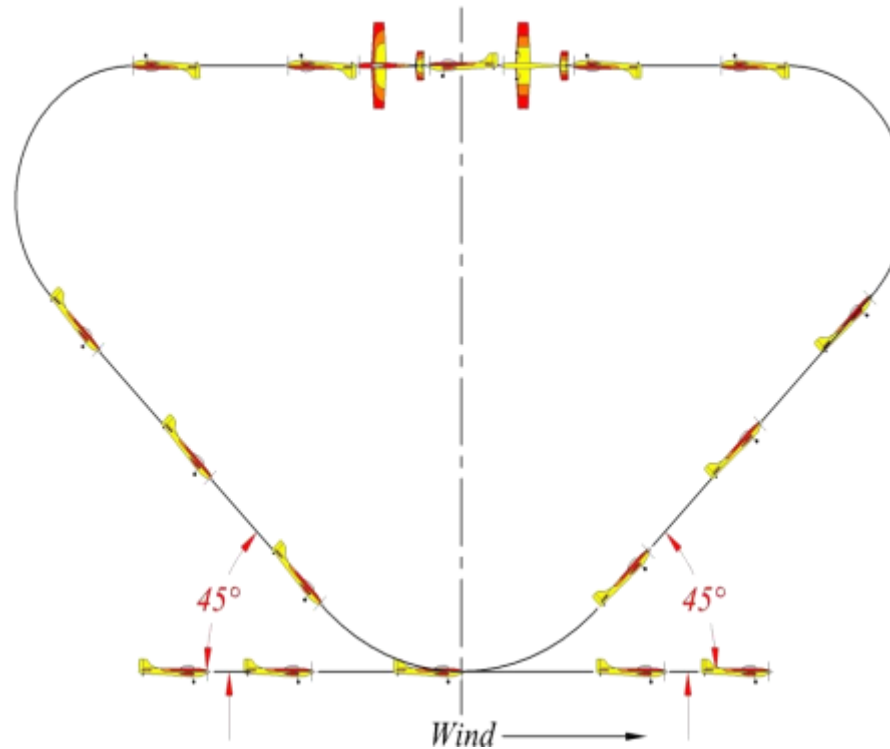
Model pulls up into a vertical attitude, pauses, makes a half roll, pauses, pulls over to inverted flight for a short period, pulls down, pauses, makes a half roll, pauses and recovers in level flight.

Downgrades:

1. Model not vertical before starting and finishing rolls.
2. Rolls not exactly 180 degrees.
3. Model does not fly straight and level inverted.
4. Vertical and horizontal legs not same length.
5. Rolls not the same length.
6. Changes in heading during maneuver.

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## TRIANGLE ROLLING LOOP



**1978-79 FAI K=4**

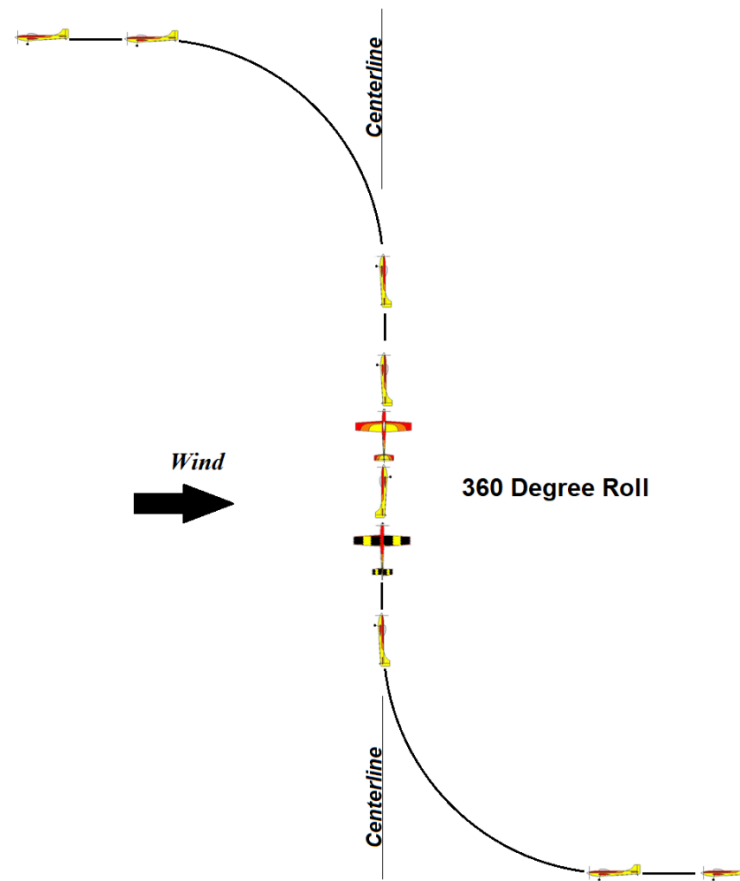
Model pulls up into a 45-degree climb, holds the attitude for approximately one second, loops through 135 degrees, does one complete roll, loops through 135 degrees, holds the attitude for approximately one second and recovers in level flight at the same point that the maneuver started. The climbing 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 ROLL



**1978-79 FAI K=3**

Model pulls up and executes a 360 degree roll vertically upward and pushes over to finish in level flight.

Downgrades:

1. Model not vertical at start and finish of roll.
2. Roll not exactly 360 degrees.
3. Roll not vertical.
4. Roll rate not constant

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