



# Senior Pattern Association

**2019-2020**

**Section III**

**Maneuver Descriptions**

**Revised April 26, 2019**

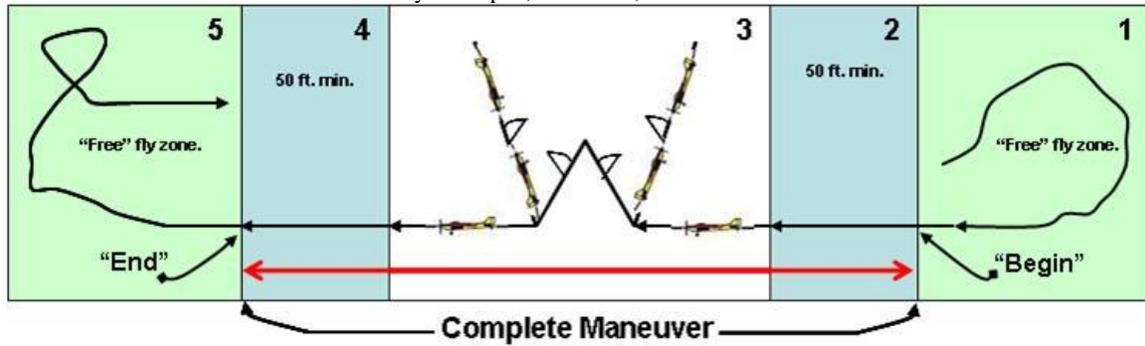
**NOTE: MANEUVER DESCRIPTIONS THAT FOLLOW ARE TAKEN VERBATIM FROM THE APPROPRIATE AMA RULE BOOKS FROM WHICH THE MANEUVERS WERE TAKEN. THE ONE EXCEPTION IS FOR THE LANDING, FOR WHICH EVERY APPEARANCE IN THE AMA RULE BOOK CONTAINED A REFERENCE TO A LANDING CIRCLE. CONSEQUENTLY, THE SPA BOARD HAS OPTED 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.

## 2019-2020 Maneuver Listing for Each Class

SPA Novice 2019-2020		K
1.	Takeoff (U) <i>(Downwind Trim Pass)</i>	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.	Cuban 8 (U)	2
10.	Straight Inverted Flight (D) <i>(Fly By For Landing 2 Allowed)</i>	2
11.	Landing Perfection (U)	1
Total K Factor		18
<small>Notes:                      * No EXTRA Fly-by's allowed                      * Maneuvers flown out of sequence will be scored ZERO (0)</small>		

SPA Sportsman 2019-2020		K
1.	Takeoff (U) <i>(Downwind Trim Pass)</i>	1
2.	Double Stall Turn (U)	3
3.	Reverse Cuban 8 (D)	2
4.	Double Immelmann (U)	2
5.	Rolling 8 - Inside Loops (D)	2
6.	1 Reverse Outside Loop (U)	2
7.	Slow Roll (D)	3
8.	3 Inside Loops (U)	2
9.	3 Horizontal Rolls (D)	3
10.	3 Turn Spin (U)	2
11.	Cobra Roll with 1/2 Rolls (D) <i>(Fly By For Landing)</i>	2
12.	Landing Perfection (U)	1
Total K Factor		25
<small>Notes:                      * No EXTRA Fly-by's allowed                      * Maneuvers flown out of sequence will be scored ZERO (0)</small>		

SPA Advanced 2019-2020		K
1.	Takeoff (U) <i>(Downwind Trim Pass)</i>	1
2.	Figure M (U)	3
3.	Cuban 8 (D)	2
4.	Double Immelmann (U)	2
5.	Slow Roll (D)	3
6.	3 Reverse Outside Loops (U)	3
7.	4 Point Roll (D)	4
8.	Square Loop (U)	3
9.	3 Horizontal Rolls (D)	3
10.	Top Hat (U)	3
11.	Rolling 8 - Inside Loops (D)	2
12.	3 Turn Spin (U) <i>(Fly By For Landing)</i>	2
13.	Landing Perfection (U)	1
Total K Factor		32
<small>Notes:                      * No EXTRA Fly-by's allowed                      * Maneuvers flown out of sequence will be scored ZERO (0)</small>		

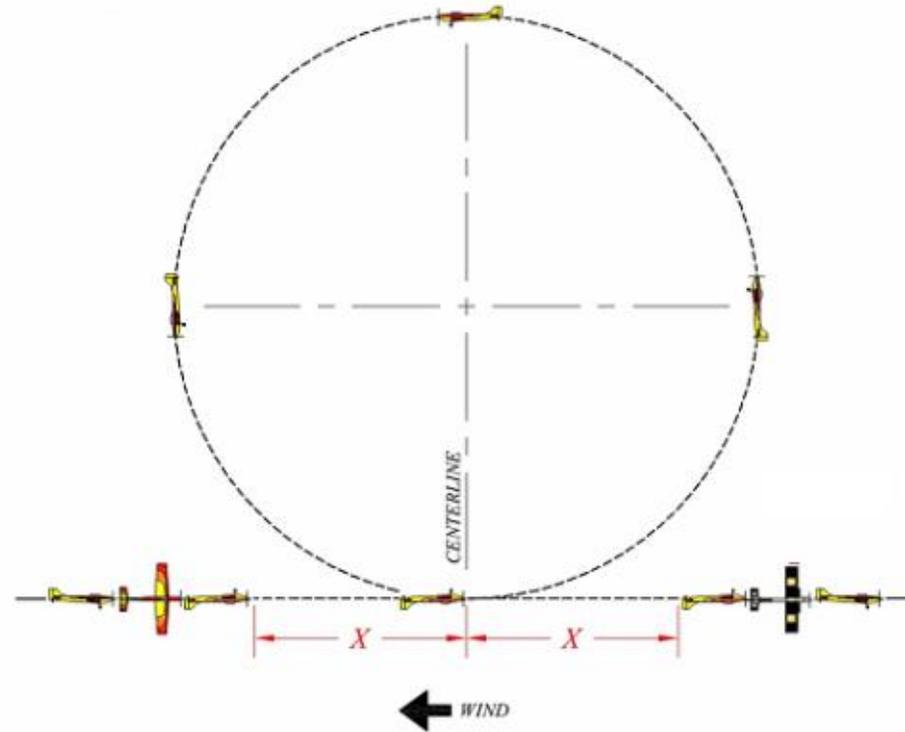
SPA Expert/Sr Expert 2019-2020		K
<i>Use for Expert and Senior Expert</i>		
1.	Takeoff (U) <i>(Downwind Trim Pass)</i>	1
2.	Figure M 1/4 Rolls (U)	5
3.	3 Horizontal Rolls (D)	3
4.	Cobra Roll with Full Rolls (U)	3
5.	Slow Roll (D)	3
6.	3 Reverse Outside Loops (U)	3
7.	Reverse Point Roll (D)	4
8.	Reverse Top Hat (U)	4
9.	8 Point Roll (D)	4
10.	Avalanche (U)	3
11.	Running 8 (D)	2
12.	Inverted 3 Turn Spin (U) <i>(Fly By for Landing)</i>	3
13.	Landing Perfection (U)	1
Total K Factor		39
<small>Notes:                      * No EXTRA Fly-by's allowed                      * Maneuvers flown out of sequence will be scored ZERO (0)</small>		

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# 1 REVERSE OUTSIDE LOOP



## 1978-79 FAI \*

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:

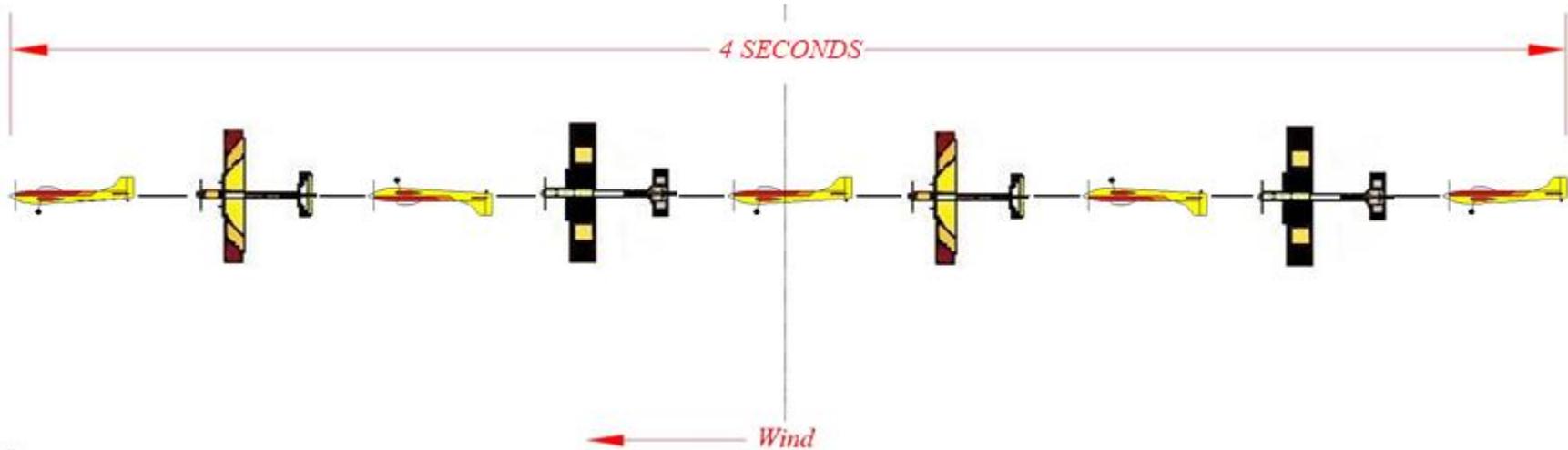
1. Loop not round
2. Changes in heading during loop and rolls
3. Wings not level during loop
4. Model pauses more than one (1) second before and after loops

\* **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 Novice pilots

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## 2 HORIZONTAL ROLLS



### 1978-79 FAI \*

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

#### Downgrades:

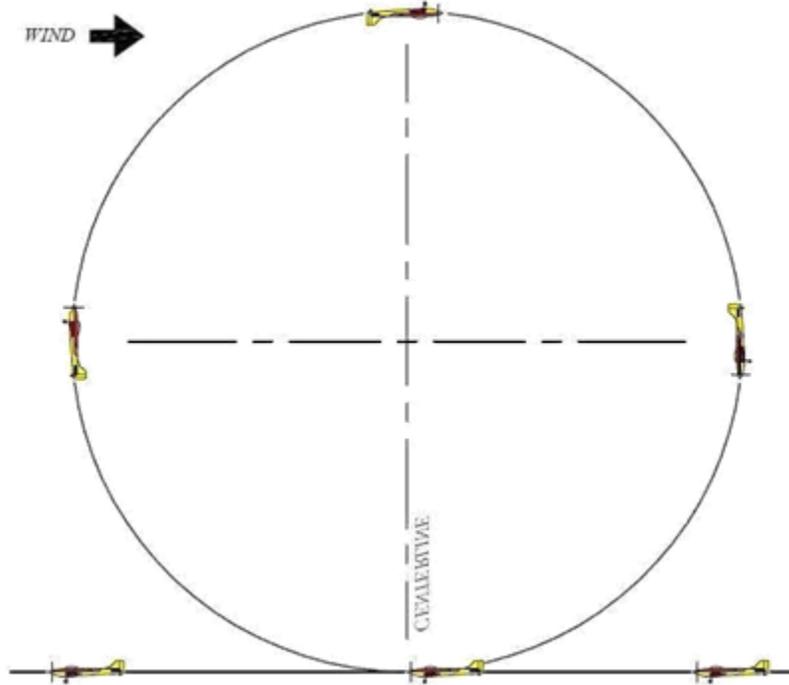
1. Changes in heading during rolls
2. Changes in altitude during rolls
3. Roll rate not constant
4. Model does not perform exactly two rolls
5. Maneuver takes less than 3 or more than 5 seconds

\* **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 Novice pilots

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## 2 INSIDE LOOPS



1978-79 FAI \*

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

Downgrades

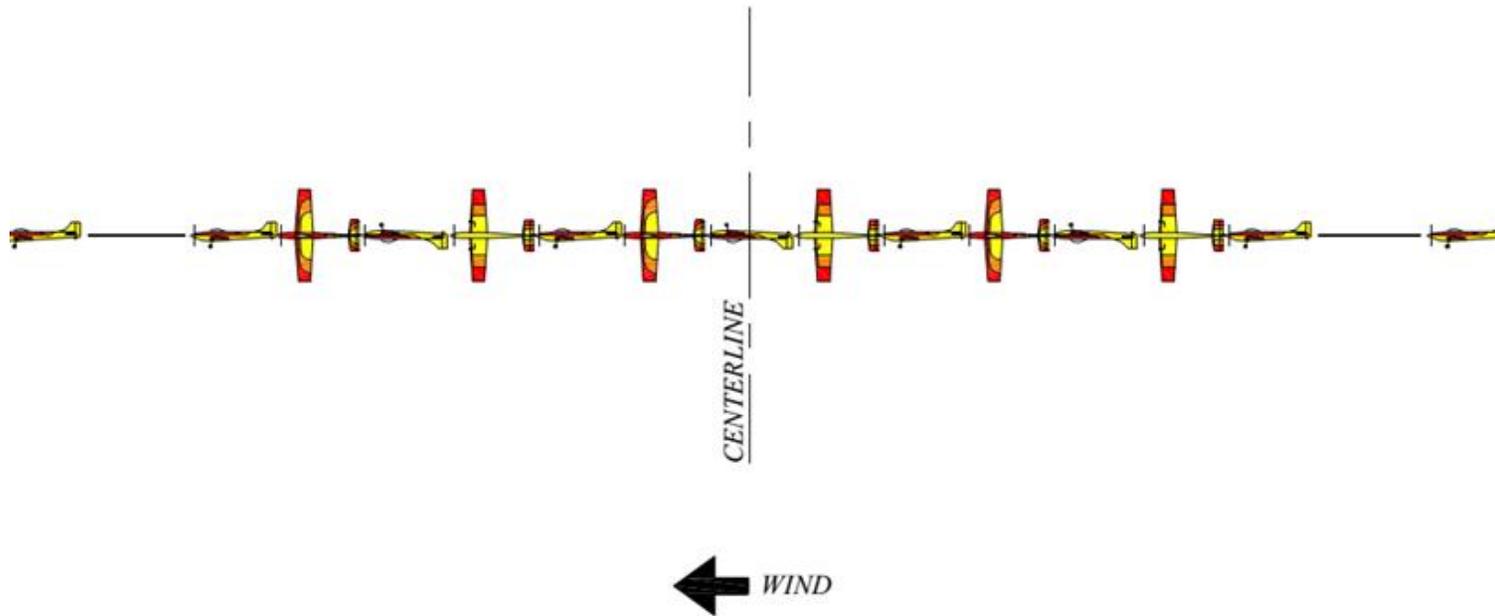
1. Loops not round
2. Loops not Superimposed
3. Wings not level during loops
4. Changes in heading during loops

\* **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 Novice pilots

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## THREE HORIZONTAL ROLLS



**1978-79 FAI**

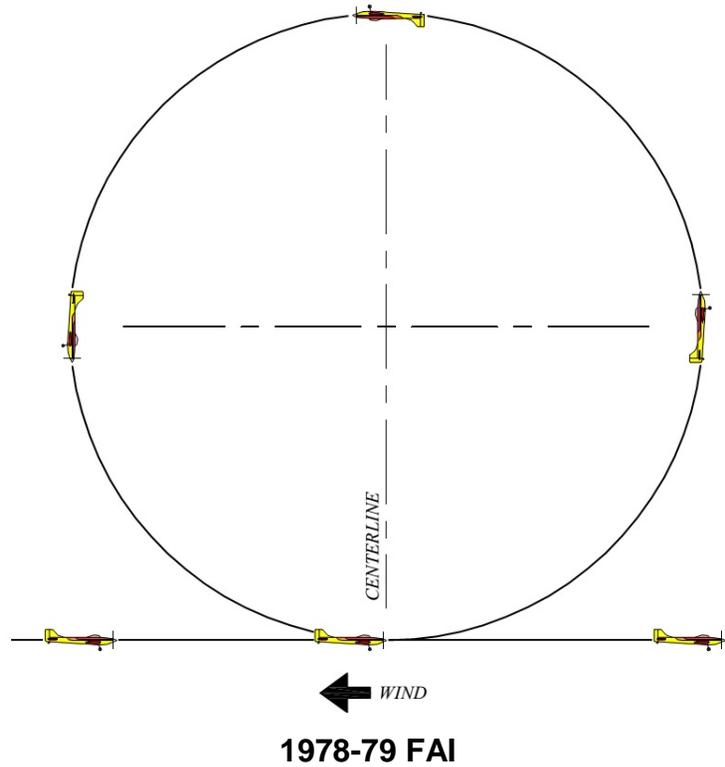
Model rolls at a uniform rate through three (3) complete revolutions in either direction; maneuver takes approximately 5 seconds

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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## THREE INSIDE LOOPS



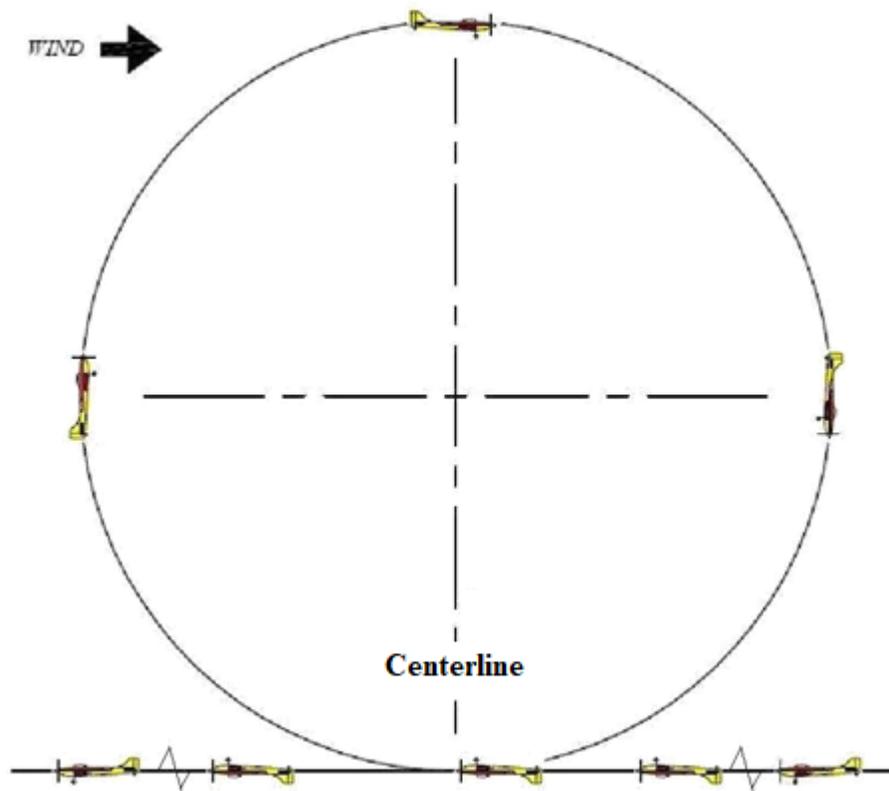
Model pulls up and executes three (3) consecutive loops; all loops shall be round and superimposed.

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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## THREE REVERSE OUTSIDE LOOPS



### 1978-79 FAI

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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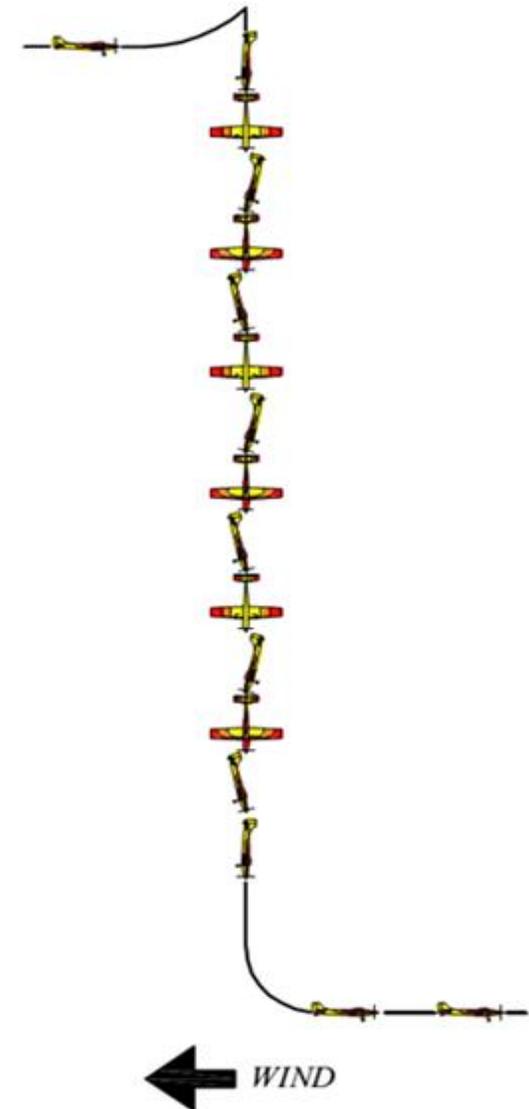
# THREE TURN SPIN

## 1978-79 FAI

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.

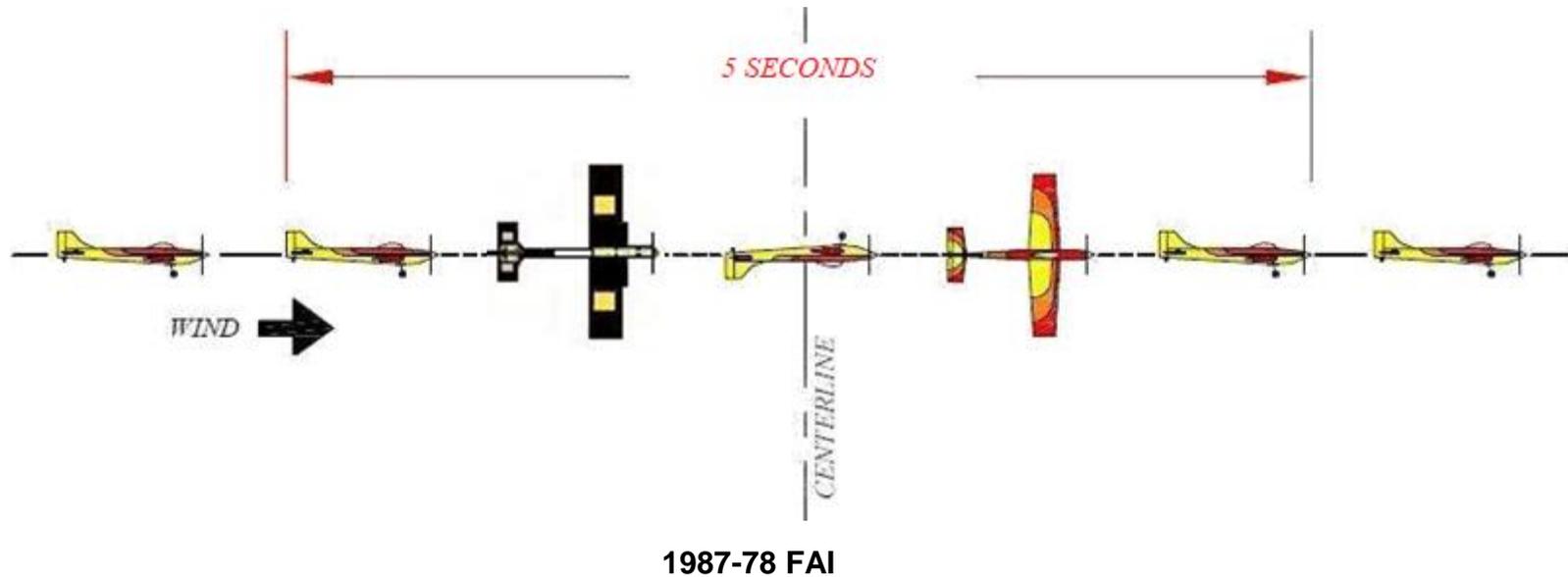
Downgrades:

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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## FOUR POINT ROLL



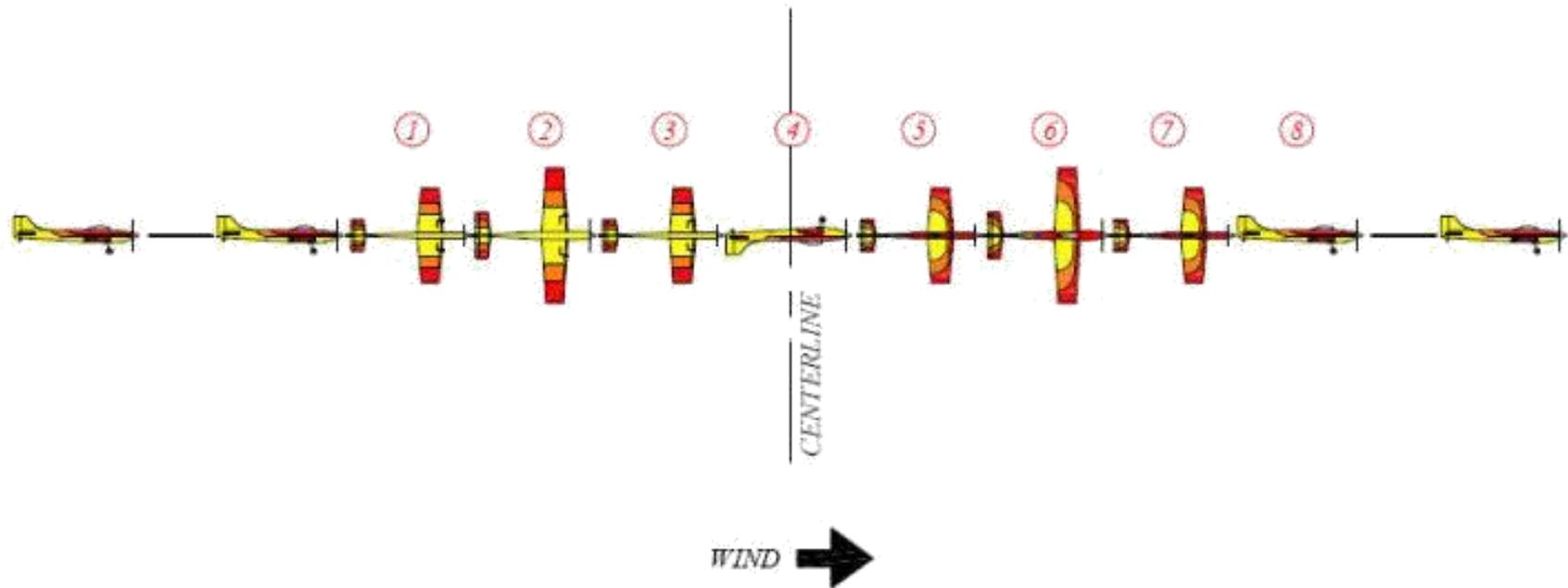
Model rolls through 360 degrees, hesitating at each 90 degree point; at each hesitation the wings are parallel or vertical to the horizon; maneuver takes approximately 5 seconds.

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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## EIGHT POINT ROLL



**1978-79 FAI**

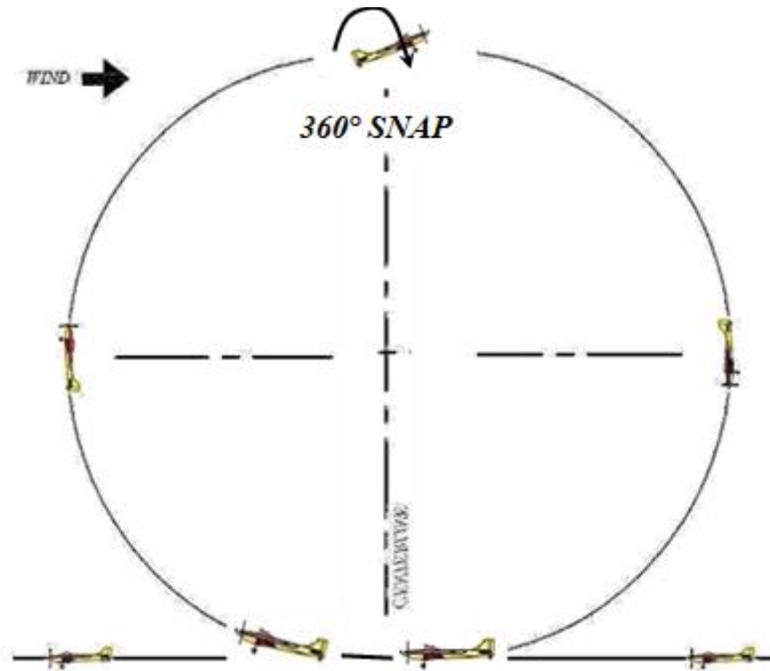
Model rolls through 360 degrees hesitating at each 45-degree point; the wings should be parallel, vertical to or 45 degrees to the horizon; maneuvers to take approximately 5 seconds.

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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## AVALANCHE



### 1978-79 FAI

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.

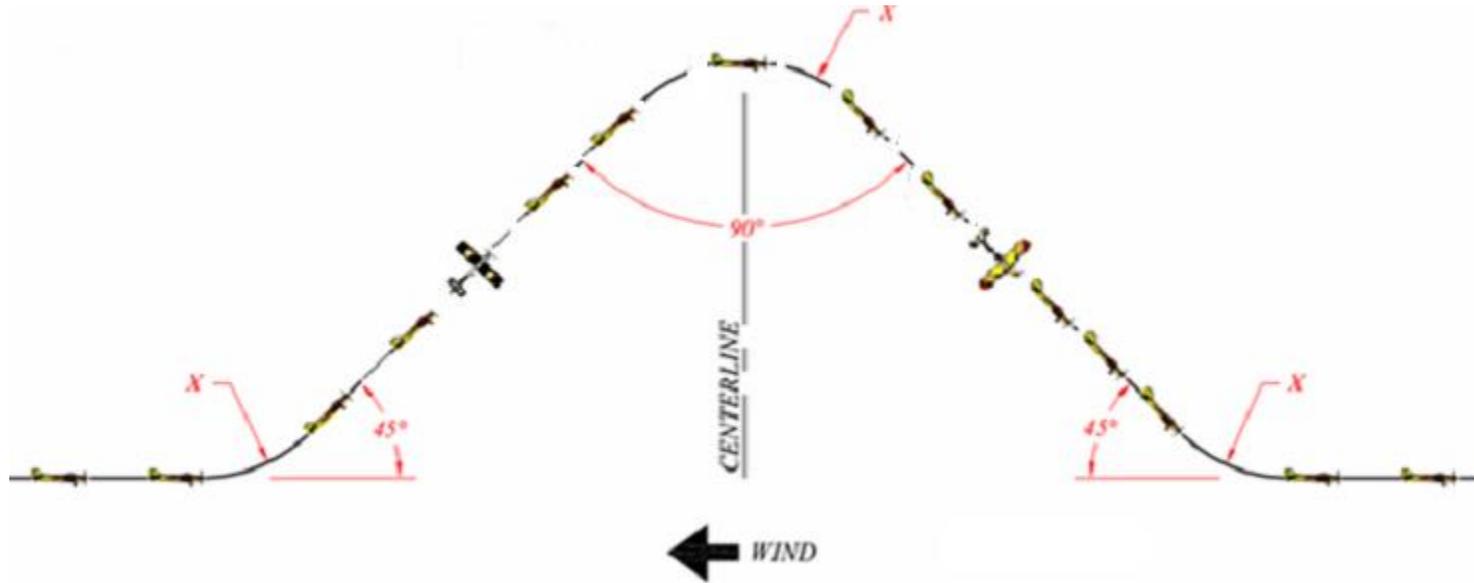
Downgrades:

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 a snap.

\*\* 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

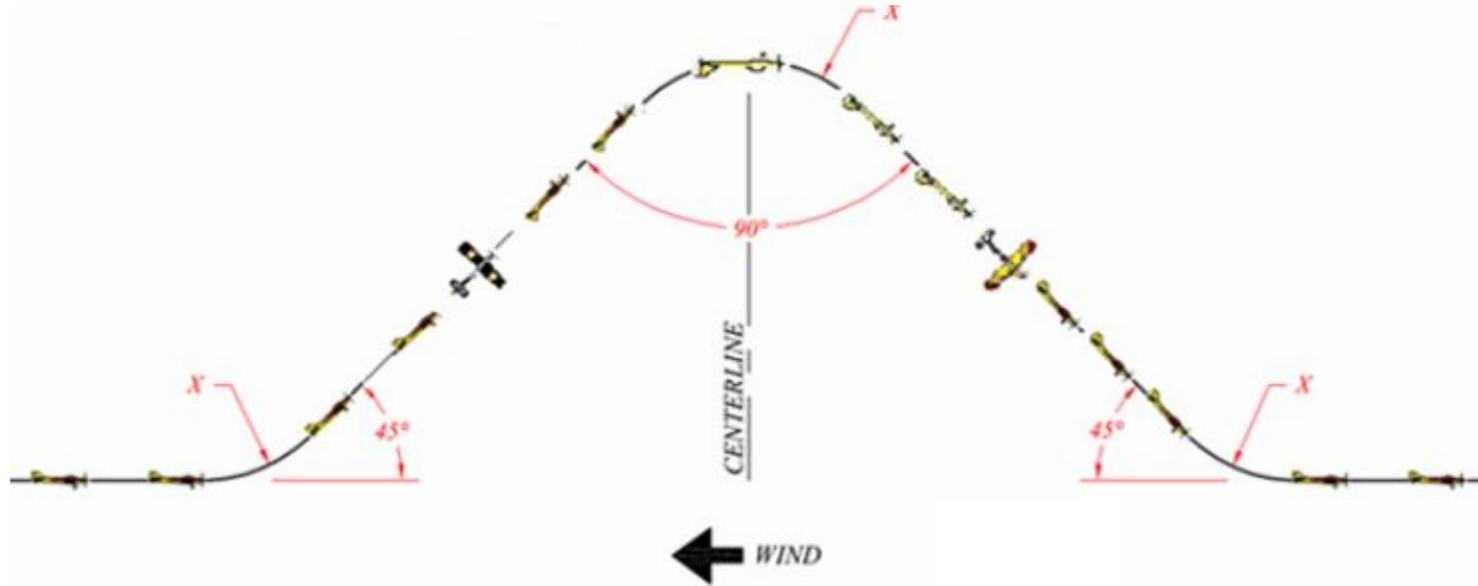
From upright, straight and level flight, the plane pulls up into a 45 degree climb, performs one complete roll at a moderate rate, continues the 45 degree climb for a moment, goes over the top in what amounts to one-quarter of an outside loop and heads down at a 45 degree angle. Another full roll, equal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



1978-79 FAI

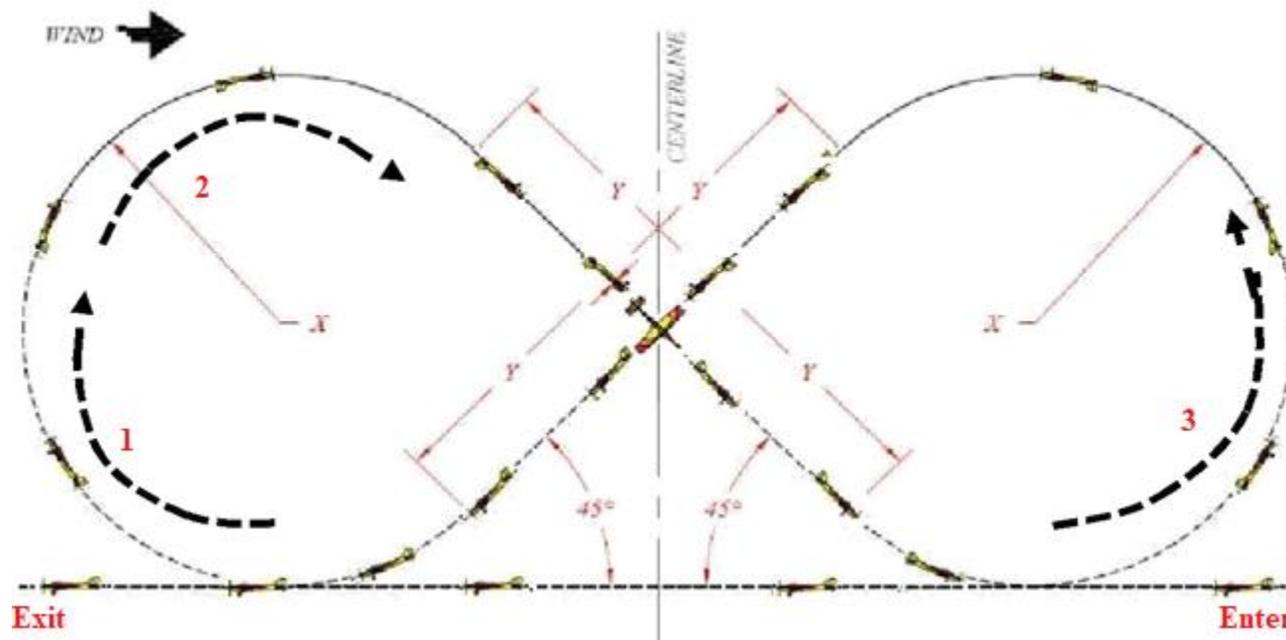
Model pulls up into a 45-degree angle, half rolls to inverted attitude, executes a 1/4 loop, half rolls to upright attitude and recovers to level flight.

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

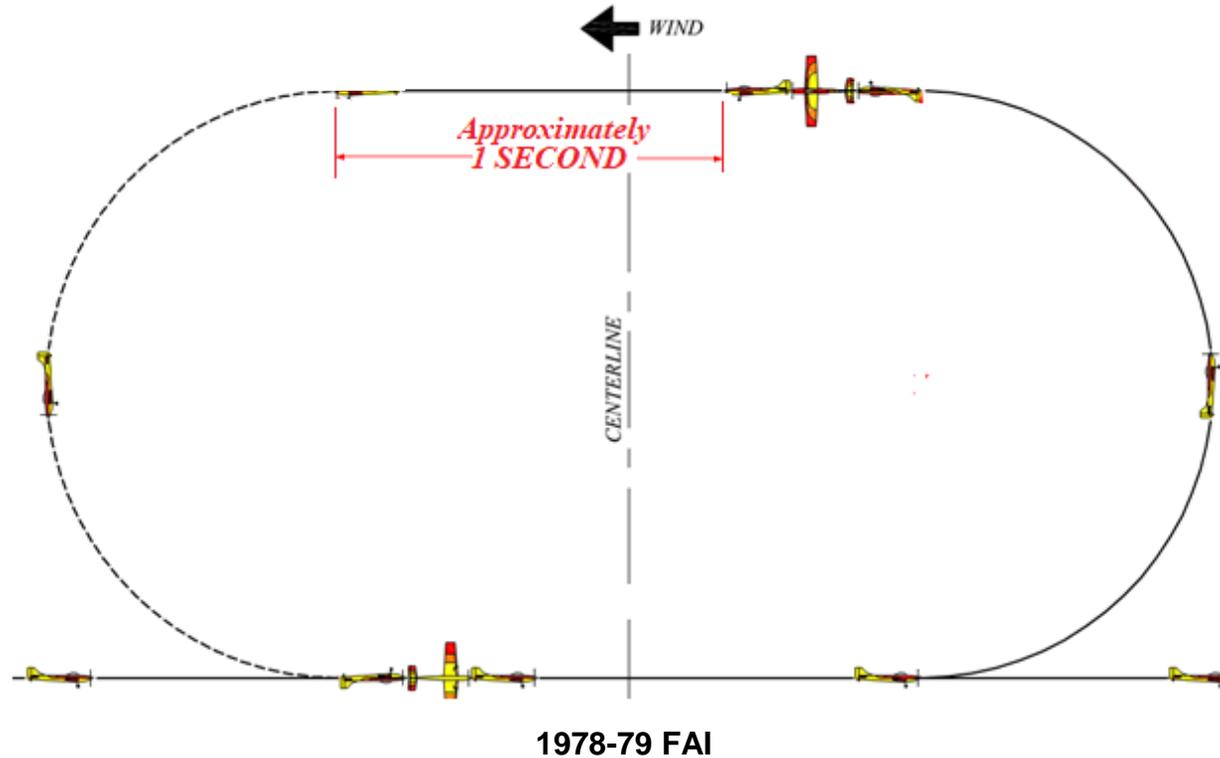
Model pulls up and executes an inside loop, when at 45 degrees inverted model does a half roll, followed by another inside loop, again when 45 degrees inverted the model does another half roll and recovers to level flight.

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



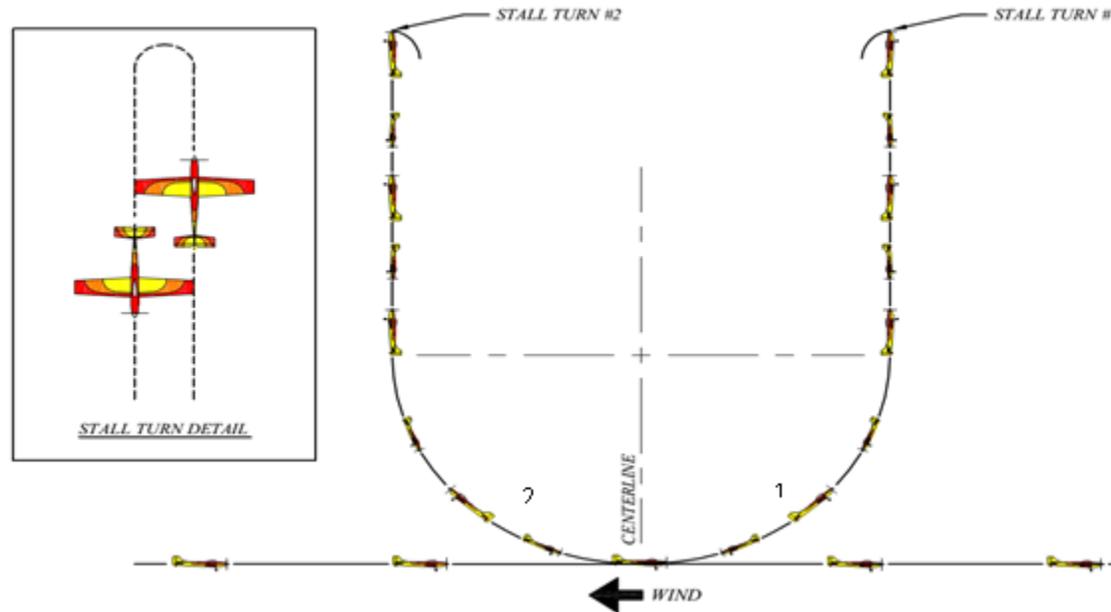
Model pulls up into a half inside loop, half rolls to upright, flies straight and level for approximately one second, does a half outside loop and half rolls to level flight.

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

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:

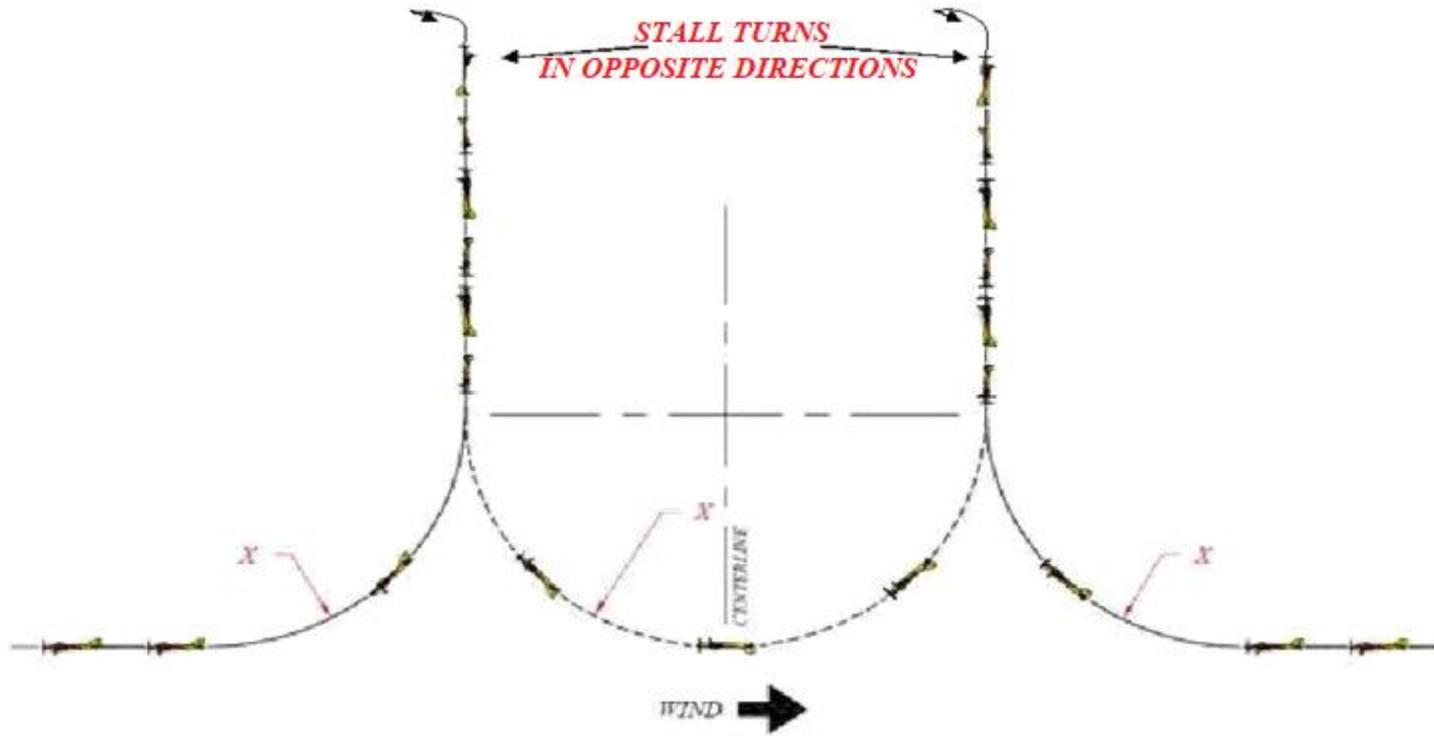
1. Model not flying straight and level at beginning and end of maneuver.
2. Model does not become exactly vertical at points of turn.
3. Half-inside-loop not round and consistent in heading.
4. Bottom part of loop not at same altitude as entry and finish.
5. Model turns left or right during pull-ups.
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**

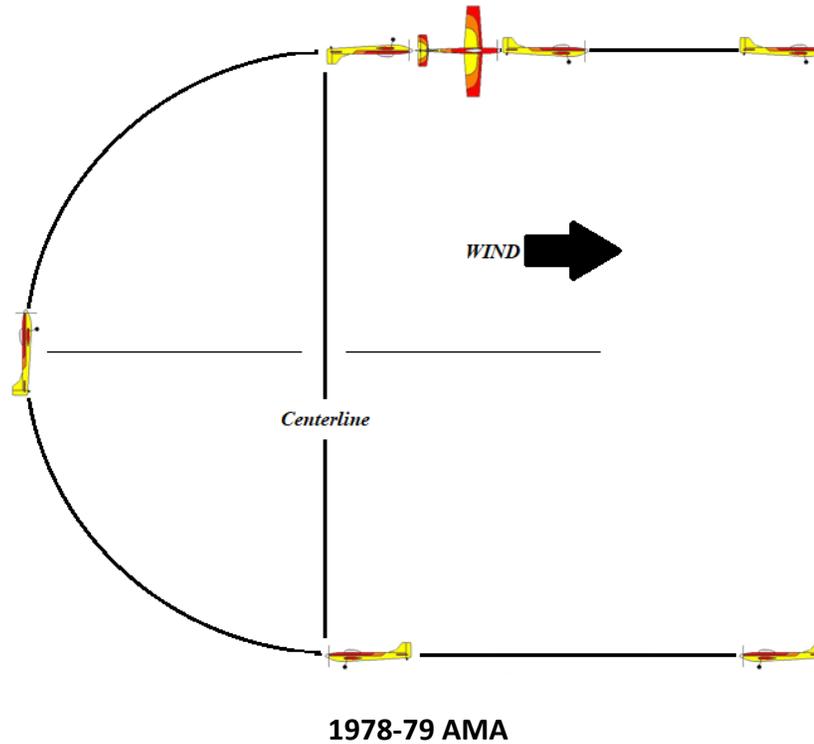
Model pulls up into a vertical attitude and executes a 180-degree stall turn, in either direction, does a 1/2 outside loop, again executes a stall turn, in the opposite direction, and recovers in level flight.

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.

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## IMMELMANN TURN



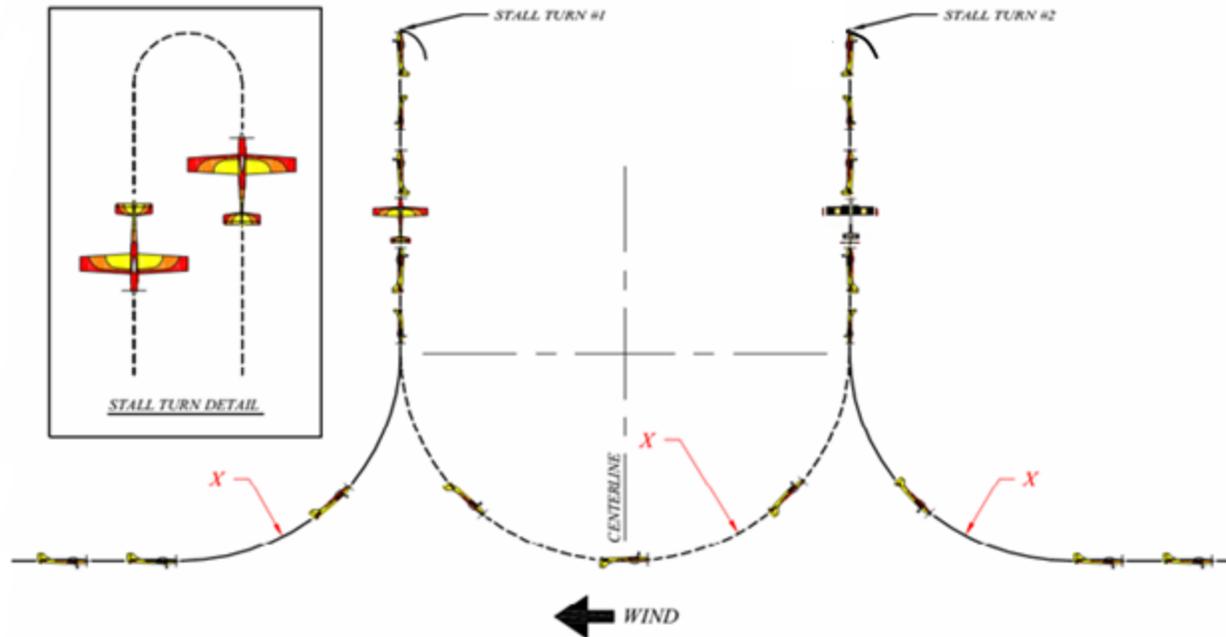
The model starts the Immelmann flying straight and level, pulls up into a half loop followed by a half roll and finishes flying straight and level exactly 180° from the heading at entry.

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 the 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.

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## FIGURE M WITH ¼ ROLLS



1978-79 FAI

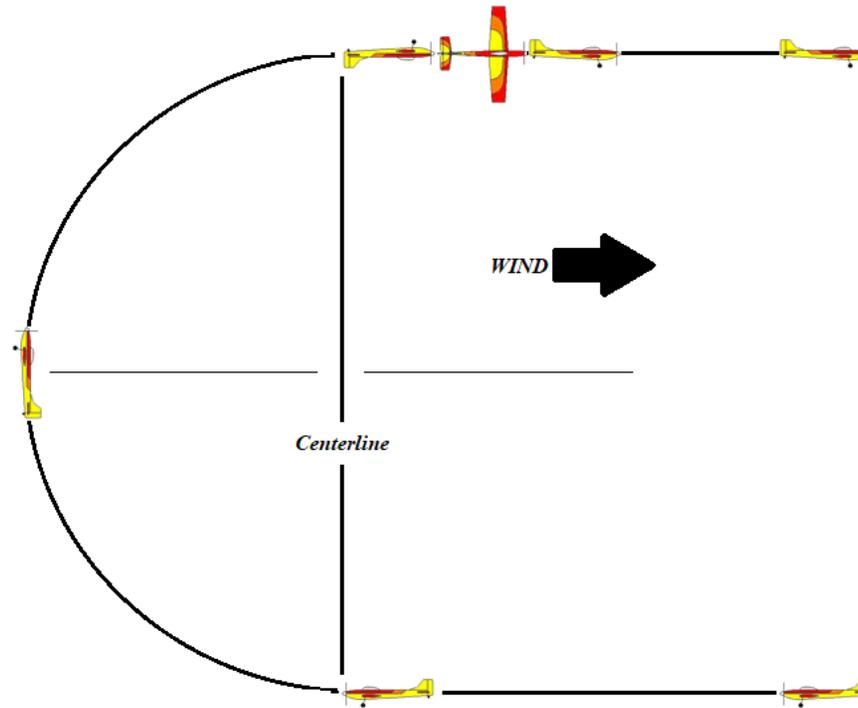
Model pulls up into a vertical attitude, executes a ¼ roll, stall turns through 180 degrees, ¼ turns again in the same direction as the first roll, does a ½ outside loop to a vertical attitude again, ¼ rolls in the same direction as the first two, does an inverted stall turn through 180 degrees, ¼ rolls 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 outside loop or rolls.
6. Stall turns not at same altitude.

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## IMMELMANN TURN



1978-79 AMA

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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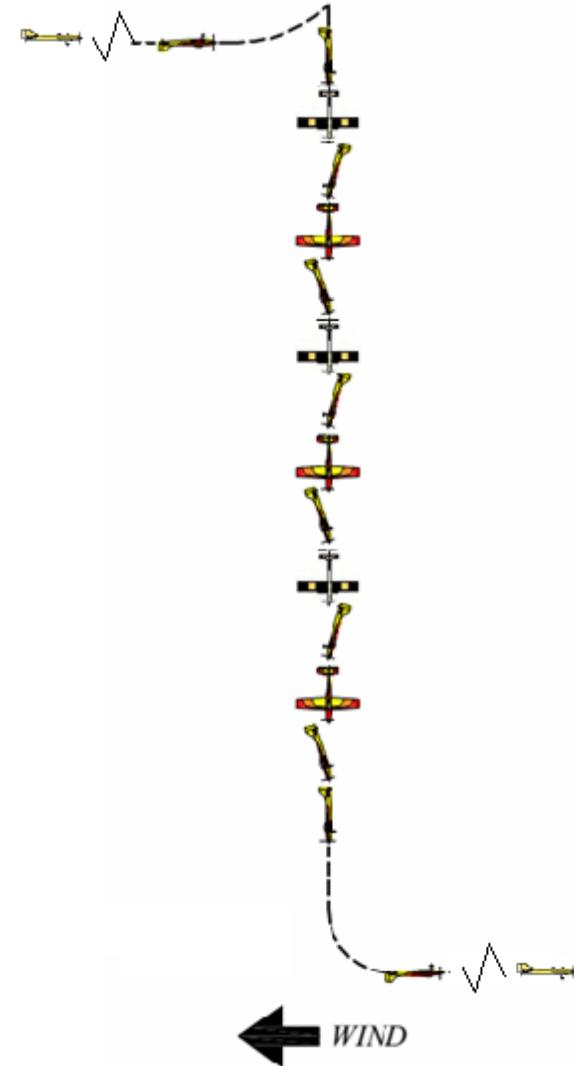
# INVERTED SPIN

## 1978-79 FAI

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.

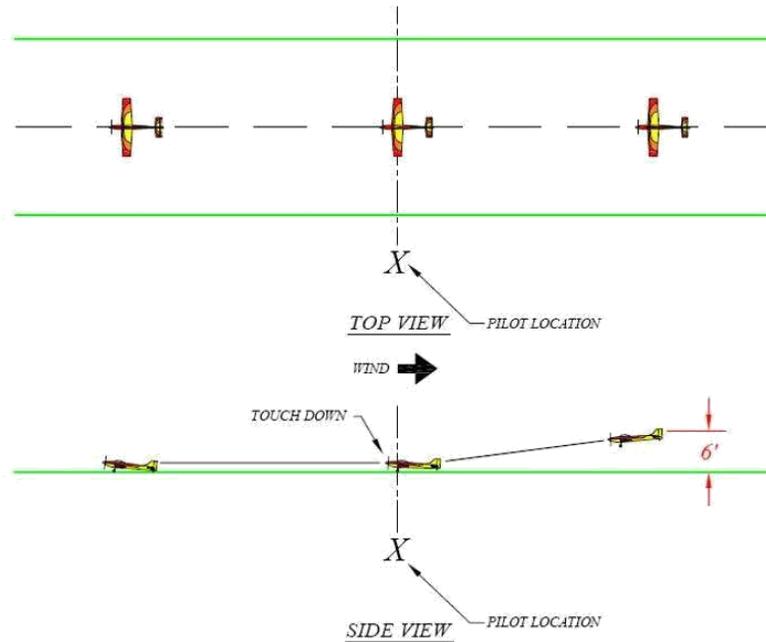
Downgrades:

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.



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## LANDING PERFECTION



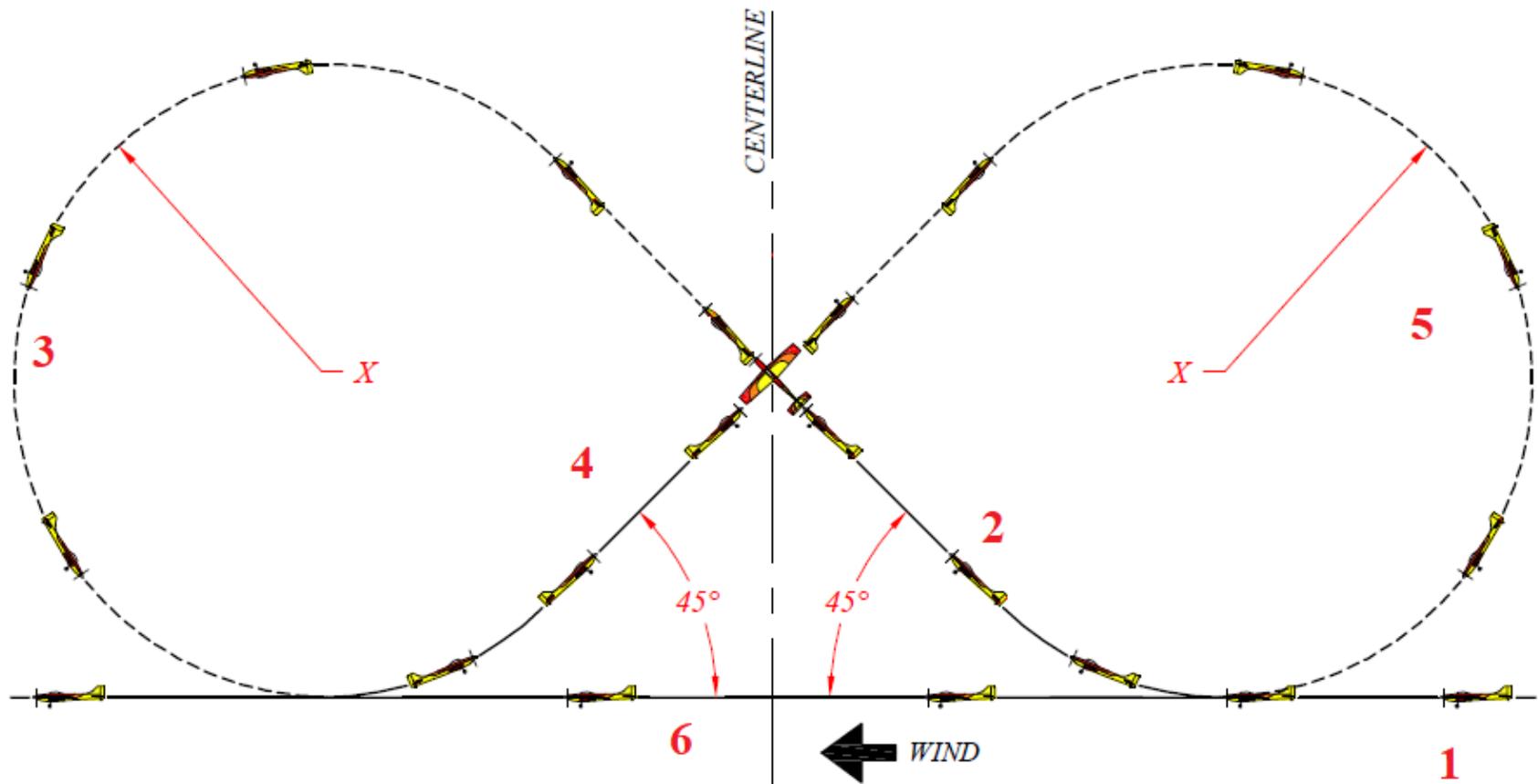
## NO REFERENCE

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 AMA

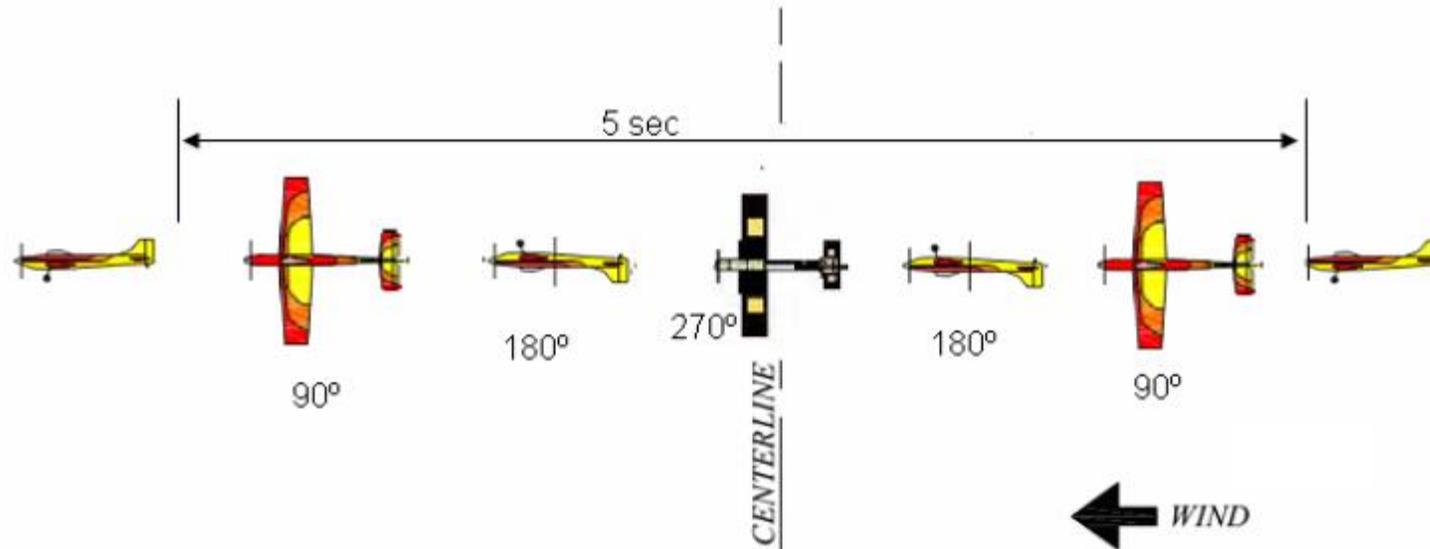
Model pulls up into a 45 degree climb, half rolls, executes a  $\frac{3}{4}$  loop, half rolls to inverted and loops back to level flight at the same point as entry.

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 POINT ROLL



### 1978-79 FAI

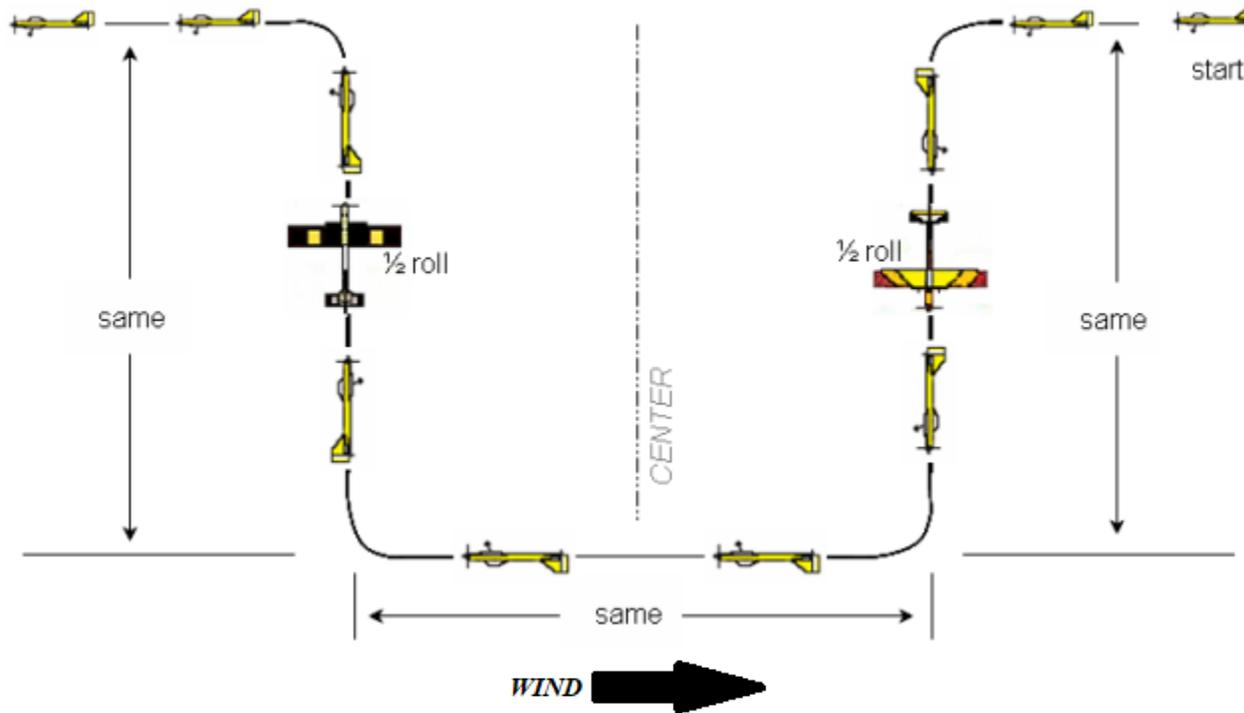
Model rolls through 270 degrees, hesitating at each 90-degree point, then rolls 270 degrees in **opposite** direction, hesitating at each 90-degree point to finish in level flight. Maneuver takes approximately 5 seconds.

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

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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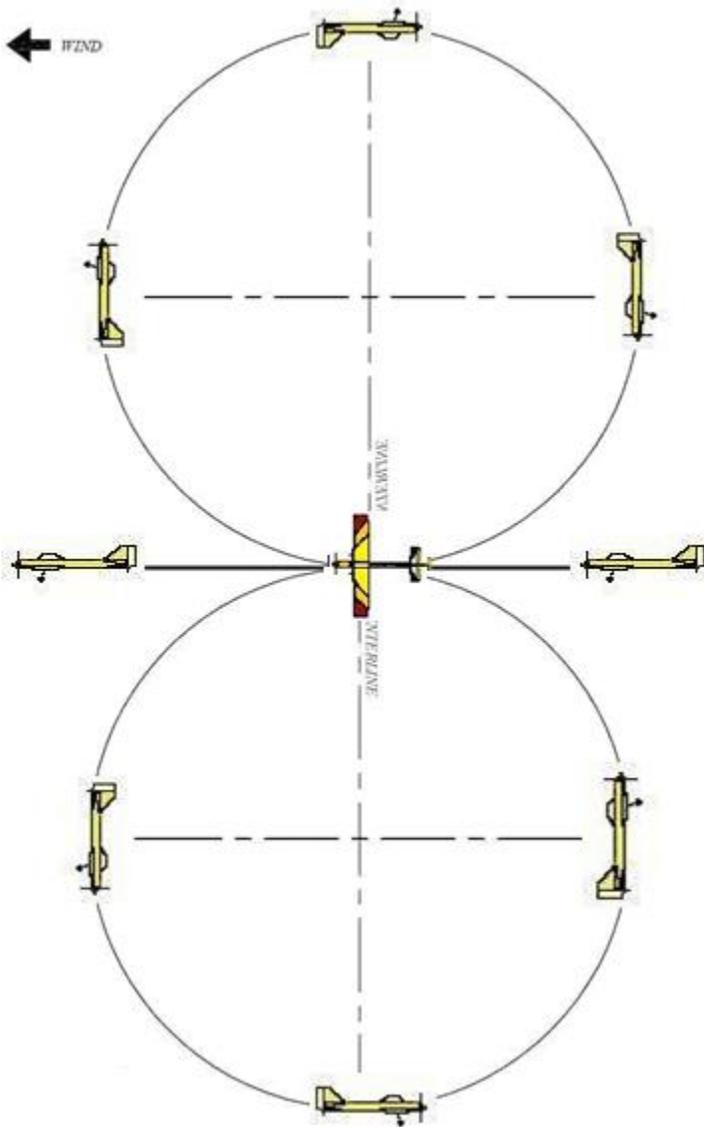
# ROLLING EIGHT

1978-79 FAI

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.

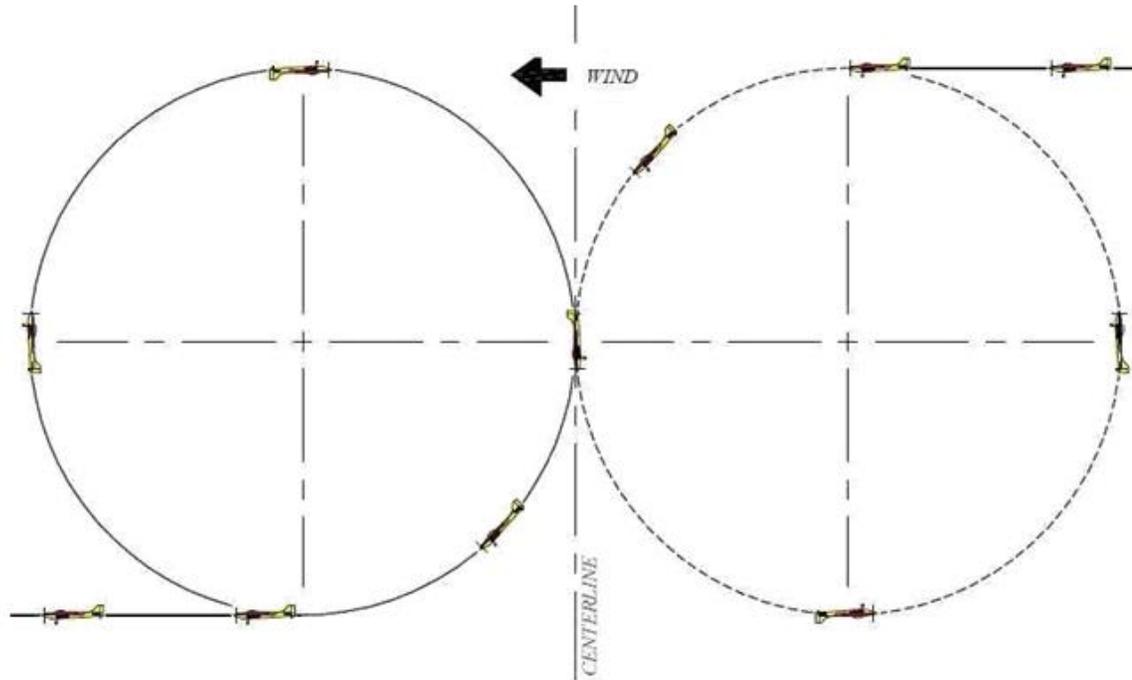
Downgrades:

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

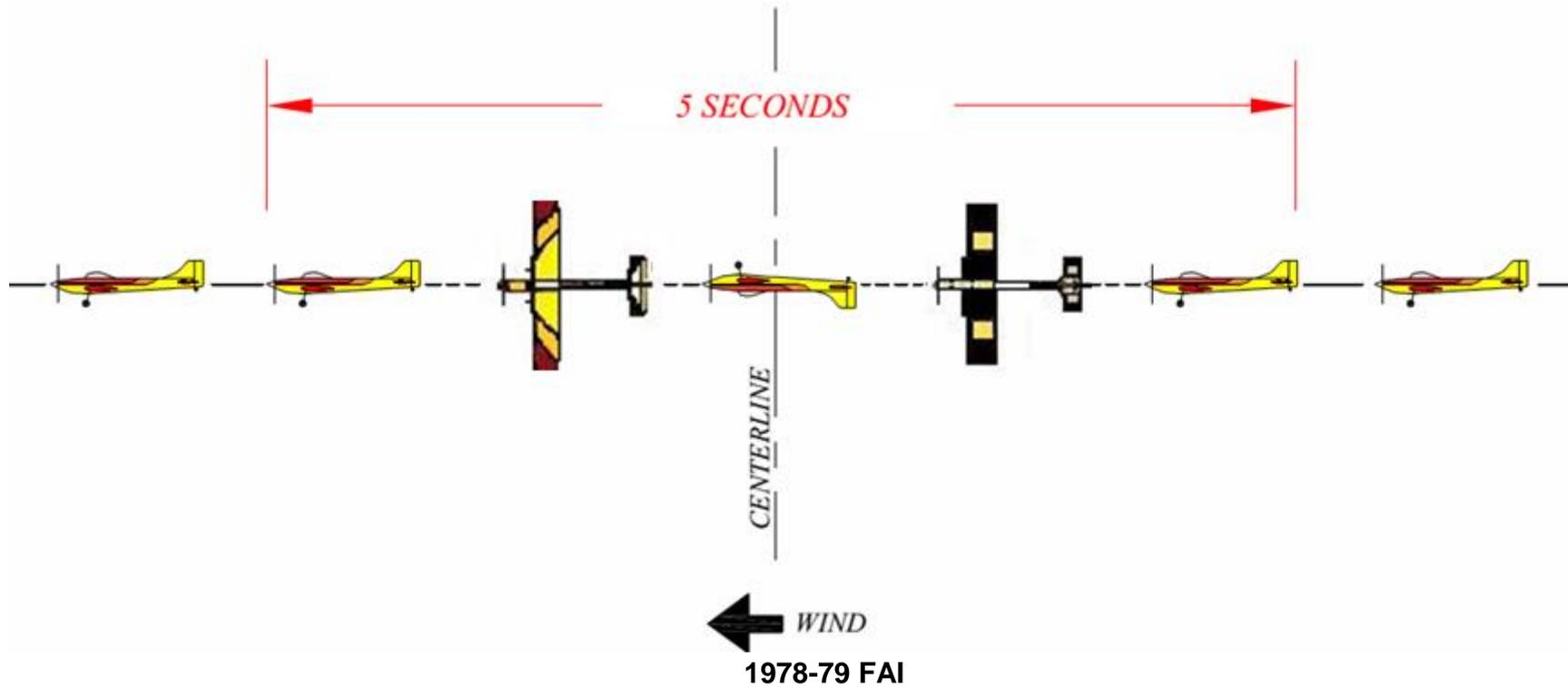
Model starts in level flight and completes 1-1/4 outside loops, model then does 1-1/4 inside loops finishing at bottom. The model passes through the intersection three times, then recovers on the same heading but at a lower altitude than entry.

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



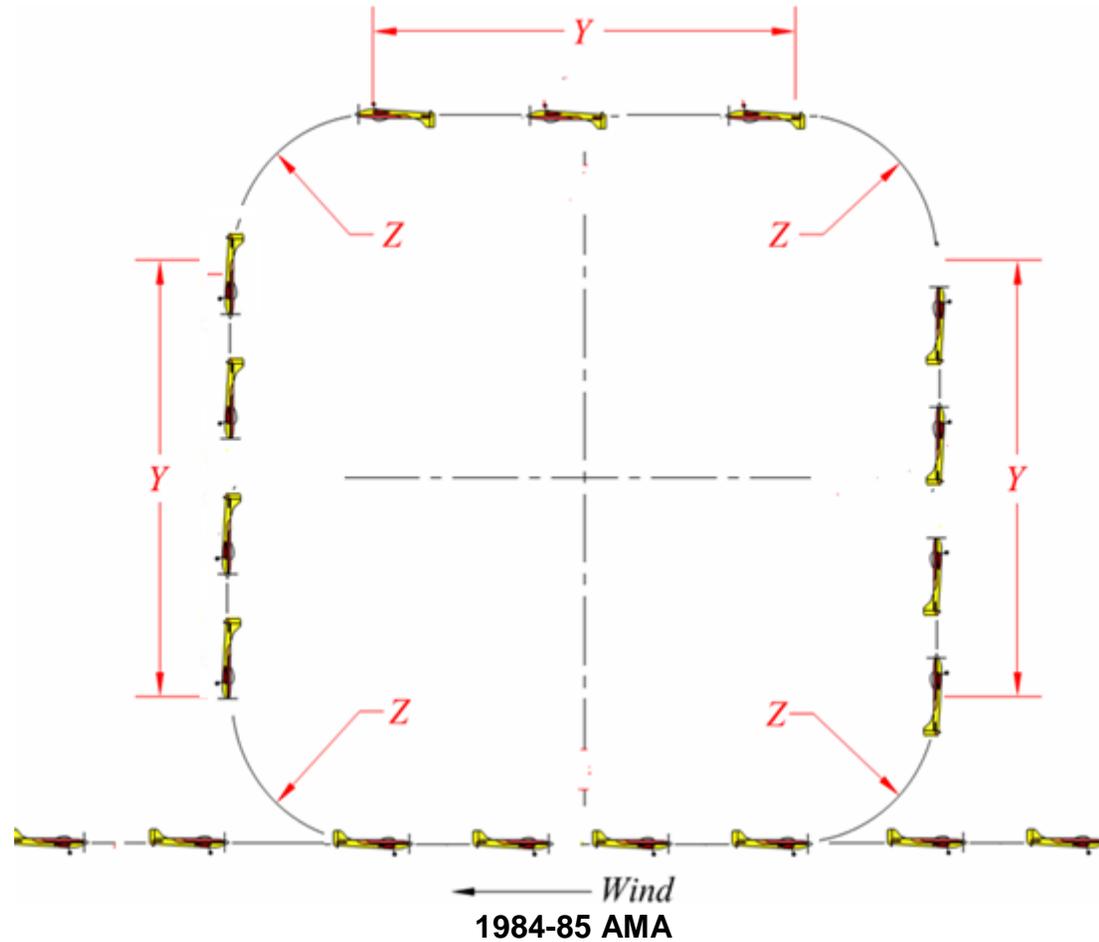
Model rolls slowly through one complete revolution, in either direction; maneuver takes approximately five seconds

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 LOOP



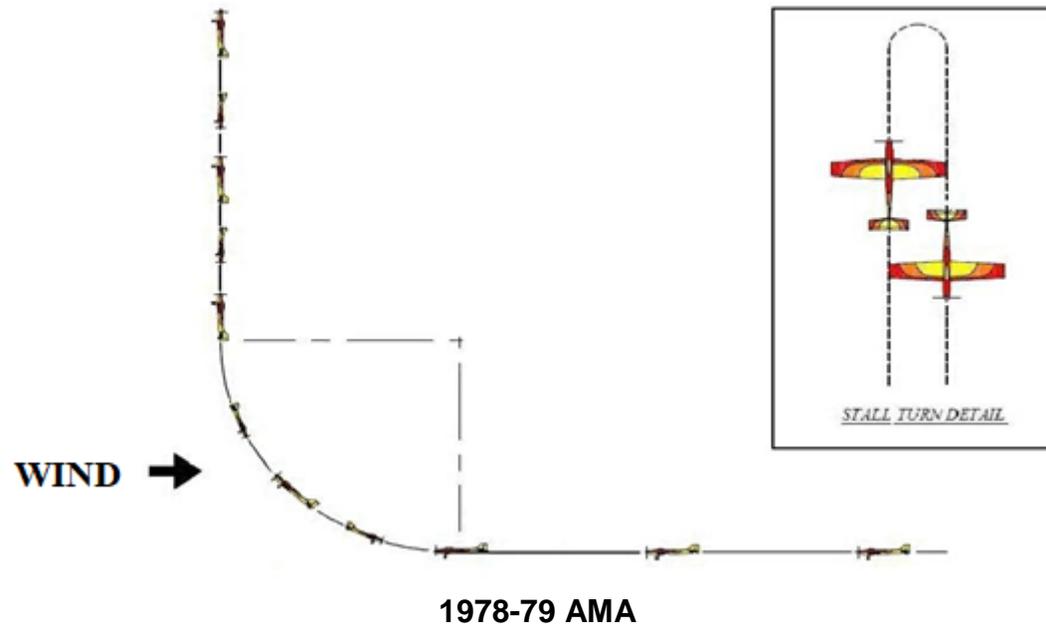
Model pulls up and executes a square loop. The model should rotate sharply at the corners.

Downgrades:

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

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## STALL TURN



1978-79 AMA

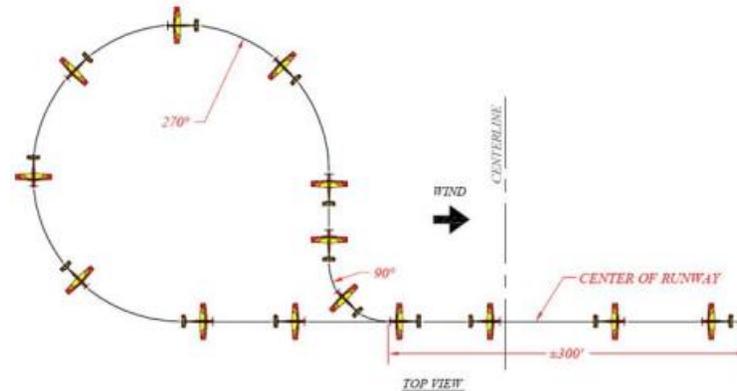
The model starts from straight and level flight and noses up to a vertical position, yaws through 180 degrees, then dives along a parallel path and finishes the maneuver with the plane level at the same altitude as the entry.

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:** 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:** 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

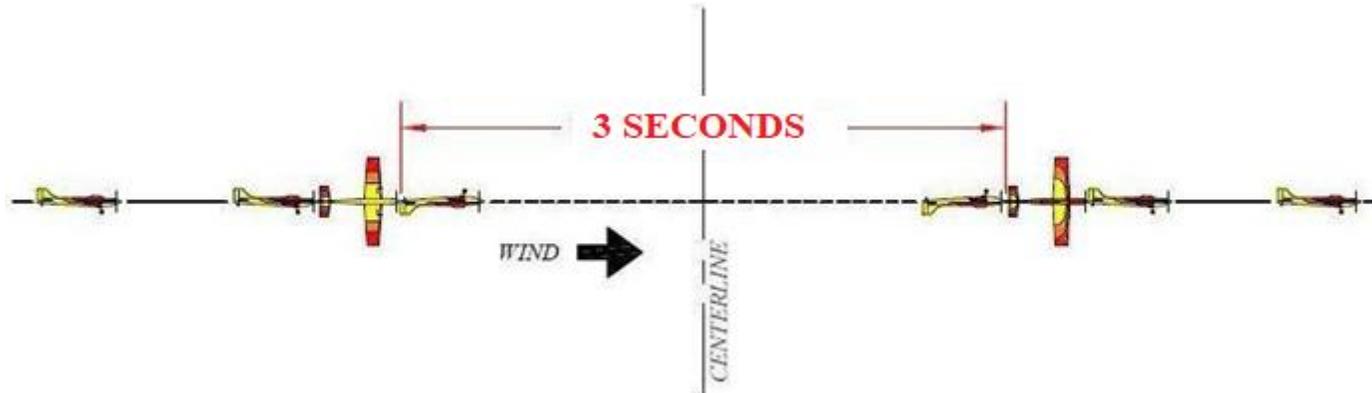
**STRAIGHT FLIGHT BACK:** The model should fly back toward the circle along the same line as the outgoing path and pass exactly over the circle.

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

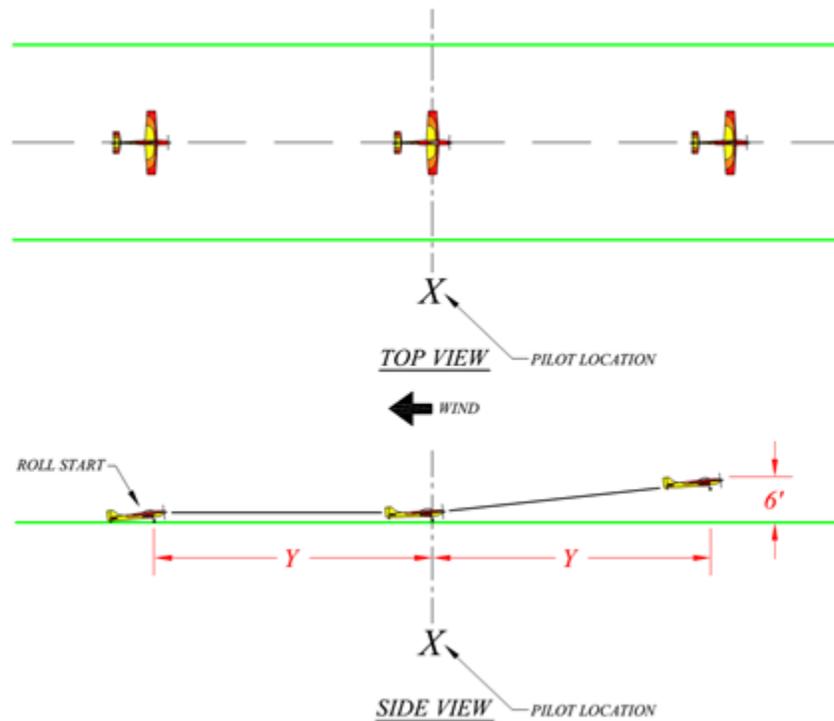
The model starts in straight, level, upright flight, then rolls 180° (roll approximately one (1) second), stops in the inverted position, proceeding in straight level inverted flight for approximately three (3) seconds, then rolls 180° (in same direction and roll rate as first roll) back to level, straight,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

Downgrades:

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

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## TAKE-OFF



### 1978-79 FAI

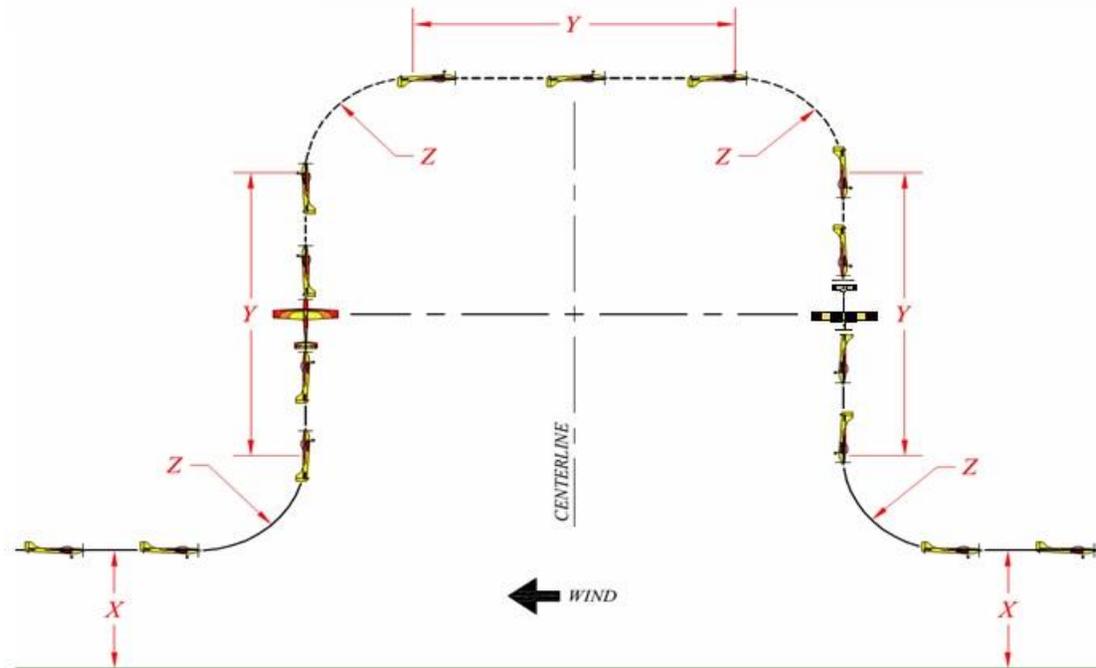
The model must stand still on the ground with the engine running, without being held, and must then take off. The take-off run should be straight, the model lifts gently from the ground and climb at a gradual angle. The take-off is completed when the model is approximately two meters (6½ feet) from the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

Downgrades:

1. The model does not stand still when released.
2. Changes in 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

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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