CL Dive Bombing and Strafing								
Engine Size (cubic inch)	Max. Model Weight	Required Line Length	Required Minimum Diameter of Each Line					Pull Test
			Single Strand			Multi-Strand		
			1 Line	2 Lines	3 Lines	2 Lines	3 Lines	
.1500–.4028	4 lbs.	59'9"–60'3"	.018"	.016"	—	.015"	—	10G
.4029–.4599	4 lbs.	59'9"–60'3"	.020"	.018"	—	.018"	—	10G

5. Engine(s) shall be of the reciprocating internal combustion type with piston displacement of from .1500 through .4599 permitted. Sixty percent of the actual piston displacement of four-stroke cycle engines shall be taken for compliance with this regulation. Jet assist, catapult or other launching device is not permitted.

6. Duration of Flight. Total elapsed flight time from takeoff to and including landing shall not exceed seven (7) minutes.

7. Control Line Requirements. Sizes and pull test as per chart.

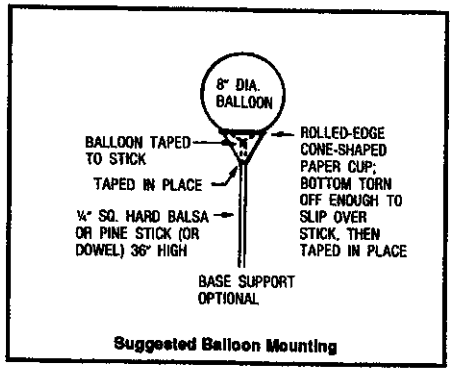
8. Flight. The plane must rise off ground and fly seven (7) laps at maximum altitude of 15 feet for speed timing. The plane shall be timed from the instant of release to the instant the plane passes the release point the seventh time, then the pilot must approach the targets in upright position flying level, dive over the barrier and knock out targets. Maximum altitude before dive is approximately 20 feet. Pilots are allowed five (5) passes to knock out targets. The pilot must signal when the airplane is over the target area prior to each scoring pass by raising an arm over head. All balloons broken in any pass will count; however, they must be broken by the plane itself. Balloons knocked over (except by prevailing winds) will not be replaced during flight. Pilots must not:

a. Use two-speed control.
b. Whip or lead model during speed run.
c. Stunt or engage in aerobatic flying except the diving and climbing necessary to engage the targets.
d. Crash.
e. Use more than one (1) airplane.

9. Official Flight. Three (3) attempts will be permitted toward two (2) official flights. An official flight is charged if the airplane has completed seven (7) laps and the pilot signals for a scoring pass. Note: Once the pilot has signaled for a scoring pass he will be charged with it the next time the airplane passes over the target area, whether or not he dives and attacks the targets.

An attempt will be charged if the pilot fails to start the engine in three (3) minutes time from the signal from the judge. Two (2) additional minutes will be allowed for each additional engine. An attempt will also be charged if the pilot waves off flight before signaling for a scoring pass.

10. Scoring. The target balloon nearest the barrier pole is worth 10 points, the next is worth eight (8) points, then six (6), four (4), and (2). *Note: See field layout diagram.*



Suggested Balloon Mounting

10.1. To qualify for bonus points planes must:

a. Represent a combat type military plane of some country and have appropriate military markings.

b. Break at least one (1) target balloon according to the rules and comply with the rules of the "flight" paragraph.

10.2. Bonus points are to be awarded on the basis of realism of the airplane and workmanship displayed by the builder.

10.3. Multiengine airplanes will receive five (5) additional bonus points for each additional engine. No points to be awarded for the first engine. All engines of a multiengine plane must be running until the completion of the scoring passes. No passes will be permitted unless all engines are running. Pilots are not required to make all five (5) scoring passes. *Note: Semiscale includes full-bodied and profile types.*

Bonus Breakdown:	Poor	Good	Excellent
Airplane Scale	50	75	100
Airplane Semi-Scale	10	20	30

10.4. The final score equals the speed in mph times the sum of balloons broken plus bonus. Example: 40 mph × 12 (6.4 and 2 balloons) plus 20 = 500 points. *Note: Bonus points are tentatively awarded before flight; if the flight qualifies then they are awarded.* A crash or failure to break any balloons would result in a zero (0) score.

RADIO CONTROL AEROBATICS

RADIO CONTROL, GENERAL (FOR NONSCALE EVENTS)

1. Applicability. In addition to the following General Radio Control rules and the specific rules for each radio control event, radio control model aircraft construction, flying, and competition are also governed by the rules of the following sections: Sanctioned Competition, Records, and General. Although the following general and specific rules primarily govern competitive activity in AMA events, it is strongly recommended that in the interest of safety and consistency they be followed in all radio control activity.

2. Safety Declaration. At all sanctioned contests, each contestant shall sign an AMA Flight Safety Declaration (perhaps as part of an entry form), attesting to the fact that he/she has previously and is now capable of confidently performing the maneuvers comprising his competitive event. Furthermore, the contestant shall also similarly declare that any and all aircraft he/she uses in said competition have been test flown at least to the extent that they have performed the same competitive maneuvers and are therefore qualified to be flown in the contest and in the presence of fellow contestants, contest officials, and all others who may be in the flight area during the competition period.

RADIO CONTROL PATTERN

For events 401, 402, 403, 404, 406.

1. Applicability. All pertinent AMA regulations (see sections entitled Sanctioned Competition, Criteria for Cancellation of Contests, Selection of Champions and Radio Control, General) shall apply except as specified below.

2. Objective. To control by radio a model airplane so that various planned maneuvers may be accomplished. The criterion is the quality of execution of the maneuvers compared to defined geometric descriptions and specified procedures. Maneuvers shall be judged according to the AMA Radio Control Pattern Judges Guide.

3. Licensing Requirements. All radio equipment and operation must conform to the regulations of the FCC. The AMA membership card of each entrant shall be checked at every sanctioned meet. An FCC amateur license is required for use of 50 and 53 MHz.

4. Model Aircraft Requirements.

4.1. Power. Models shall be powered by reciprocating or rotary piston internal combustion engine(s) or electric motor(s). Total displacement of a reciprocating or rotary piston internal combustion engine in a single engine model shall not exceed .6102 cubic inch (10 cubic centimeters). In a model powered by two (2) or more reciprocating or rotary piston internal combustion engines driving separate propellers, the total displacement shall not exceed .8056 cubic inch (13.20 cubic centimeters) and none of these individual engines shall exceed .6102 cubic inch (10 cubic centimeters). Fifty percent of the actual piston displacement (volume swept by the piston) of four-stroke cycle engines shall be taken for determining maximum displacement allowed.

● **4.2. Noise Limit.** Each reciprocating or rotary piston internal combustion engine shall be equipped with an effective silencer. The maximum noise level for all classes shall be 98 decibels measured at three (3) meters from the center line of the model with the model standing on concrete or macadam, and 96 db if an earth or short grass surface must be used. All measurements will be taken perpendicular to the fuselage centerline on the right-hand downwind side of the model with the motor running at full power; the microphone to be placed on a stand 30 centimeters above the ground and in line with the motor. No noise reflecting objects shall be nearer than three (3) meters to model or microphone. A score penalty of five (5) percent of the raw flight score shall be assessed for those models registering over 98 db, and a 10 percent penalty for those registering over 101 db. The Event Director shall have the option of deleting the noise level requirement at any sanctioned event; however, such deletion must be published in advance of the event date. (See recommended sound reading procedures in addendum I at the rear of this book.)

4.3. Weight. No model may weigh more than five (5) kilograms (11 pounds) gross—but excluding fuel—ready for takeoff.

4.4. Controls. There shall be no radio equipment or aircraft control function limitations in any Pattern class except Novice; however, the use of an "automatic pilot" type device, which places the model under anything less than full pilot control at all times, is prohibited in all classes of competition.

● **4.4.1.** In the Novice class, aircraft must be of the fixed gear type, or, if the aircraft is equipped with retractable landing gear, the aircraft must be flown with the gear down.

4.5. Number of Airplanes. Two (2) models may be entered by each contestant. A contestant may interchange the aircraft and/or various parts as he wishes provided the resulting complete model conforms to the rules and that the parts have been checked before flight.

4.6. The builder-of-the-model rule shall not apply to the Pattern events.

4.7. Identification. All models shall be identified by the contestant's AMA license number permanently affixed to the upper side of the right-hand lifting surface or to each side of the fuselage or vertical stabilizer. The height of the numerals must be at least one (1) inch. Both stroke and width shall be such as to enable ready recognition.

5. Number of Helpers. Each pilot is permitted one (1) helper during the flight. Two (2) helpers may be present during the starting of the engine(s). Once airborne no person other than the pilot shall operate the transmitter controls. Operation by anyone else shall require disqualification of the flight.

6. Safety Requirements. Considerations of safety for spectators, contest personnel, and other contestants are of utmost importance in the event, and the following safety provisions must be observed.

6.1. The Contest Director at an AMA sanctioned event has the authority to perform safety inspections of any equipment and to prevent any

participant from using equipment which in the Contest Director's opinion is deemed unsafe.

6.2. The "flight line" shall be defined as a straight line, infinitely long in both directions, in front of which all flying is done and in back of which all officials, contestants, and spectators are positioned. The judges shall be positioned right at the flight line, and, in fact, it shall be established by the judges' position. If at any time during a flight, including the takeoff and landing, the plane goes behind the flight line, the maneuver being executed or the previous maneuver (if the plane is between maneuvers) shall be scored zero (0). If two (2) zeros are earned during the same flight for flight line infractions, the remainder of the flight shall be scored zero (0), and the pilot shall be ordered to land the plane. Continued flying behind the flight line shall result in disqualification of the contestant by the Contest Director.

6.3. Dangerous flying of any sort or poor sportsmanship of any kind shall be grounds for disqualification of the contestant involved.

6.4. The pilots shall remain near the judges while flying and in particular shall stay off the runway and/or landing area during maneuvers which call for flying (or taking off or landing) in line with the center of the runway and/or landing circle.

6.5. All planes must have rounded prop spinners or blunt faced hubs such that no propeller shaft protrudes. Rounded devices shall have a radius of point not less than three (3) millimeters.

6.6. Knife-edge wings are not allowed. Leading edges must have two (2) millimeters minimum radius.

● **7. Pattern Event Classes.** The Pattern event shall be divided into five (5) classes. The first four (4) shall (in order of increasing difficulty) be referred to as Novice, Sportsman, Advanced, and Master. The fifth class shall be referred to as FAI class. The Novice class is supplemental (see Supplemental and Provisional Rules, page 2). Competitors must be advised prior to the start of the contest of any planned deviations from standard AMA rules pertaining to the events they have entered.

8. Contestant Classification. At his first Pattern contest a contestant may enter any one Pattern class at his own option. (This decision should be made with care as no one at any time, except as noted in 8.1.2. and 8.2.5., will be permitted to change to a lower class.) Once committed to a certain class a contestant will be allowed to move only to a higher skill class. This move will come about in one of two ways: (1) voluntary, (2) mandatory.

8.1. A contestant may promote himself voluntarily to a higher class at any time; however, once the move is made, he may not change back to a lower class.

8.1.1. Exception: A contestant may fly in the next higher class at a contest where his class is not being flown without committing himself to a permanent move to a higher class. He may not fly in a class lower than the one to which he is committed.

8.1.2. Exception: For a flier to be reclassified to a lower rank, that person must make application (using a form supplied by AMA HQ) to be signed by a Contest Director and forwarded to the petitioners District Contest Board representative and Vice President for their approval.

8.1.3. Exception. Contestants who flew Expert or Masters during 1990–91 rule cycle may elect to fly Advanced or Masters under this rule book but must declare which at their first contest. A person electing Masters may not move back to Advanced except as provided for by the rule book. Remaining classes are unaffected and progression is per the rule book. FAI/F3A fliers may revert to Masters at their option.

8.2. A contestant will be mandatorily advanced through the classes as follows: A flier must move out of the Novice class at the end of that calendar year if he places first, second, or third, and above at least four (4) other fliers (having recorded an official flight) in any sanctioned Pattern class contest. For Sportsman, and Advanced fliers, advancement takes place through the accumulation of points. In these classes, contestants receive points according to their finishing place in every contest they compete in. For fliers finishing third or below in a given contest, they will receive points equal to the number of official (having recorded an official flight) fliers they beat. The second place winner will receive points equal to twice the number of official fliers he beats, and the first place winner will receive points equal to three times the number of official fliers he beats. The points each contestant receives go into his cumulative record.

8.2.1. A flier accumulating or exceeding 100 points in Sportsman or Advanced classes will automatically be advanced to the next higher class up to the top AMA style class of Masters at the end of that calendar year.

8.2.2. A contestant may voluntarily move to the next higher class upon attaining the goals itemized in 8.2.1. but will not be required to do so until the end of the calendar year.

8.2.3. The time required to attain the goals of 8.2.1. has no limit. A contestant's point accumulation does not start over again at the beginning of each year, but continues until, if ever, the advancement goal is reached.

8.2.4. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2.) he begins with zero (0) points. *Note: A contestant who flies in a higher class under the Exception Rule (8.1.1.) above still acquires classification points in accordance with 8.2. above.*

8.2.5. There is no mandatory advancement into from the Masters class.

Examples

1. The contestant is one (1) of eight (8) who flies officially in a given class, except Novice, and places first. He acquires three (3) times seven (7) (the number he beat) or 21 classification points.

2. The contestant is one (1) of 16 and places fifth. He receives 11 points.

3. The contestant accumulates 95 points in 1990 and thus remains in his declared class into 1991. At the first 1991 contest, he picks up 12 points. He may fly the rest of 1991 in his declared class but will be advanced to the next higher class starting January 1, 1992. (He may move up sooner if he so desires.)

8.3. Each Pattern contestant is responsible for maintaining an accurate record of his own classification points. Handy walletsize Classification Advancement Record forms are available upon request from AMA HQ; please include a preaddressed and stamped return envelope. CDs of meets having RC Pattern events are also provided with a small supply of such forms.

9. Number of Flights. At the beginning of a contest, before any flying is done, the CD shall announce the number of flights that will be flown. This number should be reasonably determined based upon the number of contestants and the time available. Once this number has been announced, this is the exact number of flights that must be flown. The winners in each class will be the contestants who are ahead when this number of flights is finished. Fewer flights may be flown if weather conditions cause some loss of flying time during the contest. Contest officials shall make every reasonable effort to ensure that all contestants receive equal opportunity to fly.

10. Official Flight. There is an official flight when an attempt is made whatever the result.

10.1. There is an attempt when:

a. the pilot announces the start of the takeoff maneuver or

b. the model fails to commence the takeoff maneuver within the three (3) minutes allowed to each competitor.

If the engine stops after the pilot has announced the start of takeoff and before the model is airborne, it may be restarted within the three-minute (3) period. However, no points will be awarded for the subsequent takeoff maneuver.

● **10.2.** Each competitor is entitled to one (1) attempt for each official flight. An attempt may be repeated at the judges' discretion only if, for some unforeseen reason, the model fails to make a start (i.e., safety delay due to other aircraft traffic, etc.). The Event Director shall have sole discretionary authority to grant a single repeat attempt, if, in his/her opinion, the competitor has encountered radio interference during the course of an official attempt.

10.2.1. When a competitor is allowed a reflight due to radio interference, the aircraft shall be impounded by the Event/Contest Director and only refueling will be allowed prior to the reflight attempt. Such a repeat attempt, if granted, shall start with the maneuver immediately preceding the point in the flight where the interference was encountered. If radio interference is again encountered during the reflight, the flight scores shall stand as originally recorded during the initial attempt. Whenever possible, data gathered by electronic monitoring should be consulted by the Event Director when making the decision to grant or deny an interference reflight.

10.3. In the case of a collision during a Pattern flight, the contestants must immediately recover their aircraft. They may resume their flights with the same aircraft if the aircraft are judged to be airworthy or with a backup or repaired aircraft. They will begin with the maneuver that was in progress or with the next scheduled maneuver if the collision occurred between maneuvers. The contestants may, at their option, elect to refly the entire flight. The previously defined starting times will apply for a resumed flight and the contestant will be allowed no more than two (2) passes in front of the judges for the purpose of trimming the plane. Scores of the previous maneuvers will be added to the scores of subsequent maneuvers in the resumed flight. Maneuver scores prior to the collision will not be used if the contestant chooses to refly the entire flight. The flight must be completed by the end of the round being flown, or within a timeframe designated by the CD.

10.4. Competitors must be present and ready when they are called to the flight line. Once a round is complete there will be no makeup flights. Competitors who are not present will receive zero (0) points for each flight they are not present. Late entries will receive zero (0) points for each flight they are not present.

11. Time Limits. Each contestant has three (3) minutes to start the engine and commence the takeoff maneuver. When the contestant fails to commence within the three (3) minutes and is so informed by the timer, he must immediately clear the area for the next contestant. No engine restarts are allowed after the wheels leave the ground on takeoff. Restarting is permitted within the first three (3) minutes, but only if prior to takeoff (also see paragraph 10).

● **12. Point System.** All classes shall be judged and scored on a 10 to zero (0) basis to the nearest one half (1/2) point, with each individual maneuver score being multiplied by an assigned "K" factor degree of difficulty modifier. The flight score is the sum of the "K" multiplied maneuver scores.

13. Determining the Winner. Each flight score shall be normalized in the following manner. When all competitors for a class have flown in front of a particular set of judges once, the highest score shall be awarded 1,000 points. The remaining scores for that set of judges are then normalized to a percentage of the 1,000 points in the ratio of actual raw score over round winner's raw score multiplied by 1,000.

$$\text{Score Y} = \frac{Sy}{Sw} \times 1{,}000$$

Score y = points awarded to competitor
Sy = raw score of competitor
Sw = raw score of winner of round

For example: A total of 10 contestants are entered in Sportsman. After all 10 have flown in front of judge set A, the winner of that round has a raw score of 81. He will receive 1,000 points. Competitor Y has a raw score of 75.75 divided by 81 multiplied by 1.000 equals 925.9 points which is Y's score. *Note: If a class (example here Sportsman) is split between two (2) lines, the score can only be normalized after the second round when all 10 have flown in front of judge set A.*

● **13.1.** In all classes, the winner shall be the only flight score when only one (1) round is flown; the highest total of the best two (2) flight scores when two (2) or three (3) rounds are flown; the highest total of the best three (3) flight scores when four (4) rounds are flown; and the highest total of the best four (4) flight scores when five (5) or more rounds are flown. Points from repeat flights may not be added to earlier flights. Each flight is complete in itself. In case of ties, the best nonscored flight of the contestant shall be used to determine the higher placement.

13.2. Although normalizing is the expected method of scoring at a contest, a CD has the option of not using normalizing if he so advertises in advance.

● **14. Flight Pattern and Maneuvering Area.** The maneuver schedules of all classes must be executed in the order in which they are listed during an uninterrupted flight within a maneuvering area or "box" bounded by lines 60 degrees each side of center. The vertical height shall not exceed 60 degrees from the horizontal. The boundaries of the maneuvering area may be marked by the placement of vertical poles at the center position and 60 degrees right and left on a line approximately 150 meters in front of the pilot, or by surface lines of white or

contrasting color originating at the pilot's position, or both, depending on local conditons and topography. The Novice class is not required to stay within the box. The judges shall be seated not more than 10 meters behind the pilot's position (the apex of the 60 degree lines) and within an area described by the extension of the 60 degree lines to the rear of the pilot. Maneuvers must be performed where they can be clearly seen by the judges. Center maneuvers should be performed centered in the maneuvering area in a plane exactly perpendicular to the judges' line of sight to the model. Scored turnaround maneuvers should not exceed the 60 degree right and left limits of the maneuvering area. Maneuvers in those classes with all scored turnarounds should be performed along a line of flight approximately 150 to 175 meters from the judges, with the main criteria being visibility. Infractions of any of the above rules are cause for downgrading in addition to those downgrades listed in the Description of Maneuvers section. The Procedure Turn in the Novice class shall not be downgraded for exceeding the limits of the maneuvering area. Unscored turnarounds in any class may exit the maneuvering area.

● **14.1.** Each time the model passes in front of the judges, a maneuver must be executed, except after takeoff and before landing, where in each case a maximum of two (2) passes may be made. In the maneuver lists that follow (U) and (D) denote mandatory maneuver orientation (Upwind–Downwind). This orientation, or *Direction of Flight* shall be determined by the direction of takeoff and landing as specified by the Event Director. In all classes, entry into the maneuvering area for the first maneuver after takeoff shall be in the upwind (U) direction.

14.2. If a maneuver other than landing is done out of order it shall be scored zero (0). Judges may inform the pilot or helper that a maneuver has just been performed out of sequence.

14.3. If an illegal pass (crossing a line perpendicular to and centered on the judges) is made the maneuver which should have been executed shall be scored zero (0).

14.4. After a contestant performs a wrong maneuver or makes an illegal pass, he shall then be judged on the remaining maneuvers in the schedule, provided they are executed in proper sequence, and in proper upwind/downwind orientation.

14.5. The contestant (or his helper) may not touch his plane after it has become airborne until completion of the flight; i.e., he may not land the plane between maneuvers in order to make adjustments to engine, trim, etc.

● **14.6.** In all classes, the contestant (or helper with the permission of the judges) must call out the initiation and completion of the takeoff and landing maneuvers and all maneuvering area entries and exits.

15. Novice Pattern Maneuvers.

1. Takeoff (U)	k=1
2. Straight Flight Out (U)	k=1
3. Procedure Turn	k=2
4. Straight Flight Back (D)	k=1
5. Stall Turn (U)	k=2
6. Immelmann Turn (U)	k=2
7. Three (3) Inside Loops (U)	k=3
8. One (1) Horizontal Roll (D)	k=1
9. Landing (U)	k=1
Total	k=15

Note: (U) means upwind; (D) means downwind.

16. Sportsman Pattern Maneuvers.

1. Takeoff (U)	k=1
2. Double Stall Turn (U)	k=3
3. One Half Cuban 8	k=1
4. Cuban 8 (D)	k=2
5. Immelmann Turn (U)	k=2
6. Split "S"	k=1
7. Three (3) Inside Loops (U)	k=3
8. Straight Inverted Flight (D)	k=1
9. One (1) Reverse Outside Loop (U)	k=3
10. Three (3) Horizontal rolls (D)	k=3
11. Landing (U)	k=1
Total	k=21

Note: (U) means upwind; (D) means downwind.

17. Advanced Pattern Maneuvers.

1. Takeoff (U)	k=1
2. Double Immelmann (U)	k=2
3. One Half Reverse Cuban Eight	k=1
4. Slow Roll (D)	k=3
5. Stall Turn	k=2
6. Top Hat with 1/2 Rolls (U)	k=3
7. Humpty Bump with Options	k=2
8. Four (4) Point Roll (D)	k=4
9. Stall Turn with 1/2 Rolls	k=2
10. Cobra Roll with 1/2 Rolls Up and Down (U)	k=2
11. Immelmann Turn	k=2
12. Three (3) Outside Loops from the Top (D)	k=3
13. Split "S"	k=1
14. Square Loop (U)	k=2
15. Landing (U)	k=1
Total	k=31

Note: (U) means upwind; (D) means downwind.

18. Masters Pattern Maneuvers.

1. Takeoff (U)	k=1
2. Square Loop with Four (4) Half Rolls (U)	k=5
3. Half Reverse Cuban Eight	k=1
4. Four (4) Point Roll (D)	k=4
5. Immelmann Turn	k=2
6. Reverse Top Hat (U)	k=4
7. One and half Turn Spin	k=3
8. Square Horizontal Eight (D)	k=5
9. Top Hat with 1/4 Roll	k=2
10. Avalanche (U)	k=3
11. Half Cuban Eight	k=1
12. Triangle Rolling Loop (D)	k=4
13. Stall Turn with 1/2 Rolls	k=2
14. Cobra Point Roll with 1/4 Up and Down (U)	k=3
15. Half Square Loop with 1/2 Roll in Vertical	k=2
16. Six-sided Outside Loop	k=4
17. Split "S"	k=1
18. Figure M with Half Rolls (U)	k=5
19. Humpty Bump with Pilot's Option	k=2
20. Reverse Knife Edge (D)	k=4
21. Half Square Loop with Full Roll in Vertical	k=3
22. Three (3) Turn Inverted Spin (U)	k=4
23. Landing (U)	k=1
Total	k=66

Note: (U) means upwind; (D) means downwind.

19. FAI Pattern Maneuvers. The FAI class shall fly according to the current FAI RC Aerobatics (F3A) rules. The builder-of-the-model rule, if any, shall not be enforced.

20. Suggested Field Procedure. The procedures listed below are suggestions to Contest Directors for operation of an RC Pattern event, and may be altered to fit local conditions.

20.1. All RC contestants shall be set up in "pits" at the spot assigned by the Event Director so they will be under his immediate control.

20.2. There will be no testing of transmitters or receivers during the flying period. Transmitters may be impounded at the discretion of the Event Director. Any person causing interference will suffer immediate disqualification. The Event Director should provide a monitor receiver, if available, to check for interference.

● **20.3.** The flight order shall be determined by random draw within each class, except wherever possible, frequency shall not follow frequency, and identical frequencies on adjoining flight lines shall be separated by at least two (2) positions in the flight order. The flight order shall rotate top to bottomeach round that fraction of its length which corresponds to the number of rounds to be flown; for example: One-sixth of its length each round for a six (6) round contest. Alteration of the flight order by anyone other than the Event Director or his designated representative is not allowed. When multiple flight lines are used, a separate flight order shall be established for each flight line.

20.4. The Event Director shall carry out the following procedure.

● **20.4.1.** Numbers one, two, and three on the flight order shall be on the flight line with their models, equipment, and one (1) helper if desired. Number one is contestant flying or ready to fly, number two is next man to fly, etc.

● **20.4.2.** Number one man shall have three (3), minutes from completion of preceding flight in which to release model for the start of his flight, unless the preceding flier's aircraft is on the same frequency. In this case, the flier shall be provided sufficient time to perform a radio safety check prior to going on the clock. False starts are permitted within the three (3) minute limit. Failing to start flight within this limit, contestant must immediately remove his plane and equipment to the pits. It shall be the responsibility of the Event Director or his representative to notify the contestant of the start and end of the three (3) minute period.

● **20.4.3.** Numbers four, five, and six on the flight order shall have their planes and equipment in a ready box located near the flight line. As soon as a flight is completed, the number four man becomes number three and shall be requested to move his model and equipment onto the flight line. If he is not on hand to do so, he shall be dropped from the flight order, and the order advanced to fill his place. The Event Director or his representatives shall be responsible for notifying contestants when they are to move to the ready box or flight line.

20.5. When technically possible and when judges and space are available, it is strongly recommended that two (2) or more flights be flown simultaneously under the following conditions.

20.5.1. Separate takeoff and landing areas sufficiently spaced from each other to minimize engine noise and flight path interference.

● **20.5.2.** Individual maneuvering area markings are established for each flight line.

● **20.5.3.** The Event Director shall arrange the multiple flight orders so that delays due to frequency conflicts are minimized as far as possible.

20.6. Officials. An Event Director, a Dispatcher–Recorder and Judges are the essential officials for an RC Event. If possible, the Dispatcher–Recorder should have at least two (2) helpers.

● **20.7.** Each flight should be judged by at least two (2) judges, with their scores averaged or totaled to give final score for the flight. It is suggested that each maneuver be scored immediately after it is performed. Judges shall score maneuvers individually and without consultation between them. There should be enough judges available to establish a rotational procedure which will average out variations in judging. Sets of judges shall judge all contestants an equal number of times. If different judges are used during the contest, all contestants shall have an equal opportunity to fly before all judges. Substitution of judges which precludes equal exposure by all contestants shall be avoided. If adverse weather conditions preclude equal exposure for all contestants the results of these flights may be disqualified at the discretion of the Event Director.

● Definitions

Attitude: The angle of the fuselage of the model with respect to its track.

Maneuvering Area: The aerobatic zone or "box", bounded by lines radiating from the pilot's position 60 degrees each side of center, with a vertical height not exceeding 60 degrees and a depth determined by the model's line of flight.

Symmetry: The balanced and equal correspondence of opposing or superimposed maneuver elements with respect to size, shape, and position.

Track: The trajectory or flight path of the center of gravity of the model with respect to fixed ground reference.

Wind Correction: An alteration of aircraft attitude made for the purpose of compensating for the effects of wind drift on the track of the model. All maneuvers in RC Aerobatics are required to be wind corrected in such a way as to preserve the shape of the maneuver in the track of the model as described in Section E of the AMA RC Pattern Judges' Guide.

● AMA RC PATTERN JUDGES' GUIDE

A. Purpose. The purpose of the AMA RC Pattern Judges' Guide is to furnish an accurate description of each maneuver used in Pattern competition and to provide a reference for use in developing a uniformly high standard of judging in all AMA sanctioned contests.

Study of this guide by the competitor will help him learn exactly what is expected, while study by the judges will help them decide precisely how well the competitor meets these expectations.

B. Principles. The principles of judging an RC model shall be based on the perfection with which the model executes the maneuvers described in section E. The main criteria used to judge the degree of perfection are:

1. Precision of the maneuver.
2. Smoothness and gracefulness of the maneuver.
3. Positioning or display of the maneuver.
4. Size or dimensions of the maneuver relative to the maneuvering area, distance from the judges, and other maneuvers in the flight.

The above criteria are listed in order of importance; however, all of them must be met for a maneuver to be rated perfect. These criteria are discussed below.

a. Precision. Grading of maneuver precision will be based on how well the model tracks the shape of the individual maneuver as described in section E, Description of Maneuvers. All maneuvers in RC Aerobatics are required to be wind corrected in such a manner as to preserve the shape and symmetry of the maneuver in the track of the model. All straight lines, both horizontal and vertical, will be graded on the track projected by the model. Changes in attitude of the model to maintain a straight track will not be reason for downgrading the maneuver.

The judge should form an image of the forthcoming maneuver based on using the straight and level entry identified in section D, Judging Individual Maneuvers, as a reference. The absence of a definite entry into a maneuver increases the difficulty of judging its precision and competitors will recognize this as justification for downgrading. The straight and level exit from a maneuver is one of the more valuable portions of a maneuver in evaluating how well the intended course of the maneuver was followed. Therefore, the absence of a well definied straight and level exit should also result in downgrading.

Calling of the landing and takeoff maneuvers as well as all maneuvering area entries and exits is required (see 14.6.). Failure to correctly call an entry or exit of the maneuvering area should result in a major downgrade of the maneuver immediately following the failure to call.

b. Smoothness and Gracefulness. A most general definition would relate to providing a smooth, flowing, polished appearance in flight. A perfect set of consecutive rolls should have a constant roll rate from start to finish. A perfect loop must have a constant radius defining a perfect circle. It cannot be made up of a series of straight flight increments joined with sudden angular jerks. Rotations in the pitch axis of the model should be made evenly and be of sufficient radius to give a smooth appearance in flight. Excessivly tight maneuvers should be avoided.

c. Positioning. All scored maneuvers except landing and takeoff and the procedure turn in the Novice class must be performed within the maneuvering area. The center maneuvers in all classes should be performed in the center of the maneuvering area in a plane exactly perpendicular to the judges' line of sight to the model. In those classes with scored turnarounds, the turnaround maneuvers should not exceed the limits of the maneuvering area as defined in the RC Pattern rules (see 14.).

The diagrams used to describe the maneuvers in section E are intended to represent the geometry of the maneuver three-dimensionally. They are not intended to define the best view of the maneuver to present to the judge. "End on" or "canted" presentation of maneuvers is reason for downgrading and should be avoided, unless the maneuver is intentionally offset (with permission of the judges) to avoid the sun.

While no bonus for exceptionally low altitude is justified, the entry and exit altitudes for all maneuvers should be the same (as noted in section E, Description of Maneuvers). In general, scored turnaround maneuvers are positioning maneuvers. Therefore, entry and exit altitude need not be the same if the pilot is making an altitude correction. The downgrade should be taken on the previous out of position maneuver. An additional downgrade for a position correction in the turnaround would, therefore, amount to two (2) downgrades for one (1) mistake. Unscored turnarounds, of course, may be used to position the aircraft in any manner required.

It should be noted that it will sometimes be impossible for a competitor to avoid the sun in the course of a flight involving scored turnarounds. The judge should follow through to the best of his/her ability, and resist the temptation to downgrade the maneuver for this unfortunate circumstance. In those classes with predominantly unscored turnarounds it may be possible for the competitor to offset maneuvers to avoid the sun. If this is to be done, it should be discussed between the competitor and the judges prior to the flight. If, after such discussion, an aircraft crosses the sun unnecessarily the judge is perfectly justified in being quite severe.

d. Size. Flying so far out as to make evaluation of a maneuver difficult should be severely downgraded. The main criteria here is *visibility*. For a large, highly visible model, a line of flight approximately 175 meters in front of the pilot may be appropriate, while a smaller and less visible model might have to be flown at 140 to 150 meters. Maneuvers performed on a line greater than approximately 175 meters in front of the pilot should be downgraded under any circumstances, as even the keenest eye begins to lose perspective at this distance.

Since the size of the maneuvering area varies proportionally with the distance from the judges to the model's line of flight, the size of the maneuvers will vary as well. In addition, maneuvers should be proportioned relative to the size of the other maneuvers in the flight. In other words, absolute maneuver size is of little importance; maneuver size relative to the available maneuvering area and other maneuvers in the flight is paramount.

In those classes with mostly unscored turnarounds, the competitor should proportion the maneuver sizes, especially those with loops, squares, or verticals, to the distance out within that broad corridor that he/she chooses to fly. Large maneuvers placed close in will suffer downgrading for exceeding the vertical 60 degree maneuvering area limit, and small maneuvers placed far out will suffer downgrading for appearing to hide the maneuver.

In all classes, the judge should be careful to judge only the skill with which the maneuver is flown and presented, not the performance of the aircraft. A slow flying model, flown closer to the judges and flying proportionally smaller maneuvers may present the same "pace" and appearance as a faster flying model flown at a greater distance with proportionally larger maneuvers.

C. Accurate and Consistent Judging. The most important aspect of consistent judging is for each judge to establish his/her standards and to maintain that standard throughout the meet. It is advisable for the Contest Director or Chief Judge to hold a briefing prior to the start of the meet in order to make the standards as uniform as possible. This is done best by means of a practice flight or flights which all judges score simultaneously and privately. After each flight, the defects in each maneuver should be discussed by all judges and agreement reached about the severity of the defects. However, once this is done and the contest is started, the individual judge should not alter his/her standards under any influence.

An accurate standard of judging is also very important. Being a consistent judge, whether high or low, is not good if the scores awarded are not a fair reflection of the maneuver performed.

D. Judging Individual Maneuvers. The schedule of maneuvers to be performed is described in the RC Pattern rules. Each maneuver is to be scored individually on a basis of 10 to zero (0) points, in half point increments, according to the degree of excellence.

One common problem is to score the first flights too high and then find there is no margin left to reward a superb flight. When in doubt, give the lower score. A 10 should be awarded only if no flaws are seen that would justify a lower score.

Another common problem is failure to use the entire 10 point scale when scoring maneuvers, particularly within the same flight. The judge should not hesitate to reward an exceptional maneuver simply because it appears following a series of mediocre or poor maneuvers. Conversely, a severely defective maneuver which appears in an otherwise impressive flight should be given the low score it deserves.

The following section contains a description of each maneuver and lists a number of reasons for downgrades. The maneuver should be downgraded according to 1) the type of defect; 2) the severity of the defect; 3) the number of times any one defect occurs, as well as the total number of defects; 4) the positioning of the maneuver. Additionally, in classes with predominately scored turnarounds, the size of the maneuver relative to the other maneuvers in the flight and the maneuvering area should be considered. The availability of whole and half points will aid the judge in assigning the proper downgrade value to major and minor defects.

For example, a small single change in heading during the slow roll would be considered one (1) defect while two (2) or three (3) distinct turns would be considered two (2) or three (3) defects. Note that for many maneuvers there are more than six (6) possible kinds of defects and that some of these can be repetitive. It is not possible to downgrade one (1) point for each defect or, indeed, we would have many negative scores.

A score of 10 should be given only if the maneuver is well-positioned and no defects are observed that would justify a lower score. Any demerit in poor positioning should be decided at the start of the maneuver and also fed into the final score for the maneuver.

The following is a collation of all mandatory zero (0) scores applicable to all Pattern classes:

1. Flying behind flight line during or between maneuvers (see 6.2.).
2. Maneuver performed out of sequence (see 14.1.).
3. Execution of an illegal pass. (see 14.2., 14.3., 14.4.).
4. Touching the plane before completion of the flight (see 14.5.)
5. Maneuver not completed.
6. Model ends up on back when landing.
7. Any gear retracts or collapses during landing.
8. Flight scores zero (0) if any component of the aircraft falls off in flight.
9. Failure to take off (see 10.1.).
10. Landing outside runway.

One Point per 15 Degree Rule. This basic rule provides a general guide for downgrading deviations from defined manuever geometry. One (1) point should be subtracted for each approximate 15 degrees deviation. In general, lines can and should be judged more critically than deviations in roll.

Suggested Downgrades. Certain types of defects pose difficult judging decisions. The following guidelines are suggested:

Stall Turn: Airplane rotates through pitch axis (flops over) instead of yaw axis: In Sportsman class where the turn is the main point of the maneuver, a "severe downgrade" of three (3) or four (4) points for this defect alone; in other classes where the turn is but one part of a larger maneuver (Figure Ms with various rolls), downgrade two (2) or three (3) points.

Number of Loops or Axial Rolls (where three (3) are required): Two (2) or four (4) performed, severe downgrade of three (3) or four (4) points for that defect alone.

Maneuvers Off-Center: Deduct two (2) points for each quarter of the total maneuver's length that is offset. Examples (assuming no offset with judges' permission due to sun): Loops offset so that edge of loop just reaches judges—deduct four (4) points because maneuver is off center one half diameter; two (2) of three (3) axial rolls are offset—deduct about one and one half (1-1/2) points because maneuver is off center by one sixth (1/6). Narrow vertical maneuvers (such as spins, etc.) downgrade the same amount as for off center loops, as if the narrow maneuver were off center of a loop.

In those classes with scored turnarounds, if the scored turnaround is flown *entirely* out of the maneuvering area, including the entry and exit, it is scored zero (0). If it is flown partially out of the area, the downgrade assigned should be proportional to the percentage of the maneuver that is out of the area. The suggested downgrades listed under Maneuvers Off-Center should be used a guidelines.

E. Description of Maneuvers (in alphabetical order). All maneuvers will start and finish in straight and level flight. Maneuver entries and exits which are preceded or followed by unscored turnarounds will be at least 15 meters in length. Center maneuvers will have the same altitude and heading for entry and exit unless otherwise noted. Scored turnarounds will finish on a heading 180 degrees from the entry. In general, turnaround maneuvers are positioning maneuvers. Therefore, entry and exit altitude need not be the same if the pilot is making an altitude correction. The downgrade should be taken on the previous out-of-position maneuver.

All maneuvers which contain more than one (1) loop or contain partial loops should maintain a constant radius for the looping portions of the maneuver. Similarly, all maneuvers which have more than one (1) roll should have the same roll rate. All consecutive rolls should be at the same altitude and heading.

All maneuvers with half or quarter rolls will have short pauses of equal length before and after the rolls unless otherwise noted.

Any violation of the above will be a reason for downgrading, in addition to the downgrades listed in the maneuver descriptions.

All maneuvers consist of a number of basic elements, such as lines, loops, rolls, stall turns, snaps, and spins. A short discussion of these elements precedes the individual maneuver descriptions to aid the judge in determining appropriate downgrades for deviations from defined maneuver geometry.

Lines—All aerobatic maneuvers are started and ended by a horizontal line. When no line is flown between two (2) scored maneuvers, this should be considered a major defect in the upcoming maneuver.

All lines within a maneuver have a beginning and end which define their length. The length of a line should only be graded when a maneuver contains several lines with a given relationship, as in a square loop. Unequal or misrelated lines should be downgraded according to the severity of the defect.

Whenever a type of roll is placed on a line, the length of line before and after the roll must be equal. A small inequity should be considered a minor defect while a total absence of line should be considered a major defect.

Loops—A loop must have, by definition, a constant radius, and must be flown in the vertical plane throughout. A loop must start and end with a well defined line which, for a complete loop, should be horizontal. For a partial loop such lines may be in another plane of flight, as required by the maneuver.

Partial loops flown as part of the same maneuver must have identical radii. A slight difference in radius would be a minor defect; a more severe difference would be a major defect. Every loop or partial loop should be flown with a smooth, continuous radius. Each angular jerk or segmentation should be considered as a separate defect.

Excessivly tight radii should be downgraded, as this violates the requirement for smoothness and gracefulness (see B.b.)

Rolls—Rolls may be flown as individual maneuvers or as elements of other maneuvers. The following criteria apply to all rolls.

1. Roll rate must be constant.
2. Roll must have a well defined start and stop.
3. All rolls flown on lines between partial loops must be centered on the line.
4. Point rolls must hesitate with equal time on each point.

Downgrades for the above defects are assigned according to the severity of the defect.

Stall Turns—Stall turns consist of lines and partial loops as well as stall turns. The following criteria apply to all maneuvers containing stall turns (e.g., Figure M, Stall Turn with Half Rolls, etc.).

1. Lines must have exactly vertical and horizontal flight paths.
2. Entry and exit must consist of partial loops with equal radii.
3. Length of the vertical line is not a criterion.
4. All rolls must be placed in the center of the lines.
5. Maximum pivot radius is one half (1/2) wingspan. A pivot radius of more than one and one half (1-1/2) wingspan should be considered a major defect.

Snaps—A snap roll is a rapid autorotation in a stalled attitude. The following criteria apply:

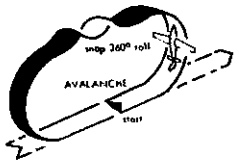
1. Since the maneuver is defined as a stalled maneuver, the attitude and flight path must show a definite break. If the stall does not occur, the maneuver is zeroed.
2. Snap rolls have the same judging criteria as axial rolls as far as start and stop of rotation and rate are concerned.
3. Snap rolls may be flown both positive and negative.
4. If the model returns to an unstalled condition during the maneuver element, the maneuver is severely downgraded.

Spins—All spins begin and are ended by a horizontal line. In order to accomplish a spin, the model must be stalled. The entry should be flown in a near horizontal path with the nose high attitude increasing as the speed decreases. The nose then drops as the model stalls. Simultaneously, the wing drops in the direction of the spin. The following criteria apply to spins.

1. Snap roll or unstalled entry scores zero (0).
2. The stop of rotation is judged according to the One Point per 15 Degree Rule. An error of more than 180 degrees in either direction scores zero (0).
3. A nearly vertical downward line of visible length must be flown after the rotation stops. The pull or push-out is judged as a partial loop.
4. The attitude of the model during the spin is not a judging criterion as long as the model is stalled.

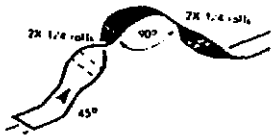
● **Avalanche.** Model pulls up and completes a half loop, at the top it executes a complete snap roll, recovers and does another half loop to finish in level flight. Downgrades:

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 scores zero (0).



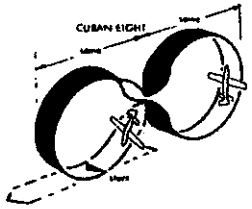
Cobra Roll with Half Rolls Up and Down. Model pulls up to a 45 degree climb, half rolls, pulls into a 45 degree dive, half rolls, recovers to level flight. Downgrades:

1. Climb and dive not 45 degrees.
2. Half rolls not centered in 45 degree climb and dive segments.
3. Half rolls not 180 degrees.
4. Changes in heading.



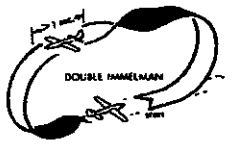
Cuban Eight. Model pulls up and executes an inside loop, when at 45 degrees inverted model pauses, does a half roll, pauses, followed by another inside loop, again when 45 degrees inverted pauses, the model does another half roll, pauses, and recovers to level flight. Downgrades:

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 not centered in the 45 degree descents and on each other.



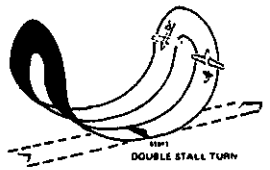
Double Immelmann. Model pulls up into a half inside loop, half rolls to upright, flies straight and level for greater than one (1) second, does a half outside loop and half rolls to level flight. Downgrades:

1. Half loops deviate left or right.
2. Half rolls not immediately after half loops.
3. Half rolls deviate left or right.
4. Level flight less than one (1) second.
5. Half loops not at same altitude.



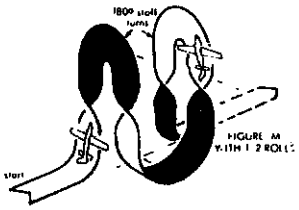
● **Double Stall Turn.** The model begins by pulling up into a quarter loop and then performing a stall turn. At the bottom of the pullout, the plane pulls up, thus completing half of an inside loop, at which point a second stall turn is executed, followed by a quarter loop pullout. The maneuver may be down- graded because:

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. Half inside loop not round and consistent in heading.
4. Bottom of half loop not at same altitude as entry and finish.
5. Model turns left or right during pullups.
6. Does not yaw tightly through 180 degrees.
7. Return track more than one half (1/2) wingspan fromentry path.
8. Return paths not parallel to entry path.
9. Maneuver not finished at same altitude as entry.



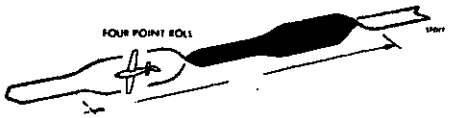
● **Figure M with One Half Rolls.** Model pulls up into a vertical attitude, performs a one half roll, a stall turn through 180 degrees, another one half roll, then executes a half inverted loop, followed by a third one half roll, a second stall turn and a fourth one half roll, recovering into level flight. All rolls and stall turns may be in either direction. 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. One half rolls not exactly 180 degrees.
4. Bottom of outside loop not level with entry.
5. Changes in heading during one half outside loop and rolls.



Four-Point Roll. Model rolls through 360 degrees, hesitating at each 90 degree point; at each hesitation wings are parallel or vertical to the horizon. Center is when model has rolled exactly 180 degrees. Downgrades:

1. One quarter rolls less than 90 degrees.
2. Model does not hesitate after each one-quarter roll.
3. Roll rate not constant.
4. Changes in altitude.
5. Changes in heading.

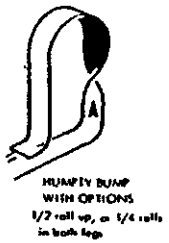


● **Half Reverse Cuban Eight.** Model pulls up into 45 degree climb, half rolls, executes a partial inside loop back to level flight in opposite direction as entry. Downgrades:

1. Initial pull up not at 45 degrees.
2. Half roll not centered in 45 degree climb segment.
3. Changes in heading.

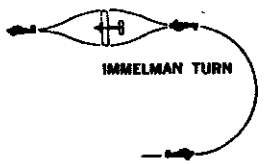
● **Humpty Bump with Options.** Model pulls up to a 90 degree climb, half rolls (or optionally quarter rolls), pushes or pulls through a half loop to a 90 degree dive, pauses (or executes a quarter roll if one was done on the climb segment) then recovers to level flight in opposite direction as the entry. Downgrades:

1. Track not 90 degrees in climb and dive.
2. Half roll (or quarter rolls) not centered in vertical lines.
3. Half roll not 180 degrees (or quarter rolls not 90 degrees).
4. Half loop not round.



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 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.



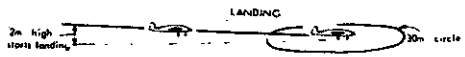
● **Landing.** The landing maneuver will start two (2) meters from the ground. The model flares smoothly to a nose-high attitude, dissipating flying speed, then smoothly touching the ground, within the landing zone, with the main wheels first, with no bouncing or changes in heading after touch down. The nose wheel on a tricycle gear and the tail wheel on a conventional gear (unless a "three (3) point landing" of mains and tail wheel touching simultaneously is executed) should settle gently to the ground after a brief rollout. The maneuver shall be considered complete once the plane has slowed below flying speed and has rolled straight for 15 meters.

The landing zone shall be marked by lines placed perpendicular across the runway and spaced 30 meters apart. The width of the landing zone shall be normally the width of the runway, but in no case shall exceed 30 meters. Displacement of the touchdown point from the runway center line shall not be reason for downgrade if the touchdown is within the zone. Normally this zone will be placed directly in front of the judges' position; however, should runway conditions or safety considerations dictate, the zone may be displaced at the discretion of the Event Director to such location as he/she may require. If such displacement is decided upon, it will be thoroughly discussed and defined to both pilots and judges, and no downgrade will be given for any touchdown within the zone but not centered in front of the judging panel. The landing will not be downgraded if:

1. Plane rolls straight to a controlled stop in less than 15 meters.
2. Wing dips, unless they are not immediately corrected, which are caused by air turbulence.
3. The pilot elects to "slip to a landing," to handle a crosswind condition, in which case the upwind wing will be low.

Downgrades:

1. Model impacts the ground due to lack of flare.
2. Model bounces after touchdown.
3. Changes in heading.
4. If model ends on its back, zero (0) points.
5. Model lands outside 30 meter zone. Zero (0) points.
6. If any undercarriage leg retracts on landing, zero (0) points.
7. Aircraft "porpoises" and/or wanders during approach and flare.
8. Aircraft lands in other than a nose-high attitude.
9. Aircraft lands outside landing area or runway, zero points.
10. Aircraft touches down while not straight to runway and ground track.



One (1) Horizontal Roll. Maneuver performed similar to Three (3) Horizontal Rolls except for number of rolls. Center is inverted point of maneuver.

Procedure Turn. Immediately after the Straight Flight Out 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. The turn may be downgraded because:

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

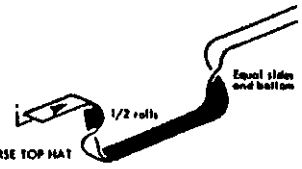
This maneuver shall not be downgraded for not staying within the 120 degree aerobatic frame.

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. Downgrades:

1. One quarter rolls more or less than 90 degrees.
2. Model does not hesitate in the two (2) knife-edge positions.
3. Roll rate not constant.

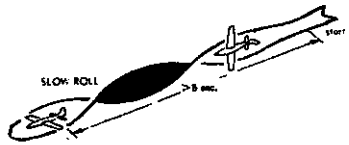
Reverse Top Hat: Model pushes into vertical downward attitude, half rolls, pushes to level inverted flight, flies inverted for the same distance as the downward path, pushes upward to vertical attitude, half rolls, and pushes over to level flight Downgrades:

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 the same length.
5. Changes in heading during maneuver.



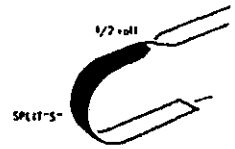
● **Slow Roll.** Model rolls slowly through one (1) complete revolution, in either direction; maneuver takes longer than three (3) seconds. Center is when model has rolled exactly 180 degrees. Downgrades:

1. Changes in heading.
2. Changes in altitude.
3. Roll rate not constant.
4. Model does not roll exactly 360 degrees.



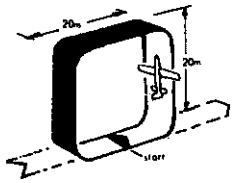
● **Split "S".** Model half rolls to inverted, then immediately executes half an inside loop to level flight in opposite direction as the entry. Downgrades:

1. Half roll not 180 degrees.
2. Half loop not started immediately after half roll.
3. Half loop not constant radius.
4. Changes in heading.



● **Square Loop.** Model pulls up and executes a square loop. The corner partial loops should be of equal radius. Downgrades:

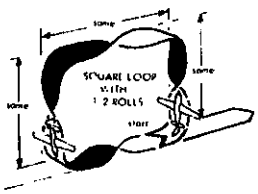
1. Loop not square.
2. Sides of square not same size.
3. Changes in headings.
4. Wings not level.
5. Corner loops not of equal radius.



● **Square Loop with One Half Rolls.** Model pulls up and completes a square loop; in each side the model executes a one half roll. Downgrades:

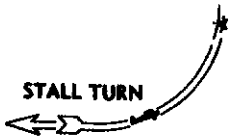
1. Loop not square.
2. Rolls not 180 degrees.
3. Wings not level during one quarter loops.
4. Changes in heading during rolls and loops.

5. Sides of square not of equal length.
6. Corner loops not of equal radius.



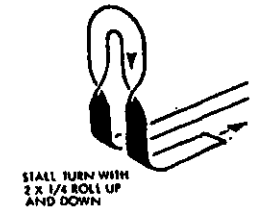
● **Stall Turn.** The model starts from straight and level flight and noses up to a vertical track, stalls, yaws tightly through 180 degrees then dives along a parallel path and finishes the maneuver with the plane level at the same altitude as the entry. The Stall Turn may be downgraded because:

1. Model not level at start.
2. Track does not become exactly vertical.
3. Turns left or right during pullup.
4. Does not yaw tightly through 180 degrees.
5. Return track more than one half (1/2) wingspan from entry track.
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.
10. Pendulum movement after stall.



● **Stall Turn with Half Rolls.** Model pulls up to a 90 degree climb, half rolls left or right, stalls, yaws tightly through 180 degrees, half rolls left or right, then recovers to level flight in opposite direction as the entry. Downgrades:

1. Track not 90 degrees in climb and dive.
2. Half rolls not centered in vertical lines.
3. Half rolls not 180 degrees.
4. Return path more than one (1) wingspan from entry path.
5. Pendulum movement after stall.



Straight Flight Back. Immediately after the Procedure Turn the model shall fly back along the same line as the outgoing path. The Straight Flight Back may be downgraded because:

1. Turns or wiggles during straight flight.
2. Change in altitude.
3. Gallops in pitch, yaw, or roll.
4. Flight not along straight flight out path.

This maneuver shall not be downgraded for not staying within the 120 degree aerobatic frame.

Straight Flight Out and Back—see Procedure Turn Figure

Straight Flight Out. The model must be brought exactly parallel to the flight path and flown in an absolutely straight and level path for a distance of approximately 100 meters centered on the judges before starting the Procedure Turn. (Distance does not have to be accurate; however, judges may specify start of turn if they wish.) Straight Flight may be downgraded because:

1. Plane deviates left or right.
2. Does not hold constant altitude.
3. Turns before permission is given by judge.
4. Gallops in yaw, roll, or pitch.

This maneuver shall not be downgraded for not staying within the 120 degree aerobatic frame.

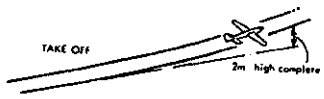
Straight Inverted Flight. Model half rolls to inverted and flies straight and level inverted for a minimum of four (4) seconds, then half rolls back to level flight. Half rolls may be in either direction. Downgrades:

1. Half roll not level.
2. Inverted flight not straight and level.
3. Changes in heading during rolls and inverted flight.

● **Takeoff.** The model must stand still on the ground with the engine(s) running, without being held. The throttle is then smoothly, not suddenly, advanced. After the takeoff roll has started, the nose wheel lifts off the ground (tail wheel for a conventional gear airplane), and the aircraft assumes a climb attitude while still rolling on its main wheels. When the aircraft reaches flying speed it should gently lift off the ground and climb at a gradual angle. The aircraft must not deviate in heading during the takeoff. The takeoff is completed when the model is approximately two meters (6-1/2 feet) from the ground.

The takeoff should not be downgraded for wing dips caused by air turbulence, unless the wings are not immediately leveled. Center of maneuver is liftoff. Downgrades:

1. Model does not stand still when released.
2. Changes heading during takeoff and climb.
3. Model jumps from the 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.
8. Throttle not accelerated smoothly.

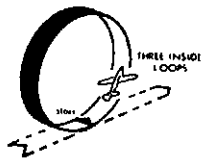


Three (3) Horizontal Rolls. Model rolls at a uniform rate through three (3) complete revolutions in either direction. Center is inverted portion of second roll. Downgrades:

1. Changes in heading during rolls.
2. Changes in altitude during rolls.
3. Roll rate not constant.
4. Model does not do exactly three (3) rolls.

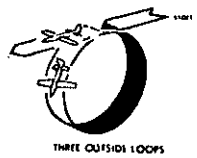
Three (3) Inside Loops. Model pulls up and executes three (3) consecutive loops; all loops shall be round and superimposed. Downgrades:

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



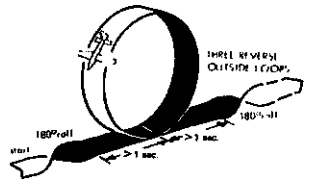
Three (3) Outside Loops. Model pushes over and executes three (3) consecutive outside loops. All loops should be round and superimposed. Downgrades:

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



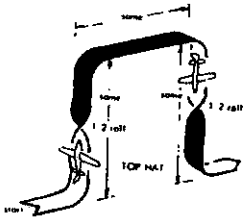
Reverse Outside Loops. Model half rolls to inverted, pauses for greater than one (1) second and pushes up to execute outside loops, pauses for greater than one (1) second then half rolls to level flight; all loops to be round and superimposed. Downgrades:

1. Loops 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.
6. Exit not same altitude and heading as entry.



● **Top Hat.** Model pulls up into a vertical attitude, pauses, makes a half roll, pauses, pulls over to inverted flight for a distance equal to the vertical climb 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. Rolls not centered on line segments.
5. Changes in heading during maneuver.



● **Triangle Rolling Loop.** Model pulls up into 45 degree climb, loops through 135 degrees, does one (1) complete roll, loops through 135 degrees, pauses, then 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.
6. Roll not centered.