

# OFFICIAL MODEL AIRCRAFT REGULATIONS 1984-85



## Governing Sporting Model Aviation in America



# \$1.50

**Academy of Model Aeronautics**  
1810 Samuel Morse Dr., Reston, VA 22090

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Reston, VA  
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## 38. RADIO CONTROL, GENERAL (FOR NON-SCALE EVENTS)

**1. Applicability.** In addition to the following General Radio Control Rules and the specific rules for each radio control event, the modeler must read and understand the rules for the event, and the modeler must read and understand the rules for the event, and the modeler must read and understand the rules for the event.

**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 or she has previously and is now capable of confidently performing the maneuvers comprising his competitive activity. Furthermore, the contestant shall also sign a declaration that any and all aircraft he or she uses in said competition have been test flown at least to the extent that they have performed the same competitive maneuvers in the presence of fellow contestants, contest officials, and all others who may be in the flight area during the competition period.

## 39. RC PATTERN

**1. Applicability.** All pertinent AMA regulations (see sections entitled Sanctioned Competition, Records, Selection of National Champions and General) shall be applicable except as specifically changed 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 Judges Guide.

**3. Licensing Requirements.** All radio equipment and operation must conform to the regulations of the FCC. AMA membership card and FCC license of each entrant shall be checked at every sanctioned meet.

**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 (10cc). In a model powered by two or more reciprocating or rotary piston internal combustion engines driven by separate propellers, the total displacement shall not exceed .8056 cubic inch (13.20cc) and none of these individual engines shall exceed .6102 cubic inch (10cc). 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. Mufflers(s).** Each reciprocating or rotary piston internal combustion engine shall be equipped with an effective muffler.

**4.3. Weight.** No model may weigh more than 5 kg. (11 lb.) 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 must comply with FCC rules, is permitted. All radio equipment must be certified by FCC for sale and competition.

**4.5. 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. No tuned pipe (i.e., muffler device which increases engine rpm) may be used.

**4.6. Number of Airplanes.** Two 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.

**4.7. Identification.** All models shall not apply to the Pattern events.

**4.8. 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. Height of the numerals must be at least one inch. Both stroke and width shall be such as to enable ready recognition.

**5. Number of Helpers.** Each pilot is permitted one helper during the flight. Two helpers may be present during the starting of the engine(s). Once a pilot has taken control of the aircraft, the helper must 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 the utmost importance in the event, and the following safety provisions must be observed.

**6.1. All models must pass a general safety inspection by the Event Director or his representative before they are allowed to compete.**

**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. If two zeros are earned during the same flight for flight line infractions, the remainder of the flight shall be scored zero, and the pilot shall be required 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. Pilots shall remain near the judges while flying and in particular shall stay off the runway and/or landing area during takeoffs and landings.**

**6.5. All planes must have a propeller spinner or blunt faced hubs such that no propeller shall be exposed. Rounded devices shall have a radius of point not less than 3/16".**

**6.6. Knife-edge wings are not allowed. Leading edges must have 2mm minimum radius.**

**7. Pattern Event Classes.** The Pattern event shall be divided into six classes. The first five shall (in order of increasing difficulty) be referred to as Novice, Sportsman, Advanced, Expert, and Master. The sixth class shall be referred to as FAI class. The Novice class is supplemental (see Supplemental and Provisional Rules, p. 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 Classifications.** At his first Pattern contest a competitor shall be placed in each of the six classes at his own option. (This decision shall be made by the Contest Director.) He may, at any time, request to be placed in a higher class. This move 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 an application (using a form supplied by AMA HQ) to be signed by a Contest Director and forwarded to the district Contest Board member and Vice-President for their approval.

**8.2. A contestant will be mandatorily advanced through the classes as follows:** A flier must move out of the Novice class if he places first, second or third and above at least four other fliers (having received an official flight) in any sanctioned Pattern class contest. In Sportsman, Advanced and Expert classes, if a flier places first, second or third and above at least four other fliers in each of these three classes consecutively, he will be advanced to their finishing place in every contest they compete in. If 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 will automatically be advanced to the next higher competition class at the end of that calendar year.**

**8.2.2. A contestant may voluntarily move to the next higher class at the time he accumulates 100 points but will not be required to do so until the end of the calendar year.**

**8.2.3. Time required to acquire 100 points has no limit. A contestant's point accumulation does not start over again at the beginning of each new year, but continues until, if ever, 100 points are 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 points.**

**8.2.5. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.6. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.7. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.8. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.9. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.10. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.11. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.12. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.13. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.14. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.15. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.16. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.17. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.18. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.19. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**8.2.20. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**8.2.21. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**12. Point System.** Sportsman and Advanced maneuvers shall be judged and scored on a zero to ten basis to the nearest 1/2 point. Flight scores are the sum of the individual maneuver scores. Flight scores are multiplied by a "K" factor. (See Paragraphs 18 and 19.) Flight score is the sum of the "K" multiplied maneuver scores.

**13. Determining the Winner.** In all classes, the winner shall be the contestant with the highest total score. If two or more contestants have the highest total score, the winner shall be the contestant with the highest total of the best three flights when four or five rounds are flown, and the highest total of the best four flights when six or more rounds are flown. Maneuver points from repeat flights may not be added to earlier flights. Each flight is complete in itself. In case of ties, the best non-scored flight of the contestant shall be used to determine the higher place.

**14. Flight Pattern.** The maneuvers in all classes must be executed during an uninterrupted flight in the order in which they are listed. 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 passes may be made.

**14.1. In the maneuver lists that follow, (U) and (D) denote mandatory maneuver orientation. Sequence must be followed in accordance with the direction of takeoff and landing as specified by contest officials.**

**14.2. If a maneuver other than landing is done out of order it shall be scored zero. 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.**

**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, regardless of upwind/downwind orientation.**

**14.5. The following is the scoring method for a missed approach for Novice: If on an aborted landing (missed approach), the pilot does not descend below two meters but went once around the field and then landed, the traffic pattern maneuver shall be scored zero. If the plane did descend below two meters the traffic pattern shall be given appropriate credit. Landing scores shall pass in front of the judges, the landing must be scored zero as well as the traffic pattern irrespective of any previous minimum altitude.**

**14.6. A missed approach or aborted landing in Sportsman, Advanced, Expert and Master yields zero points for the landing. Contestant (or his helper) may not touch his plane after it has become airborne until completion of flight, i.e., he may not land plane between maneuvers in order to make adjustments to engine, trim, etc.**

**14.8. The contestant (or helper with permission of judges) may not touch the model just prior to execution of the straight and level entry. Complete flight must be called after execution of the straight and level entry. Failure to call out will be cause for downgrade of the maneuver scored. The contestant may make only one attempt at each maneuver during the flight.**

**15. Novice Pattern Maneuvers.**

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

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

**16. Sportsman Pattern Maneuvers.**

1. Takeoff (U)
2. Double Stall Turn (U)
3. Cuban 8 (D)
4. Immelmann Turn (U)
5. 3 Inside Loops (U)
6. Straight Level Outside Flight (D)
7. One Reverse Outside Loop (U)
8. 3 Horizontal Rolls (D)
9. Landing (U)

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

**17. Advanced Pattern Maneuvers.**

1. Takeoff (U)
2. Non-Rolling Figure-M (U)
3. Cuban 8 (D)

**18.1. A flier accumulating or exceeding 100 points will automatically be advanced to the next higher competition class at the end of that calendar year.**

**18.2. A contestant may voluntarily move to the next higher class at the time he accumulates 100 points but will not be required to do so until the end of the calendar year.**

**18.3. Time required to acquire 100 points has no limit. A contestant's point accumulation does not start over again at the beginning of each new year, but continues until, if ever, 100 points are reached.**

**18.4. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.5. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.6. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.7. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.8. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.9. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.10. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.11. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.12. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.13. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.14. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.15. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.16. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.17. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.18. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.19. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.20. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.21. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.22. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.23. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.24. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.25. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.26. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.27. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.28. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

**18.29. There is no mandatory advancement into FAI class. A contestant in any class (Novice, Sportsman, Advanced, Expert, or Master) may enter both his regular Pattern class and the FAI class at any contest.**

**18.30. When a contestant enters a new class, either higher or lower (as permitted by 8.1.2), he begins with zero points.**

- 4. Double Immelmann (U)
- 5. Four Point Roll (D)
- 6. 3 Reverse Outside Loops (U)
- 7. Slow Roll (D)
- 8. 3 Inside Loops (U)
- 9. 3 Horizontal Rolls (D)
- 10. Landing (U)
- Note: (U) means upwind; (D) means downwind.

- 18. Expert Pattern Maneuvers.
  - 1. Takeoff (U)
  - 2. Figure-M with 1/4 rolls (U)
  - 3. Cuban 8 (D)
  - 4. Double Immelmann (U)
  - 5. Slow Roll (D)
  - 6. 3 Reverse Outside Loops (U)
  - 7. Four Point Roll (D)
  - 8. Square Loop (U)
  - 9. Top Hat (U)
  - 10. Three Horizontal Rolls (D)
  - 11. Landing (U)
  - Note: (U) means upwind; (D) means downwind.

- 19. Master Pattern Maneuvers. The Master maneuver sequence is made up by the individual competitor from a list of 37 possible maneuvers. Takeoff and landing are not judged. Any maneuver can be used only once. The contestant selects a set of 12 air-maneuvers to give a maximum total of 450 points. A contestant's maneuver schedule may be changed from flight to flight, but it must conform to the aforementioned limitations. The Master maneuvers shall be chosen from the following list.
 

1. Double Immelmann	K Factor
2. Three Reverse Inside Loops	2
3. Rolling Eight	3
4. Slow Roll	3
5. Top Hat	3
6. Horizontal Eight	2
7. Figure M with 1/4 Rolls	5
8. Three Outside Loops	5
9. Three Turn Spin	2
10. Three Horizontal Rolls	3
11. Reverse Double Immelmann	2
12. Cuban Eight	2
13. Three Inside Loops	2
14. Straight Inverted	2
15. Vertical Eight	2
16. Four-Point Roll	2
17. Three Reverse Outside Loops	4
18. Two Rolls in Opposite Directions	3
19. Figure M with 1/2 Rolls	4
20. Cobra Roll	3
21. Avalanche	3
22. Inverted Spin	3
23. Square Horizontal Eight	4
24. Eight-Point Roll	5
25. Vertical Roll	3
26. Figure M	3
27. Figure M	3
28. Square Loop with Four 1/2 Rolls	5
29. Three Turn Spin	5
30. Reverse Cuban Eight	4
31. Reverse Top Hat	4
32. Reverse Cuban Eight	2
33. Triangle Rolling Loop	2
34. Vertical Downwards Four-Point Roll	4
35. Four-Turn Spin (two in opposite directions)	4
37. Rolling Circle with Four Rolls (rolling directions inside or outside)	5

The contestant's flight must conform to the flight plan submitted to the judge prior to the flight and in all other ways adhere to the specifications of Paragraph 14, Flight Pattern.

Note: A detailed description of each maneuver for all classes and reasons for downgrading when scoring will be found in the AMA RC Pattern Judges' Guide.

**A. Purpose.** The purpose of the AMA RC Pattern Judges' Guide is to furnish a 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

- 20. FAI Pattern Maneuvers. The FAI class shall fly according to the current FAI RC Aerobics (FSA) rules. The builder of the model rule, if any, shall not be enforced.
- 21. 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.
  - 21.1. All RC contestants shall be set up in "pits" at spot assigned by Event Director, so they will be under his immediate control.
  - 21.2. There will be no testing of transmitters or receivers during the flying period. Transmitters may be impounded at discretion of Event Director. Any person causing interference will suffer immediate disqualification. The Event Director will provide a monitor receiver to check for interference.
  - 21.3. The flight order shall be determined by position of contestants' signatures on a single Flight List held by Event Director or his representative. This list shall include all classes and frequencies. Contestants shall have their name on List only once any one time; names may be moved to bottom of List on request, but trading of names will be with other contestants is not allowed. When a contest is to be with other contestants is not allowed, the Flight List shall carry over from day one on a following day.
  - 21.4. Event Director shall carry out the following:
    - 21.4.1. Numbers 1, 2 and 3 on Flight List shall be on flight list with their models, equipment and one helper if desired. No. 1 is contestant flying or ready to fly. No. 2 is next man on flight list.
    - 21.4.2. No. 1 man shall have 3 minutes from completion of preceding flight in which to release model for the start of his flight. False starts are permitted within the 3 minute limit. Failure 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 contestant of start and end of the 3 minute period.
    - 21.4.3. Numbers 4, 5, and 6 on the Flight List shall have their planes and equipment in a ready box located near the flight line. As soon as a flight is completed, the No. 4 man becomes No. 3 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 List, and the List 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.
  - 21.5. When technically possible and when judges and space are available, it is strongly recommended that two or more flights be flown simultaneously under the following conditions:
    - 21.5.1. Separate takeoff and landing areas sufficient to be used from each other to minimize engine noise and flight path interference.
    - 21.5.2. Contestants flying simultaneously shall carefully check receiver and transmitter operation before takeoff, to be sure no interference between them is possible.
    - 21.5.3. Contestants flying simultaneously must be no more than three positions apart on the Flight List. Event Director or representative shall, where possible, select contestants at top of Flight List so that contestants flying on compatible frequencies will fly together.
    - 21.5.4. Should a contestant oppose flying simultaneously with someone else, he may cancel his turn and re-sign at the bottom of the Flight List.
  - 21.6. Officials. An Event Director, a Dispatcher-Recorder and Judges are the essential officials for a RC event. If possible, the Dispatcher-Recorder should have at least two helpers.
  - 21.7. Each flight should be judged by at least two judges, with their scores averaged 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 on the Flight List an equal number of times. If different judges are used during the contest, all contestants shall have an opportunity to fly before all judges. Substitution of judges which is equal exposure by all contestants shall be avoided. If, when equal exposure by all contestants shall be avoided, the equal exposure by all contestants shall be disqualified at the discretion of the contest director.

exactly what is expected, while study by the judges will help them decide precisely how well the competitor comes up to these expectations.

**B. Principles.** The principles of judging an RC model shall be based on the perfection with which the model executes the go-

metric patterns. The main criteria for perfection in an individual maneuver can be classified as follows:

1. Positioning of the maneuver.
2. Precision or display of the maneuver.
3. Size or dimensions of the maneuver.
3. Smoothness or gracefulness of the maneuver.

All of these requirements must be met for a maneuver to be rated perfect. They are discussed below.

**a. Precision.** At the instant the contestant announced his next maneuver, the judge should form an image of the course the airplane should follow during the performance of the maneuver. The precision of the maneuver will then be based on how well the model tracks through this imaginary course. Competitors will read this statement and exclaim, "How can I know what the judge imagines is a perfect course?" The answer to this is that once the model has locked in on the straight and level entry portion of a maneuver the real disparity that can exist between the judge's and the competitor's image is the size of the maneuver. The judge will have some preconceived ideas about optimum size as discussed in a later section. However, the judge should modify his image if the first portion of the maneuver clearly demonstrates that the contestant intends to do a maneuver of much smaller or larger dimensions than the judge first imagined.

It will be noted that forming an image of the forthcoming maneuver is based on using the straight and level entry portion of the maneuver as a point of reference. It will be difficult to go this far into the details of a maneuver at the start of the maneuver. The absence of a definite entry into a maneuver therefore increases the difficulty of judging its precision and competitors will recognize this as justification for downgrading.

The straight and level entry from a maneuver is one of the more valuable portions of the maneuver in evaluating how well the intended course of the maneuver was followed. The well-polished pilot will use it to announce "Maneuver completed," while the less competent pilot will often skip it in hopes that the judge will not notice that he deviated with respect to his entry heading. The absence of a well defined straight and level entry therefore should also result in downgrading.

The judging of the precision of a maneuver shall not be dependent on the throttle setting or speed of the engine. Aircraft speed, which could affect the quality of the maneuver, is not to be confused with engine speed.

**b. Positioning.** To achieve perfection, the competitor must position his maneuvers in a way that they can be easily judged. The first consideration on position is longitudinal distance from the competitor. It goes without saying that the judges should be located near the competitor so that they obtain identical views of the maneuver. The competitor should center his aerobics maneuvers at an average distance of less than 100m from himself. In short, the judge should be unmerciful if he gets the impression that the competitor is trying to hide his defects by flying at a great distance.

Positioning of maneuver involves more than mere distance. They should also be presented in a relative direction which displays the most difficult aspects of the maneuver. Specifically, maneuvers which have circular symmetry (such as Loops, Immelmanns, Cuban Eights, and FAI Horizontal Eights) should have the "holes" in their circular path clearly visible, preferably in a plane exactly perpendicular to the line of sight to the model. The same applies to the Square Flight.

The diagram below defines the best view to present to the judge. "End on" or "canted" presentation of these should result in downgrading since it increases the difficulty of judging the symmetry of figure 8's and the "tracking" of consecutive loops.

- While no special bonus is justified for exceptionally low altitude, excessively high altitude is cause for downgrading. In general, all maneuvers except Allerton Turn, Inverted Spin, Three Turn Spin, Vertical Roll, Procedure Turn and Straight Flight Back should be executed within a judging frame defined by 60° left and right from center and 60° up from horizontal. Maneuvers not properly centered within this frame should be downgraded. A comment to competitors is in order here. This downgrading is almost an automatic reaction after a judge has been looking at some maneuvers which must be followed overboard, and he is prone to be severe if he is forced to look there unnecessarily.

By using the token, most judges will refuse to even look at the remainder of a maneuver after an aircraft crosses the sun unnecessarily. There are also some places where the sun often cannot be avoided and the judge should follow through to the best of his ability. But he is completely justified in scoring zero if in his opinion the maneuver could have been placed elsewhere.

**c. Size of Maneuvers.** In the previous section it was pointed out that most maneuvers could be safely done at an average distance no greater than 100m from the competitor and judges, and at altitudes such that the line of sight to the model will seldom

exceed a 60° elevation angle. These criteria place an upper limit about 100m for the total vertical size of a maneuver. Most competitors and judges will recognize this as more than ample. It should also be recognized that the width of horizontal distance is made up of 60m diameter at 50m longitudinal distance would stay within the 60° angle and a safe altitude and would be more clearly visible to the judge than at 100m distance. The competitor who performs loops in the 60m region is therefore allowing the judge to evaluate them more critically and he should guard no downgrading for positioning. On the other hand, a 30m diameter loop at 100m distance might be downgraded.

The optimum size of maneuvers is related to some extent on the size and normal flying speed of the model. For example, loops of 7 to 10m diameter done by a 1m wingspan airplane would not necessarily look poor or out of scale. However, 7 or 10m diameter loops by a 75 km/hr multi job give the impression that an imaginary pilot in full scale simulation would be downright uncomfortable if not "blacked out" due to the high forces. Exceedingly small or tight maneuvers with unacceptably high rates of roll, pitch or yaw do not simulate full scale performance and they should be downgraded accordingly.

**d. Smoothness and Gracefulness.** These two factors are inter-related with size of the maneuver and therefore again are related to normal flying speed of the model. Various judges and competitors will have different opinions of what actually constitutes smoothness and gracefulness. The most general definition must again be related to full scale simulation and the effects of the maneuver on an imaginary pilot on performing the airplane as a whole. For example, the judge will judge the airplane as a "Dag" in being RC models in this equivalent situation, would be judged by RC models in the landing gear and a total loss of the airline company's profits and equipment.

It is recognized that few RC judges have ever been passengers in full scale aerobics airplanes and therefore have no actual experience with the "g" forces in aerobics maneuvers. Two to three g's would not be excessive in such performance, particularly in violent maneuvers such as a snap roll or spin. However, by comparison, a 10m diameter loop at 75 km/hr results in about 10 g's, which is close to or in excess of the design limits of most full scale aerobics aircraft. Clearly, such tight maneuvers are not scale-like.

The matter of smoothness is basically related to scale-like appearance. For example, a perfect set of consecutive rolls should have a constant roll rate from start to finish. A perfect loop must have a constant radius during its performance. Competitors cannot be made up of a sea of aerobics airplanes. Such sudden jerks represent high "g" forces well in excess of full scale tolerances and maneuvers should be downgraded for this.

**C. Accurate and Consistent Judging.** The most important aspect of consistent judging is for each judge to establish his standards and then maintain them. The director or chief judge to hold it advisable for the meet in order to make the standards as uniform as possible. This is done best by means of a practice flight which all judges score simultaneously and privately. After the flight, the defects in each maneuver should be discussed by all judges and a semblance of agreement reached about the severity of defects. Once this is done, however, and the contest is started, the individual judge should not alter his standards under any influence.

The contest director should clearly define areas in which it is considered unsafe for competitors to perform, such as above spectators or over buildings, etc. It is highly recommended that the judges agree to register zero points for maneuvers done in these areas. Furthermore, for consistency, judges should establish a quick nod of agreement to issue zero immediately following an "over the crowd" maneuver. Nothing should be more unmet among contestants than a zero and seven score of the same maneuver.

The responsibility for disqualifying pilots who persist in flying unsafely should be assigned to the judges by the C.D. The definition of unsafe areas should be absolutely unambiguous. For example, it should be stated that "maneuvers performed over the spectator area will be scored zero" and not that "maneuvers can be performed over the spectators at a safe altitude." Obeying such safety regulations is just one more of the many pressures associated with winning a competition and the man who overcomes all pressures is more expert than one who does not.

**D. Judging Individual Maneuvers.** The schedule of maneuvers to be performed is described in the RC Pattern Rules. Each maneuver is to be judged individually on a basis of 0 to 10 points according to the degree of excellence.

A common problem with inexperienced judging 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. Remember that perfection is not a relative thing. Perfection is

## AMA RC PATTERN JUDGES' GUIDE

the maneuver in which you see absolutely no flaws. It is not a common occurrence.

In the following section, a description of each maneuver is given and then a number of reasons for downgrading are listed. The number of defects observed; (2) the severity of the individual defects; and (3) the number of times any one defect occurs.

For example, a small single change in heading during the slow roll would be considered one defect while two or three distinct turns would be considered two or three defects. It will be noted that for many maneuvers there are more than six possible kinds of defects and that some of these can be repetitive. It will not be possible to downgrade one 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-performed and no defects are observed. One or two minor defects should result in downgrading to at least an 8, while one severe defect should put it down to 6, as should a combination of three or four minor defects. Any element 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 scores applicable to all Pattern classes. Judges must agree unanimously on any zero scores.

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, etc. (see 14.2., 14.3., 14.4., and 14.5)
4. Maneuver not completed
5. Less than 2 or more than 4 spins in 3 Turn Spin maneuver (upright and inverted)
6. Spiral dive in all spins performed scores zero, for example, one spiral in a 3-Turn Spin would be severely downgraded, not scored zero.
7. Model ends up on back when landing
8. Any gear retracts or collapses during landing
9. Turn runs out prior to completion of a maneuver, zero.
10. Less than 2 or more than 4 rolls or loops when 3 are called for
11. Failure to takeoff (10.1)
12. Landing outside runway

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

**Stall Turn.** In the following pitch axis (flaps over) instead of yaw axis; in Stuntman class where the Turn is the main point of this defect also; a "severe downgrade" of 3 or 4 points for this defect also; in other classes where the Turn is but one part of a larger maneuver (figure M's), downgrade of 2 or 3 points.

**Stall Turn Yaw's.** Wrong direction in relation to flight line upon quality of turn.

**Number of Loops or Axial rolls (where 3 are required):** Two or Four performed, severe downgrade of 3 or 4 points for that defect alone.

**Maneuvers Off-Center.** Deduct 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 4 points because maneuver is off center one half diameter; 2 of 3 axial rolls are offset—deduct about 1 1/2 points because maneuver is off center by 1/3.

**E. Descriptions of Maneuvers (in alphabetical order).**

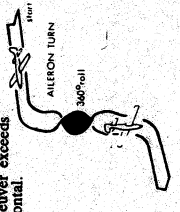
All maneuvers will start and finish in straight and level flight of at least 15 meters and have the same altitude and heading for entry and exit unless otherwise specified; if the start and finish are not straight and level and the altitude and heading are not the same for exit and entry.

**Aleron Turn.** Model pushes over and executes a 360-degree roll vertically downward and recovers to finish in level flight.

**Downgrades:**

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

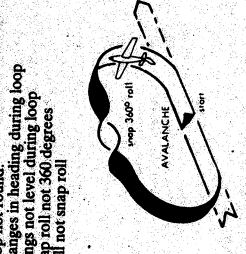
There should be no downgrade if the maneuver exceeds 60° up from horizontal.



**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:**

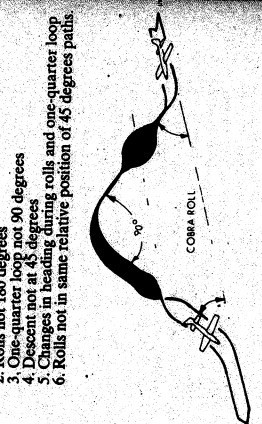
1. Loop not round.
2. Changes in heading during loop
3. Wings not level during loop
4. Snap roll not 360 degrees
5. Roll not snap roll



**Cobra Roll.** Model pulls up to a 45-degree angle, half-rolls to inverted attitude, executes a one-quarter loop, half-rolls to upright attitude and recovers in level flight.

**Downgrades:**

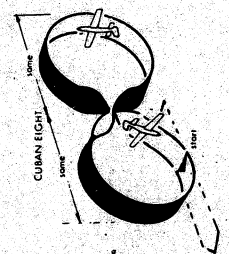
1. Roll not 180 degrees
2. One-half roll not 90 degrees
3. Descent in heading during rolls
4. Changes in heading during rolls
5. Rolls not in same relative position of 45 degrees path



**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 level flight.

**Downgrades:**

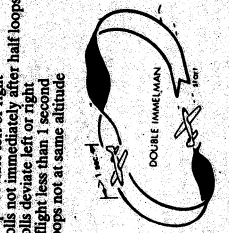
1. Loops not round and same size
2. Model not at 45 degrees before commencement of rolls
3. Changes in heading in loops or rolls
4. Rolls not centered in the 45 degree descents and on each other.



**Double Immelman.** Model pulls up into a half inside loop, half-rolls to upright, flies straight and level for greater than one second, does a half outside loop and half-rolls to level flight.

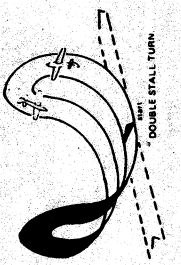
**Downgrades:**

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



**Double Stall Turn.** The model begins by performing a Stall Turn. At the bottom of the pull-out, the plane pulls up, the completing half of inside loop, at which point a second Stall Turn is executed, followed by a quarter-loop pull-out. The maneuver may be downgraded because:

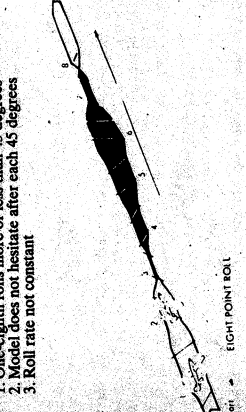
1. Model not flying straight and level at beginning and end of maneuver.
2. Model does not become exactly vertical at points of turn
3. Half-inside-loop not round and consistent in heading
4. Bottom of half-loop not at same altitude as entry and finish
5. Model turns left or right during pull-ups
6. Does not yaw tightly through 180 degrees
7. Return 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



**Eight-Point Roll.** Model rolls through 360 degrees hesitating at each 45-degree point; the wings should be parallel, vertical to or 45 degrees to the horizon. Center is middle of inverted flight.

**Downgrades:**

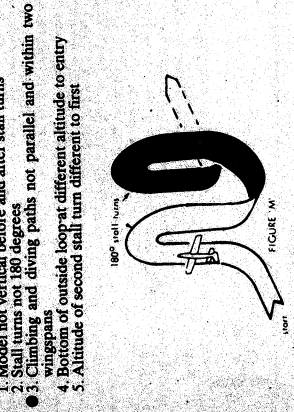
1. Model does not hesitate after each 45 degrees
2. Wings not parallel to horizon
3. Roll rate not constant



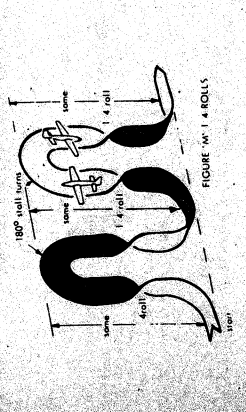
**Figure M.** Model pulls up into a vertical attitude and executes a 180-degree stall turn, in either direction, does a one-half outside loop, again pulls up into a vertical attitude and executes a stall turn, in the opposite direction, and recovers in level flight.

**Downgrades:**

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



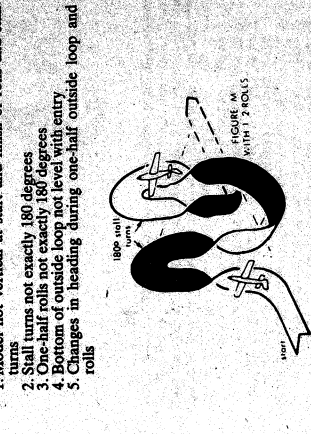
**Figure M with One-quarter Rolls.** Model pulls up into a vertical attitude; executes a one-quarter roll, stall turns through 180 degrees; one-quarter rolls again in the same direction as the first roll, does a one-half outside loop to a vertical attitude again, one-quarter rolls in the same direction as the first two, does a stall turn through 180 degrees, one-quarter 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. One-quarter rolls not exactly 90 degrees
  4. Bottom of outside loop not level with entry
  5. Changes in heading during one-half outside loop or rolls
  6. Stall turns not at same altitude

**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 stall turn through 180 degrees, followed by a third one-half roll, a stall turn through 180 degrees, one-half roll to level flight. The rolls may be in any one-half roll, but the stall turns must be in opposite directions. Viewed from the side, the model executes a figure M. Downgrades:

1. Model not vertical at start and finish of rolls and stall turns
2. Stall turns not exactly 180 degrees
3. 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 middle of inverted flight.

**Downgrades:**

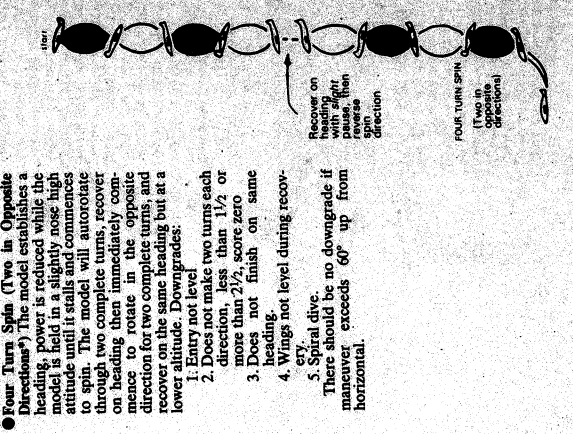
1. One-quarter rolls less than 90 degrees
2. Model does not hesitate after each one-quarter roll
3. Roll rate not constant
4. Changes in altitude



**Four-Turn Spin (Two in Opposite Directions)** The model establishes a heading, power is reduced while the model is relatively nose high and the wings are held until stalls and commences to spin. The model will autorotate through two complete turns, recover on heading then immediately commence to rotate in the opposite direction for two complete turns, and recover on the same heading but at a lower altitude. Downgrades:

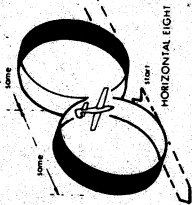
1. Entry not level
2. Does not make two turns each direction, less than 1 1/2 or more than 2 1/2, score zero
3. Does not finish on same heading
4. Wings not level during recovery.
5. Spiral dive.

There should be no downgrade if maneuver exceeds 60° up from horizontal.



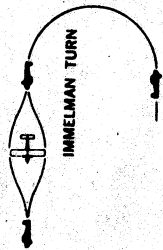
**Horizontal Eight.** Model pulls up and completes three-quarters of an inside loop to vertical position, then does a complete outside loop to the starting position again and recovers by doing a one-quarter inside loop. Downgrades:

1. Loops not vertical
2. Model not vertical at crossover point
3. Changes in heading during loops
4. Loops not same diameter
5. Loops not at same altitude
6. Model does not cross over at same point



**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. The Immelmann may be downgraded because:

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



**Inverted Spin\*.** Model establishes a heading, half-rolls to inverted, Roll rate is reduced, the model is held in a nose-high attitude until it stalls and commences to spin. The model will autorotate through the complete turns and recover on the same heading at a different altitude, then half-rolls to an upright position. Downgrades:

1. One-half rolls not level
2. One-half rolls not 180 degrees

3. Wings not level during entry and exit
4. Spiral dive
5. Does not finish in same heading
6. Does not make three turns; less than 2 or more than 4 score zero.

There should be no downgrade if the maneuver exceeds 60° up from horizontal.

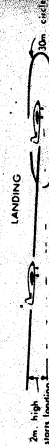
**Landing.** The landing maneuver will start two meters from the ground. The model flies smoothly to nose-high attitude, dissipating all flying speed, then smoothly opening the ground within the landing circle, with the main wing first, with no bouncing or changes in heading after touch down. The nose wheel on a tricycle gear should settle gently to the ground after a brief roll out. The maneuver shall be considered complete after the plane has slowed below flying speed and has rolled straight for 15 meters.

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 cross-wind 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 points
5. Model lands outside 30-meter circle
6. If any undercarriage leg retracts on landing, zero points and flare.
7. Aircraft "porpoises" and/or wanders during approach
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 Horizontal Roll.** Maneuver performed similar to Three Horizontal Rolls except for number of rolls. Center is inverted point of maneuver.

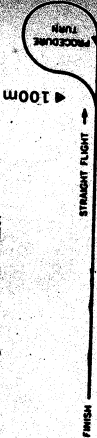


**One Reverse Outside Loop.** Maneuver executed similar to Three Reverse Outside Loops except for number of loops.

**ONE REVERSE OUTSIDE LOOP— See Three Reverse Outside Loops**

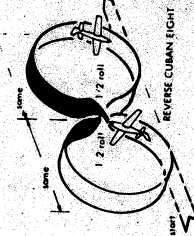
**Procedure Turn.** Immediately after the Straight Flight Out the model must turn exactly 90 degrees to the left or right which ever will take the plane away from the spectator line (direction to be specified by the Contest Director), then exactly 270 degrees to the right (or left) and cross over the 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. Does not head back over exact outgoing path
  5. Does not head back over exact outgoing path
- This maneuver shall not be downgraded for not staying within the 120 degree acrobatic frame.



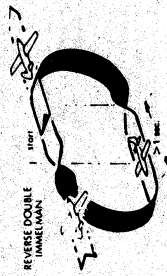
**Reverse Cuban Eight.** Model pulls up into 45-degree climb, half-rolls, executes a three-quarter loop, half-rolls to inverted and loops back to level flight at the same point as entry. Downgrades:

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



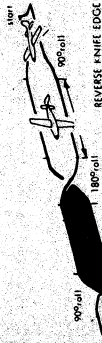
**Reverse Double Immelmann.** Model pushes over and executes one-half outside loop followed immediately by a one-half roll, pauses for greater than one second, does a one-half inside loop and immediately one-half rolls to level flight. Downgrades:

1. Changes to heading during one-half loops and one-half rolls
2. One-half rolls not immediately after one-half loops
3. Model pauses less than one second before one-half inside loop
4. One-half loops not at same altitude



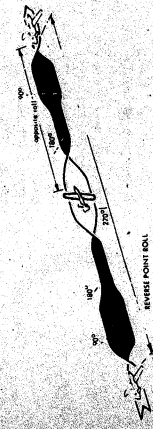
**Reverse Knife Edge.** Model rolls 90 degrees and hesitates, then rolls 180 degrees to opposite flight. Downgrades:

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



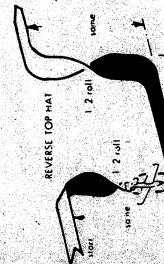
**Reverse Point Roll.** Model rolls through 270 degrees, hesitates 90 degrees at point of roll, rolls 270 degrees opposite direction, hesitating at each 90-degree point to finish in level flight. Downgrades:

1. One-quarter rolls more or less than 90 degrees
2. Model does not hesitate at each 90 degree point
3. Roll rate not constant



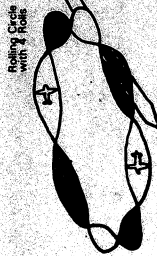
**Reverse Top Hat.** Model pushes into vertical downward attitude, half-rolls and loops to level inverted flight; flies inverted for the same distance as the downward path, loops upward to vertical attitude, half-rolls and pushes over to level flight. Downgrades:

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



**Rolling Circle with Four Rolls.** Model executes four continuous rolls while tracking a 360° circle over the ground. The roll direction may be in the direction of the turn or opposite the direction of turn. Downgrades:

1. Rolls not continuous.
2. Roll rate not constant.
3. Each roll does not cover 90° of circle.
4. Circle not round.
5. Circle not round.
6. Finish not on same heading and in line with start.

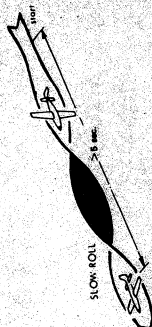


**Rolling Eight.** Model pulls up from level flight, completes an inside loop, at the bottom executes a half roll, makes a second outside loop, at the top rolls back to level flight. Downgrades:

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

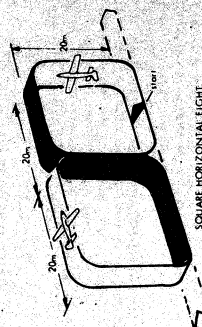
**Slow Roll.** Model rolls slowly through one complete revolution in either direction; maneuver takes greater than five seconds. Center is middle of inverted flight. Downgrades:

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



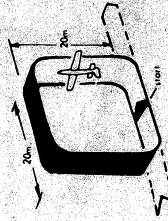
**Square Horizontal Eight.** Model pulls up and executes a square loop, when at the bottom of the third leg it does a complete square outside loop behind the inside loop; the model should rotate sharply at each corner. Downgrades:

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



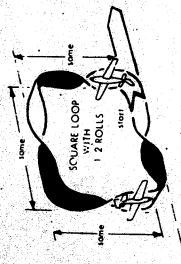
**Square Loop.** Model pulls up and executes a square loop. The model should rotate sharply at the corners. Downgrades:

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



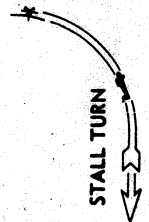
**Square Loop with One-half Rolls.** Model pulls up and completes a square loop; in each side the model executes a one-half roll.

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.



**Stall Turn.** The model starts from straight and level flight and noses up to a vertical position, 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. Does not become exactly vertical
3. Turns left or right during pull-up
4. Does not yaw tightly through 180 degrees
5. Return path more than two 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



**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. Changes in altitude
  3. Gallops in yaw, roll, or pitch
  4. Flight not 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 seconds, then half-rolls back to level flight. Half rolls may be in either direction.

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, then suddenly, advanced. After the take-off 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 take-off. The take-off is completed when the model is approximately two meters (6 1/2 feet) from the ground. The take-off should not be downgraded for wing dips caused by air turbulence, unless the wings are not immediately leveled.

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



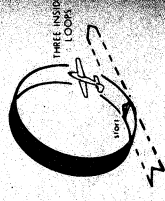
**Three Horizontal Rolls.** Model rolls at a uniform rate through three complete revolutions in either direction. Center is inverted portion of second roll. Downgrades:

1. Changes in heading during rolls
2. Roll rate not constant
3. Roll rate does not do exactly three rolls.



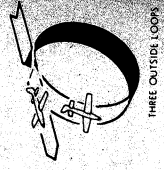
**Three Inside Loops.** Model pulls up and executes three consecutive loops; all loops shall be round and superimposed. Downgrades:

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 Outside Loops.** Model pushes over and executes three consecutive outside loops. All loops should be round, superimposed. Downgrades:

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



**Three Reverse Inside Loops.** Model half-rolls from level flight; inside loops downward, flies for greater than one second; inverted then half-rolls upright. All loops should be round and superimposed. Downgrades:

1. Changes in heading during half rolls
2. Loops not round
3. Loops not superimposed
4. Wings not level during loops
5. Changes in heading during loops



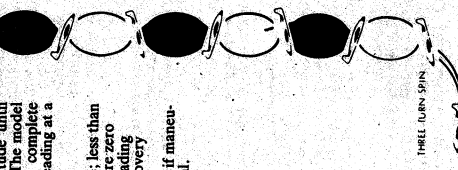
**Three Reverse Outside Loops.** Model half-rolls to inverted, pauses for greater than one second and pushes up to execute three consecutive outside loops, pauses for greater than one second then half-rolls to level flight; all loops to be round and superimposed. Downgrades:

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 less than one second before and after loops



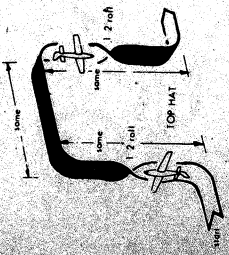
**Three-Turn Spins.** The model establishes a heading; power is reduced; the model is held in a slightly high attitude until it stalls and commences to turn. The model will autorotate through three complete turns and recover on the same heading at a different altitude. Downgrades:

1. Entry not level
  2. Does not make three turns, less than two or more than four, score zero
  3. Does not finish in same heading
  4. Wings not level during recovery
  5. Spiral dive
- There should be no downgrade if maneuver exceeds 60° up from horizontal.



**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:

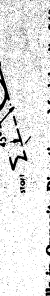
1. Model does not vertical before starting and finishing rolls
2. Rolls are not 180 degrees
3. Model does not fly straight and level inverted
4. Rolls not the same length
5. Changes in heading during maneuver



**Trumpet Rolling Loop.** Model pulls up into 45-degree climb; the attitude for greater than one second; loops through 135 degrees; does one complete roll, loops through 135 degrees; the attitude for greater than one second and recovers to level flight at the same point that the maneuver started. The ascending and descending portions should be the same length.

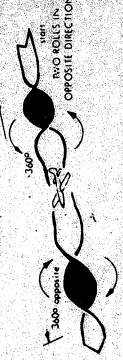
1. Climb and descending paths not 45 degrees
2. Climb and descending paths not same length
3. Roll not 360 degrees

4. Model changes heading during loops and roll  
5. Model does not start and finish maneuver at same point



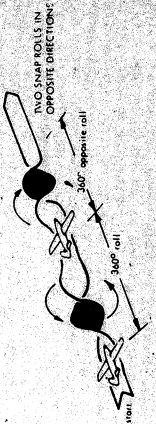
**Two Rolls in Opposite Directions.** Model rolls 360 degrees in either direction, then immediately after rolls 360 degrees in opposite direction. Downgrades:

1. Changes in heading
2. Roll rate not constant
3. Roll rate not exactly 360 degrees
4. Rolls not 360 degrees
5. Second roll does not start immediately after first roll



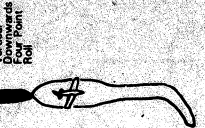
**Two Snap Rolls in Opposite Directions.** Model snap-rolls\*\* through 360 degrees, recovers and immediately snap-rolls in the opposite direction, and recovers in level flight. Downgrades:

1. Rolls not 360 degrees\*\*
2. Changes in heading
3. Changes in altitude
4. Changes in attitude



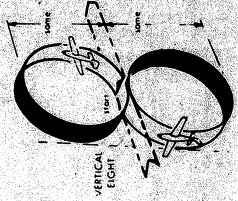
**Vertical Downwards Four Point Roll.** Model pushes over and executes a four-point roll vertically downwards and recovers to finish in level flight. Downgrades:

1. Model not vertical at start and finish of roll
  2. 1/4 rolls more or less than 90 degrees
  3. Model does not hesitate after each 1/4 roll
  4. Roll rate not constant
  5. Roll not vertical
- There should be no downgrade if maneuver exceeds 60° up from horizontal.

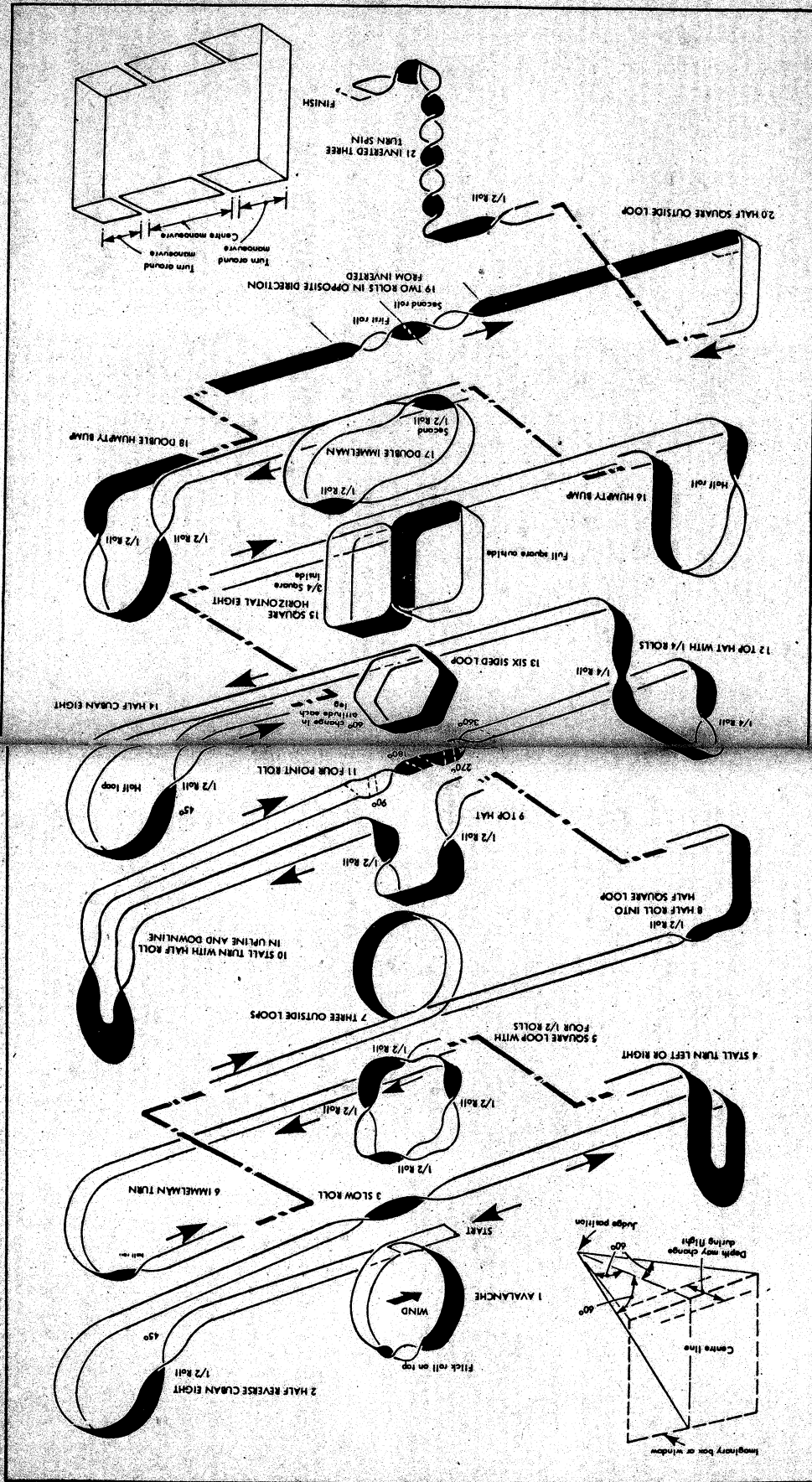


**Vertical Eight.** Model pulls up and executes a complete inside loop, at the bottom pushes over and completes an outside loop directly under the inside loop. Downgrades:

1. Loops not round and superimposed
2. Changes in heading during loops
3. Wings not level during loops
4. Outside loop not directly under inside loop







7. Three Outside Loops. Model pushes over and executes three 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.
8. Half Roll into Half Square Loop. Model half-rolls to inverted, then executes half of a square loop to recover in level flight at a lower altitude than entry. Downgrades:
1. Change in heading during 1/2 roll or 1/2 loop.
  2. 1/2 loop not square.
9. Top Hat. Model pulls up into a vertical attitude, makes a half roll, pulls over to inverted flight for a distance equal to the vertical leg, pulls down, makes a half-roll, 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 approximately the same length.
  5. Rolls not the same length.
  6. Changes in heading during maneuver.

10. Stall Turn with 1/2 Roll in Upline and Downline. Model pulls up into a vertical attitude, performs a 1/2 roll, executes a 180-degree stall turn (left or right), performs another 1/2 roll, then pulls up to recover in level flight. Downgrades:
1. Model not vertical at start and finish of rolls and stall turn.
  2. Stall turn and 1/2 rolls not exactly 180 degrees.
11. 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. Downgrades:
1. 1/4 Rolls less than 90 degrees.
  2. Model does not hesitate after each 1/4 roll.
  3. Roll rate not constant.
  4. Changes in altitude.
12. Top Hat with 1/4 Rolls. Model pulls up into a vertical attitude, executes a 1/4 roll, left or right, pulls over to inverted flight, pauses, pulls down, executes a second 1/4 roll, then pulls up to recover in level flight. Downgrades:
1. Model not vertical at start and finish of 1/4 rolls.
  2. 1/4 rolls not exactly 90 degrees.
  3. Model does not fly straight and level inverted.
13. Six-Sided Loop. Model pulls up into a 60-degree climb, pauses, pulls through 60 degrees, pauses, pulls through 60 de-

- gress to inverted, pauses, pulls down into a 60-degree diving attitude, pauses, pulls through 60 degrees, pauses, then pulls 60 degrees to recover in level flight. Downgrades:
1. Sides of loop not same length.
  2. Climbing and descending legs not at 60 degrees.
  3. Wings not level.
  4. Top leg not horizontal.
  5. Changes in heading.
14. Half Cuban Eight. Model pulls up and commences an inside loop; when at 45 degrees inverted model does a half-roll, then pulls up to recover in level flight. Downgrades:
1. Loop not round.
  2. Model not at 45 degrees before and after 1/2 roll.
15. Square Horizontal Eight. Model pulls up and commences a square loop, when at the bottom of the third leg it does a model should be out-side loop behind the inside loop, the model should be at least 20 meters (65 1/2 feet) long. Downgrades:
1. Loops not square.
  2. Vertical downward paths do not coincide.
  3. Loops not same size.
  4. Changes in heading.

5. Wings not level.
6. Loops not at same altitude.
7. Sides of squares not same size.
16. Humpy Bumper. Model pulls up into a vertical attitude, performs a half-roll, then pulls over to level flight. Downgrades:
1. Model not vertical at beginning and end of half roll.
  2. Half-roll not exactly 180 degrees.
  3. Half-loop not round.
17. 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. Changes in heading.
  5. Half loops not at same altitude.
18. Double Humpy Bumper. Model pulls up into a vertical attitude, performs a half-roll, pushes over into half an outside loop, then pulls over to half-roll, then pushes to recover in level inverted flight. Downgrades:



# FAI RC THERMAL SOARING (F3B)

Note: the FAI General Rules also apply.

## 1. GENERAL

### 1.1. Definition of a Radio-Controlled Glider.

Model airplane which is not provided with a propulsion device and which lift is generated by aerodynamic forces acting on its wings. Models must be fixed (i.e., not rotating or omnibearing type surfaces). Models must have a variable geometry or area must comply with the specifications. Variable geometry or area must comply with the specifications. Models must be controlled by the pilot on the ground using radio control connections. Any variation of geometry or area must be actuated at distance by radio control.

### 1.2. Prefabrication of the Models.

Permitted: models which are assembled by the builder from prefabricated parts and in which the builder installs the equipment. Not Permitted: models which are completely prefabricated and require only a few minutes of unskilled effort for their completion or complete ready-to-fly models which have been built by a person other than the pilot.

The model specification certificate (required for models in international competitions) shall bear a signed affidavit, that the competitor has complied with the spirit of rule 1.3.

### 1.3. Characteristics of Radio-Controlled Gliders.

- Minimum surface area (S) $\geq 150\text{cm}^2$  (2.325 sq. in.). Maximum flying weight (W) $\leq 75\text{g}$  (11.025 lbs.). Loading on the S $\leq 12\text{g}$  (between 3.95 and 29.31 oz. per sq. ft.).
- Minimum radio range (range nose): 7.5mm (285 in.).
- The radio shall be able to operate simultaneously with other equipment at 20kHz spacing where the radio does not meet this requirement, the working bandwidth (Maximum 50kHz) shall be specified by the competitor.
- Any device for transmission of information from the model to the pilot is prohibited.

The competitor may use two models in the contest.

The competitor may combine the parts of the models conforming to the rules and that the parts have been checked before the start of the contest. See also 2.1.

### 1.4. Competitor and Helpers.

The competitor (pilot) must operate his radio equipment personally. Each pilot is permitted to have helpers, team managers included, who must not give any flying signals near Base B during Tasks B and C.

### 1.5. Definition of an Attempt and an Official Flight.

- For each task, during the working time allocated to him, the competitor is entitled to an unlimited number of attempts; an attempt starts when the model is released from the hand of the competitor or their helpers under the tension of the tow line. No change of models or parts on the model is allowed after starting of the first attempt.
- The competitor is entitled to a new working time period at the end of the task if:
  - his model or launching cable whilst attached to the model collides with another model in flight, with a person while being launched, or strikes another launching cable. Should the flight continue in a normal manner, the competitor may demand that the flight be accepted as official, even if the demand is made at the end of the flight.

—the flight has been judged by the fault of judges or timekeepers.

In the case of an unexpected event, duly witnessed by the official judges or timekeepers, the flight has been hindered or aborted.

### 1.5.2. Official Flight.

The official flight is the last flight performed during the working time.

### 1.6. Cancellation of a Flight or Disqualification.

The flight is cancelled if the competitor used a model or a line or launching device not conforming with FAI rules. In the case of intentional or flagrant violation of the rules, in the judgment of the contest director, the competitor may be disqualified.

The flight is annulled if the model loses any part during the launch or the flight time. The losing of a part during landing (i.e. in contact with the ground) is not taken into account.

The competitor is disqualified if the model is controlled by anyone other than the competitor.

If the glider touches either the pilot or his helpers during the landing maneuver of task A or B, no landing points will be given.

In case of hand or pulley towing the launching device (except the launching cable with or without any device of max. 5 gms) must not be thrown by the competitor, or his helpers under penalty of cancellation of the flight.

- 21. Inverted Three-Turn Spin. Model establishes a heading, half-rolls to inverted, power may be reduced; the model is held in a nose-high attitude until it stalls and commences to spin. The model will autorotate through three complete turns and recover on the same heading at a lower altitude, then half-rolls to an upright position. Downgrades:
  - 1/2 rolls not 180 degrees.
  - Wings not level during entry and exit.
  - Spiral dive scores zero.
  - Does not finish in same heading.
  - Does not make three turns; less than two or more than four, score zero.

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

- 22. Inverted Three-Turn Spin. Model establishes a heading, half-rolls to inverted, power may be reduced; the model is held in a nose-high attitude until it stalls and commences to spin. The model will autorotate through three complete turns and recover on the same heading at a lower altitude, then half-rolls to an upright position. Downgrades:
  - 1/2 rolls not 180 degrees.
  - Wings not level during entry and exit.
  - Spiral dive scores zero.
  - Does not finish in same heading.
  - Does not make three turns; less than two or more than four, score zero.

# FAI RC AEROBATIC JUDGES' GUIDE

**● Size of Maneuvers.** The optimum size of maneuvers is governed to some extent by the size and normal flying speed of the model. Exceedingly small or tight maneuvers with unnecessarily high rates of roll, pitch or yaw do not simulate full scale performance, and they should be downgraded accordingly.

**Smoothness and Gracefulness.** These two factors are inter-related with size of the maneuver and therefore judges should relate to normal flying speed of the model. Various judges and pilots will have different opinions of what actually constitutes smoothness and gracefulness. The most general definition must again be related to full scale simulation and the effects of the maneuver on an imaginary pilot or passenger in a full scale aircraft.

A 10 meters (33') diameter loop at 80 km/h (50 m.p.h.) results in about 10 g's, which is close to or in excess of the design limits of most full scale aerobatic aircraft.

The matter of smoothness is basically related to scale-like appearance. For example, a perfect set of consecutive rolls should have a constant 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 with sudden angular forces placed between. Such sudden jerks represent high g's forces well in excess of full scale tolerances and should be downgraded.

**Accurate and Consistent Judging.** The most important aspect of consistent judging is for each judge to establish his standards and then maintain that standard throughout the contest. It is advisable for the contest director or the chief judge to hold a conference prior to the start in order to discuss judging and make the standards as uniform as possible. This is effected by means of practice flights which all judges score simultaneously and privately. After these flights, the defects in each maneuver should be discussed by all judges and agreement reached about the severity of defects. Once the contest is started, the individual judge should not alter his standard under any influence.

The contest director should clearly define areas in which it is considered unsafe for competitors to perform, such as above spectators, or over buildings, etc. The definition of unsafe areas should be absolutely unambiguous.

### Judging Individual Maneuvers.

When in doubt, give the lower score; perfection is not a common occurrence.

A description of each maneuver is given, in Annex A, and means of defects observed are listed. The number of defects observed is:

- 1) the number of defects observed.
- 2) the severity of the individual defects.
- 3) the number of times any one defect occurs.
- 4) the positioning of the maneuver.
- 5) the size of the maneuver.

For example, a small single change in heading during the takeoff would be considered one defect, while two or three distinct turns would be considered two or three defects. It should be noted that for many maneuvers there are more than ten possible kinds of defects and that some of these can be repetitive.

A score of 10 should be given only if the maneuver is well-positioned and no defects are observed. One or two minor defects should result in downgrading to at least an 8, while one severe defect should put it down to 6, as should a combination of three or four minor defects. Any element in poor positioning should be deducted at the start of the maneuver and also reduced at the start for the maneuver. Red Penalties should be considered during or at the end of a maneuver might also result in as many as 3 to 4 demerits.

- 19. Two Rolls in Opposite Direction (from inverted). From inverted flight, model rolls 360 degrees in either direction, then immediately after rolls 360 degrees in the opposite direction. Downgrades:
  1. Roll rate not level during 360 degrees.
  2. Roll rate not level during 360 degrees.
  3. Roll rate not level during 360 degrees.
  4. Second roll does not start immediately after first roll.

**● 20. Half Square Outside Loop.** From inverted, model pushes up to a higher altitude, pauses, then pushes over to recover in level flight at a higher altitude than entry. Downgrades:
 

1. Wings not level during 1/4 loops.
2. Model not vertical after first 1/4 loop.

**Purpose.** The purpose of the FAI RC Judges' Guide is to furnish an accurate description of each maneuver and to provide a reference for use in developing a uniformly high standard of judging.

**Principle.** The principles of judging an RC model should be based on the perfection with which the model simulates full scale aircraft performance. The main criteria for perfection in an individual maneuver can be classified as follows:

1. Precision of the maneuver.
2. Positioning or display of the maneuver.
3. Size of dimensions of the maneuver.
4. Smoothness or gracefulness of the maneuver.

All of these requirements must be met in order for a maneuver to be rated perfect.

**Precision.** At the instant the contestant announces his next maneuver, the judge should form an image of the course the model airplane should follow.

The judge should adjust his image if the first portion of the maneuver clearly demonstrates that the contestant intends to do a maneuver of much smaller or larger dimensions than the judge anticipated.

It is noted that forming an image of the forthcoming maneuver is based on the judge's own previous experience and reference. The absence of definite points of reference increases the difficulty of justification for downgrading.

The straight and level exit from a maneuver is one of the more valuable portions of the maneuver for evaluation of how well the intended course of the maneuver was followed. The pilot will use it to announce "maneuver completed." The absence of a well defined straight and level exit should also result in downgrading.

**Positioning.** To achieve perfection, the competitor must position his maneuvers in such a way that they can be easily judged. The first consideration on position is longitudinal distance from the competitor. All the judges should be located near the competitor so that they obtain identical views of the maneuver. The competitor should center his aerobatic maneuvers in such a way that they can be easily judged. The judge should observe if the competitor is trying to hide his defects by flying at a distance.

Positioning of maneuvers involves more than distance. They should also be presented in a relative direction which displays the most difficult aspects of the maneuver. Specifically, maneuvers which have circular symmetry (such as Loops, Immelmans, Cuban Eight and Horizontal Eight) should execute their circular path in a plane perpendicular to the line of sight to the model.

"End on" or "canted" presentation of the circular maneuvers should result in downgrading since it increases the difficulty of judging the symmetry of figure 8's and the "tracking" of consecutive loops.

While no special bonus is justified for exceptionally low altitude, excessively high altitude is cause for downgrading. Most maneuvers can be done at a distance and altitude that would not affect the judge's view of the maneuver. However, maneuvers as executed as such which allow about a degree angle. If the transmitter in a way that they force the judge to look vertically or near vertically, they should be downgraded. The main reason for this is that most maneuvers cannot possibly be properly oriented when performed directly overhead.

**● 1.7. Organization of Starts.** The competitors shall be combined in groups with a draw, in accordance with the radio frequencies used, to permit as many flights simultaneous as possible. The draw is organized in such a way that, as far as possible, there are no competitors of the same nation in the same group. The flying order of different groups is established with the draw too. A different starting order shall be used for each round.

The competitors are entitled to 5 minutes of preparation time before the starter gives the order to count off the working time.

**1.8. Organization of Contests.** All transmitters to be used during the contest must be checked and placed in a compound kept under observation of a special official. The official will issue the transmitter to the competitors only at the beginning of their preparation time according to 1.7.

During the whole preparation time the officials watch the competitor to prevent their switching on the transmitters before the prescribed compounds have finished their flights. As soon as the flight has ended the competitor must immediately return his transmitter to the official at the transmitter compound.

All unauthorized transmissions during the contest will result in automatic disqualification of the offender from the entire contest, and render him liable to further penalties.

The organizer must provide a radio monitor for the purpose of detecting possible interferences.

● Sighting apparatus, winches or any device constituting an obstacle should be placed on Base A and Base B, a minimum distance of 5 meters (9.8 ft.) from the safety line for Task C and a minimum distance of 13 meters (42.6 ft.) from the center line for Task B. Apparatus for judging the safety line in Task C shall be placed in minimum distance of 5m (16.4 ft.) from Base A or B outside the course.

## 2. RULES FOR THERMAL SOARING CONTESTS

**2.1. Definition.** This contest is a multi-task event for Radio-Controlled Gliders which includes three tasks:

- Duration
- Distance
- Speed

● The combination of Task A, B and C constitutes a round. A minimum of two rounds must be flown. In the case of a World Championship each competitor is entitled to a minimum of five rounds. At the discretion of the organizer any task may be flown in a scheduled round. Any single round must be completed with the model, without any change of parts. Only the addition of ballast, without any change of parts, in the model and with which the model must be located internally in the and/or change of angles of setting are also conform to rule 1.4)

Variations of geometry or area are allowed if actuated at distance by radio control.

**● 2.2. Launching.** All launching shall take place in an area designated by the organizer with provisions made for launching into the wind. For Task B, location of the towlines shall be outside the course. Unless otherwise specified, all launches shall be made with equipment approved by the organizer or contest director. Contest notices shall contain a description of the launching equipment to be available and its general capabilities.

● After release of the model from the towline, the tow ring must be retrieved without delay by hand to the winch or hand reel. A power winch must not be operated when its towline is lying on the ground and across other towlines.

● The launch of the glider may be by one of the following means: (1) hand towing (2) powered winch, (3) hand-operated winch.

● The total length of the towlines must be as follows:

- (1) Hand towing: must not exceed 175 m when tested under a tension of 2 kgf.
- (2) Electrically-powered winch: line length must not exceed 400 meters and shall include in its length line length must not exceed 40-50 kg nylon line, which shall be supplied by the organizers, and must be inserted in the towline at the model end of the line, no more than 5 meters from the model.

● Upwind turn-around devices, which must be used, shall be at least 200 m from the winch. Release of the model must occur within approximately three meters of the winch. An automatic means must be provided to prevent the line reel from unwinding during launch.

● The winch shall meet the following specifications: a) The winch shall be fitted with a single motor having a body diameter not exceeding 140 mm and body length not exceeding 215 mm; b) The width between winch drum flanges shall not be less than 70 mm; c) The power source shall be a single 12-volt lead/acid battery with a high linear dimension such that the sum of length, width and height (excluding mounting lugs) does not exceed 1750 mm; d) Hand-operated pulleys: must not exceed 175 meters when tested under a tension of 2 kgf. One end of the towline must be attached to the ground during launch.

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