



Competition Regulations 2007-2008

Rules Governing Model Aviation Competition in the United States

Radio Control Aerobatics

Amendment Listing

Original Issue	1/1/2007	Publication of Competition Regulations
Correction to Top Hat with ½ rolls (page 32)	4/07	Added ½ roll on downline
Correction to Straight Flight Out and Straight Flight Back (page 31)	4/07	Corrected to reflect correct maneuver sequence
Aresti for Intermediate maneuver 16 Double Immelman	4/07	Corrected drawing
Correction to Stall Turn with or without Rolls (page 30)	4/07	Correction to maneuver description

Radio Control Aerobatics

RADIO CONTROL, GENERAL (FOR NONSCALE EVENTS)

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

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

RADIO CONTROL PATTERN

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

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

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

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

4. Model Aircraft Requirements.

4.1. Power. Models shall be powered by reciprocating or rotary piston internal

combustion engine(s) or electric motor(s) of any size and displacement.

4.2. Noise Limit. Each reciprocating or rotary piston internal combustion engine shall be equipped with an effective silencer. The maximum noise level for all classes shall be 96 decibels measured at three (3) meters from the center line of the model with the model standing on concrete or macadam, and 94 dB if an earth or short grass surface must be used. All measurements will be taken perpendicular to the fuselage centerline on the right-hand downwind side of the model with the motor running at full power; the microphone to be placed on a stand 30 centimeters above the ground and in line with the motor. No noise reflecting objects shall be nearer than three (3) meters to model or microphone. A score penalty of five (5) percent of the raw flight score shall be assessed for those models registering over 96 dB and a 10 percent penalty for those registering over 98 dB. The Contest Director (CD) shall have the option of deleting the noise level requirement at any sanctioned event.

4.3. Weight and Size. No model may weigh more than five (5) kilograms (11 pounds) gross, but excluding fuel, ready for takeoff. Electric models are weighed with batteries. No model may have a wingspan or total length longer than two (2) meters (78.74 inches).

4.4. Equipment Functions. Radio control equipment shall be of the open loop type (i.e. no electronic feedback from the model to the ground). Auto pilot control utilizing inertia, light, gravity, or any other type of terrestrial reference is prohibited. Automatic control sequencing (preprogramming) or automatic control timing devices are prohibited.

Examples of control functions permitted:

- 1) Control rate or control movement limit devices that are manually switched by the pilot.
- 2) Any type of button, dial switch, or lever control that is initiated and terminated by the pilot.
- 3) Manually operated switches to couple control functions.

Examples of control functions not permitted:

- 1) Snap buttons with automatic timing mode.
- 2) Preprogramming devices to automatically perform a series of commands.
- 3) Automatic leveling or stabilization in any axis (gyros, etc.).
- 4) Propeller pitch change with automatic timing mode.
- 5) Any type voice recognition system.
- 6) Any type of learning function involving maneuver to maneuver or flight to flight analysis.
- 7) Model navigation or positioning systems (GPS, distance, or height sensors, etc.).
- 8) Electronic or other signal or feedback from the model of any kind.
- 9) Engine management systems that coordinate power output with model performance, position, or attitude.

4.5. Eligibility of models. Contestants may fly any aircraft which conform to the rules of the class in which they are entered and may share, borrow, repair, or interchange aircraft components or complete aircraft as they see fit during the competition, providing the resulting complete aircraft conforms to the equipment requirements as stated in this section, and satisfies the provisions of Paragraphs 4.7.1 and 6.1.

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

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

4.7.1. Borrowed or shared aircraft shall carry temporary identification, as shall repaired aircraft if deemed necessary by the Contest Director. Such identification shall consist of the AMA license number of the contestant operating the model affixed to or written on the model in any way which conforms to the standard set forth in 4.7. Temporary identification numbers may be affixed in any manner which will withstand the rigors of flight.

5. Number of helpers. Each pilot is permitted one (1) helper during the flight. Two (2) helpers

may be present during the starting of the engine(s). Once airborne no person other than the pilot shall operate the transmitter controls. Operation by anyone else shall require disqualification of the flight.

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

6.1. The Contest Director at an AMA sanctioned event has the authority to perform safety inspections of any equipment and to prevent any participant from using equipment which in the Contest Director's opinion is deemed unsafe.

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

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

• **6.4.** The pilots shall remain in the pilot box while flying and in particular shall stay off the runway and/or landing area. The pilot may approach the runway with the permission of the judges when landing or when aborting a flight.

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

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

• **6.7.** The maximum sustained winds during a pattern contest shall be 30 knots. The Contest Director shall suspend flying when the sustained winds (excluding gusts) exceed this limit. Flying shall be restarted when the wind

recedes. The CD may also suspend flying due to wind when in his/her opinion, flying has become unsafe due to field or other circumstances. The Contest Director will make the final decision as to the wind speed and that decision may not be questioned by contestants.

• **6.8.** The contestant may ask the CD for a flight delay or re-flight due to unsafe conditions; if the judges concur the delay or re-flight may be granted. However, the contestant's own aircraft cannot be the cause of the unsafe condition. A flight delay or re-flight shall not be granted for equipment malfunctions at 4A and 5A contests. The CD may make exceptions at other contests.

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

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

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

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

8.1.2. Exception: Consideration will be given to requests for reclassification to a lower class for various reasons, such as disability or breaks from participation of several years. For a flier to be reclassified to a lower rank, that person must make application (using a form supplied by AMA HQ) to be signed by a Contest Director and forwarded to the petitioners District Contest Board representative and Vice President for their approval.

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

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

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

8.2.3. The accumulated points for required class advancement will be based on a sliding scale of 4 years time. Advancement points acquired before the fourth (4) year will not count towards advancement. In other words, a contestant's point accumulation is based on the total accumulation for his/her previous four (4) years of competition.

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

8.2.5. There is no mandatory advancement into FAI from the Masters class. Contestants may enter their current AMA class or the FAI class at any contest but not both.

Examples

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

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

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

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

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

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

10.1. There is an attempt when:

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

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

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

10.2. Each competitor is entitled to one (1) attempt for each official flight. An attempt may be repeated at the judges' discretion only if, for some unforeseen reason, the model fails to make a start (i.e., safety delay due to other aircraft traffic, etc.). Similarly, an attempt may

be repeated at the discretion of the Contest Director if it has been interrupted due to a circumstance beyond the control of the competitor, but only the maneuver affected and the unscored maneuvers that follow will be scored. The Contest Director shall have sole discretionary authority to grant a single repeat attempt, if, in his/her opinion, the competitor has encountered radio interference during the course of an official attempt.

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

10.3. In the case of a collision during a Pattern flight, the contestants must immediately recover their aircraft. They may resume their flights with the same aircraft if the aircraft are judged to be airworthy or with a backup or repaired aircraft. They will begin with the maneuver that was in progress or with the next scheduled maneuver if the collision occurred between maneuvers. The previously defined starting times will apply for a resumed flight and the contestant will be allowed no more than two (2) passes in front of the judges for the purpose of trimming the plane. Scores of the previous maneuvers will be added to the scores of subsequent maneuvers in the resumed flight. The flight must be completed by the end of the round being flown, or within a time frame designated by the CD.

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

11. Time limits. Each contestant has three (3) minutes to start the engine and commence the takeoff maneuver. When the contestant fails to commence within the three (3) minutes and is so informed by the timer, he must immediately clear the area for the next contestant. No engine

restarts are allowed after the wheels leave the ground on takeoff. Restarting is permitted within the first three (3) minutes, but only if prior to takeoff (also see paragraph 10).

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

- **12.1.** When a judge fails to fully observe the maneuver in progress that maneuver score must be a “NO” for “Not Observed”. That judge’s score will then be given the average of the scores of the other judge’s scores when more than 2 judges are present or the score of the other judge when there are only 2 judges. In the case where all judges score a maneuver “NO” the contestant will be allowed a re-fly of the sequence through the maneuver or maneuvers that had a “NO” score. The judges will only score the maneuver in the re-fly that had the score of “NO”. All other scores from the previous flight will be used.

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

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

Score y = points awarded to competitor

Sy = raw score of competitor

Sw = raw score of winner of round

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

- **13.1.** In each class, only completed rounds in which all entrants in that class have flown, or have had official opportunity to fly under the rules set forth in Paragraph 10, shall be

counted. Individual classes competing at the same event may, at the discretion of the Contest Director, fly differing numbers of rounds to determine the winner. In all classes, the winner shall be the only flight score when only one (1) round is flown; the highest total of the best two (2) flight scores when two (2) or three (3) rounds are flown; the highest total of the best three (3) flight scores when four (4) rounds are flown; and the highest total of the best four (4) flight scores when five (5) or more rounds are flown. Points from repeat flights may not be added to earlier flights. Each flight is complete in itself. In case of ties, the best non-scored flight of the contestant shall be used to determine the higher placement. For all AMA classes, all judges scores are to be included in the tabulation of scores regardless of the number of judges used in a normal, matrix, or finals round.

- **13.2.** At large contests such as a National level contest, the number of contestants may exceed the time available to run a complete round in front of the same judges. In this case the CD may elect to use the matrix system for the 6 round event. The Matrix system is intended for use in situations where the number of pilots exceeds that which can be run on 1 site, in front of 1 set of judges, and within the time limitations of the event. For example, the Masters class at the NATS often falls into this category.

The explanation, construction and scoring instructions for the Matrix system are in 13.3. Where possible and practical, each competitor will fly 6 matrix rounds. The best 4 of 6 rounds will be used to determine the finalists. If the event cannot run a finals round due to inclement weather etc., the best 4 of 6 rounds will be used to determine the winner.

Finals format – If a Finals event is included, the number of finalists will be 20% of the total or a practical number to match the time available. The Finals format is also subject to the time available. The CD can opt to run a 4 round final, or a 3 round (or less) final. If a 3 round final is selected, one normalized preliminary overall position score will be carried over. To allow for weather problems, the best 2 of 2, or 2 of 3 will determine the winner. If a 4 round final is chosen, then there will be no carry over overall position scores. Again, to allow for weather issues, the best 1 of 1, 2 of 2, 2 of 3, or 3 of 4 normalized finals scores will decide the winner. Equal judging exposure will be applied and only completed rounds will be counted in the final standings.

● **13.3. The Matrix System**

Purpose – The Matrix system is intended for use in situation where the number of pilots exceeds that which can be run on 1 site, in front of 1 set of judges, and within the time limitations of the event. It is our goal to achieve a suitable rotation of pilots while using 2 sites and 4 flight lines.

Matrix Construction:

A simple matrix can be constructed using 4 frequency groups.

Frequency groups:

The pilots are grouped by frequency.
2 Sites with 2 flight lines each equals 4 flight groups. There may be more than 1 frequency in a group but a frequency cannot appear in more than 1 group. The number of pilots in each group should be kept as even as possible.

Flight Groups:

In the sample shown, the contestants are divided into 4 frequency groups (A-D).

The frequency groups are divided into 4 flight groups for each day.

Day #1 (A-B) (C-D)

Day #2 (A-C) (B-D)

Day #3 (A-D) (B-C)

Day #1 Groups (A, B) fly on site #1 and Groups (C, D) fly on Site #3.

Day #2 Groups (A, C) fly on site #1 and Groups (B, D) fly on Site #3

Day #3 Groups (A, D) fly on Site #1 and Groups (B, C) fly on Site #3

Flight Orders:

Flight orders are created from the flight groups. Frequencies are arranged to avoid flight line delays and pilots are rotated to avoid having the same pilot fly first more than once.

Sample flight operations for Day 1 on Site#1:

Each site has 2 flight lines (A and B)

Group (A) starts flying Round #1 on Line (A) Site #1. Group (B) starts flying Round #2 on Line (B) Site #1. When they complete their round and the judges have a break, Group (A) moves to Line (B) and Group (B) moves to Line (A). The flight orders are rotated so that the same pilot is not first more than once. When flying resumes Group (B) will complete Round #1 and Group (A) will complete Round #2. The

result is group A and B have all flown round #1 and Round #2 in front of the same set of judges.

Scoring Procedure:

Site #1 and #3 are flying simultaneously. When round #1 and #2 are complete, the scores for each round at each site are normalized. After the scores are normalized, the scores from round #1 on Site #1 are merged with the scores from round #1 at Site #3 to give a final standing for round #1. The same procedure is used for all preliminary rounds.

If the competition is terminated before all 6 rounds are completed, this scoring procedure produces the appropriate comparison of scores after each round so that contestant placing can be determined. In the event of a normalized tie, the next best normalized score will be used to break the tie. If no more normalized scores are available, raw scores will be used to determine the winner.

14. Flight pattern and maneuvering area. The maneuver schedules of all classes must be executed in the order in which they are listed during an uninterrupted flight within a maneuvering area or “box” bounded by lines 60 degrees each side of center. The vertical height shall not exceed 60 degrees from the horizontal. The boundaries of the maneuvering area shall be marked by the placement of surface lines of white or contrasting color originating at the pilot's position and, where possible depending on local conditions and topography, the placement of vertical poles at the center position and 60 degrees right and left on a line approximately 150 meters in front of the pilot. The judges shall be seated not more than 10 meters behind the pilot's position (the apex of the 60 degree lines) and within an area described by the extension of the 60 degree lines to the rear of the pilot. Maneuvers must be performed where they can be clearly seen by the judges. Center maneuvers should be performed centered in the maneuvering area in a plane exactly perpendicular to the judges' line of sight to the model. Scored turnaround maneuvers should not exceed the 60 degree right and left limits of the maneuvering area. Maneuvers should be performed along a line of flight approximately 150 to 175 meters from the judges, with the main criteria being visibility. Infractions of any of the above rules are cause for downgrading in addition to those downgrades listed in the Description of Maneuvers section. Unscored turnarounds in any class may exit the maneuvering area. Calling of box entry must be

done so there is a minimum of a 15 meter straight line before the first maneuver. Judging of the maneuver will begin at that point (lines into and out of maneuvers are part of the maneuver and are always judged). Calling of exiting the box must be done after a minimum of a 15 meter straight line after the maneuver. Judging will cease at that point.

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

● **14.1.1.** The pilot or helper may request a different landing direction to that used for takeoff without penalty to avoid downwind landings. If this option is used a maximum of two (2) passes in front of the judges may be used to position the model for landing, however, any turns used for positioning the aircraft must not be made at center.

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

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

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

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

14.6. In all classes, the contestant or helper must call out the initiation and completion of the takeoff and landing maneuvers and all maneuvering area entries and exits.

14.7. The execution of free-style aerobatic maneuvers or "hot-dogging" during the allowed free passes after takeoff and before landing is specifically prohibited. Contestants may maneuver the aircraft as necessary for trim purposes, and may employ any simple 180 degree turnaround maneuver of their choice to position the aircraft for landing or entry into the maneuvering area. If, in the judge's opinion, a prohibited maneuver has been performed during the allowed free passes, the following maneuver shall be scored zero (0).

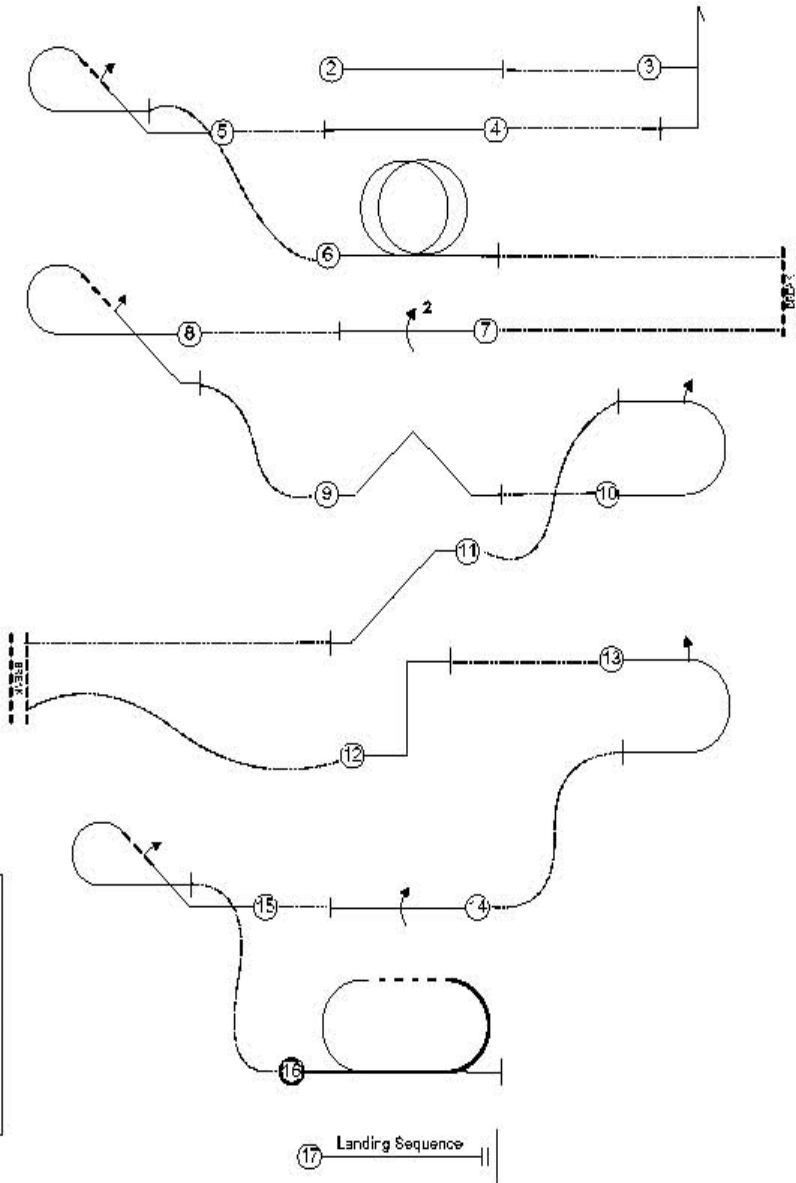
14.8. Sportsman option. At the Contest Director's option, the Sportsman class may fly their maneuver schedule twice in succession on each flight. Suggested procedure: The first sequence proceeds in the standard manner through the last airborne maneuver and box exit downwind. The pilot makes an unscored turnaround, and reenters the box upwind to start the sequence again with Straight Flight Out. The first sequence's takeoff score is used for the second sequence's takeoff score. The landing score is used for both sequences. The highest scoring sequence of each two (2) sequence flights shall be counted. The Contest Director may use this option on a round by round basis. Use of the option is not a deviation to the rules and is not required to be detailed in sanction requests. Advertisement of this option in contest announcements is recommended but not required.

● **14.9.** All pattern sequences are required to end upwind.



Sportsman 2007-2008

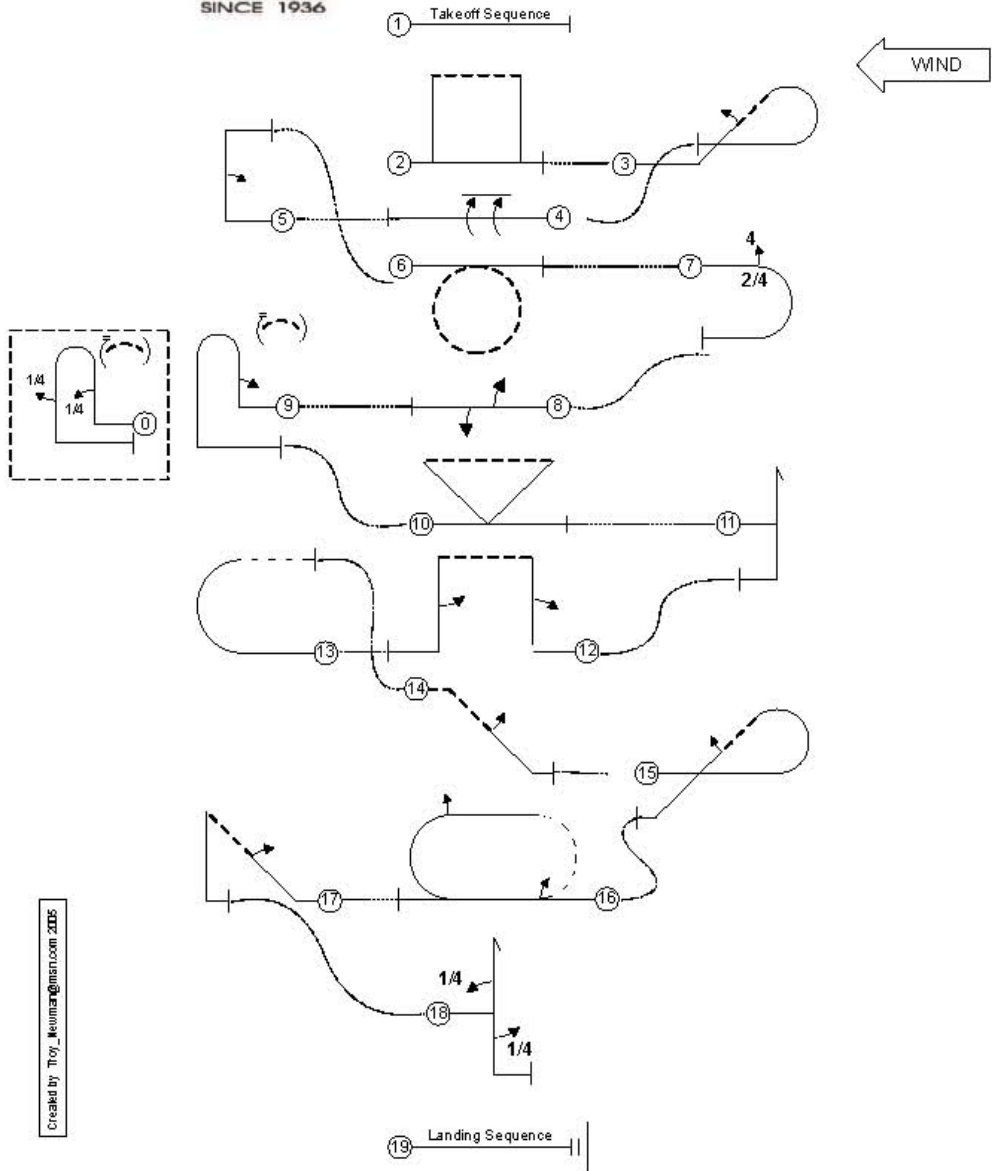
① Takeoff Sequence



Created by: [unreadable]

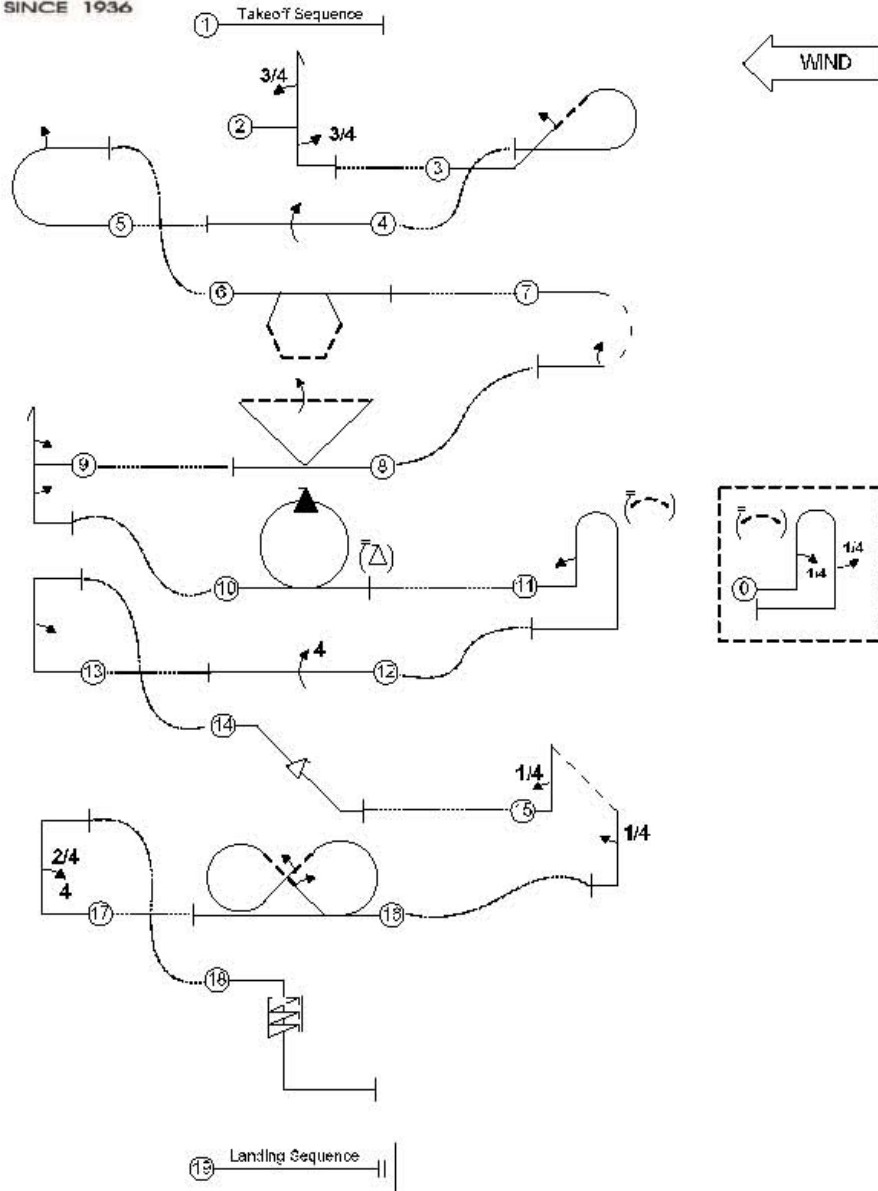


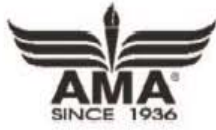
Intermediate 2007-2008



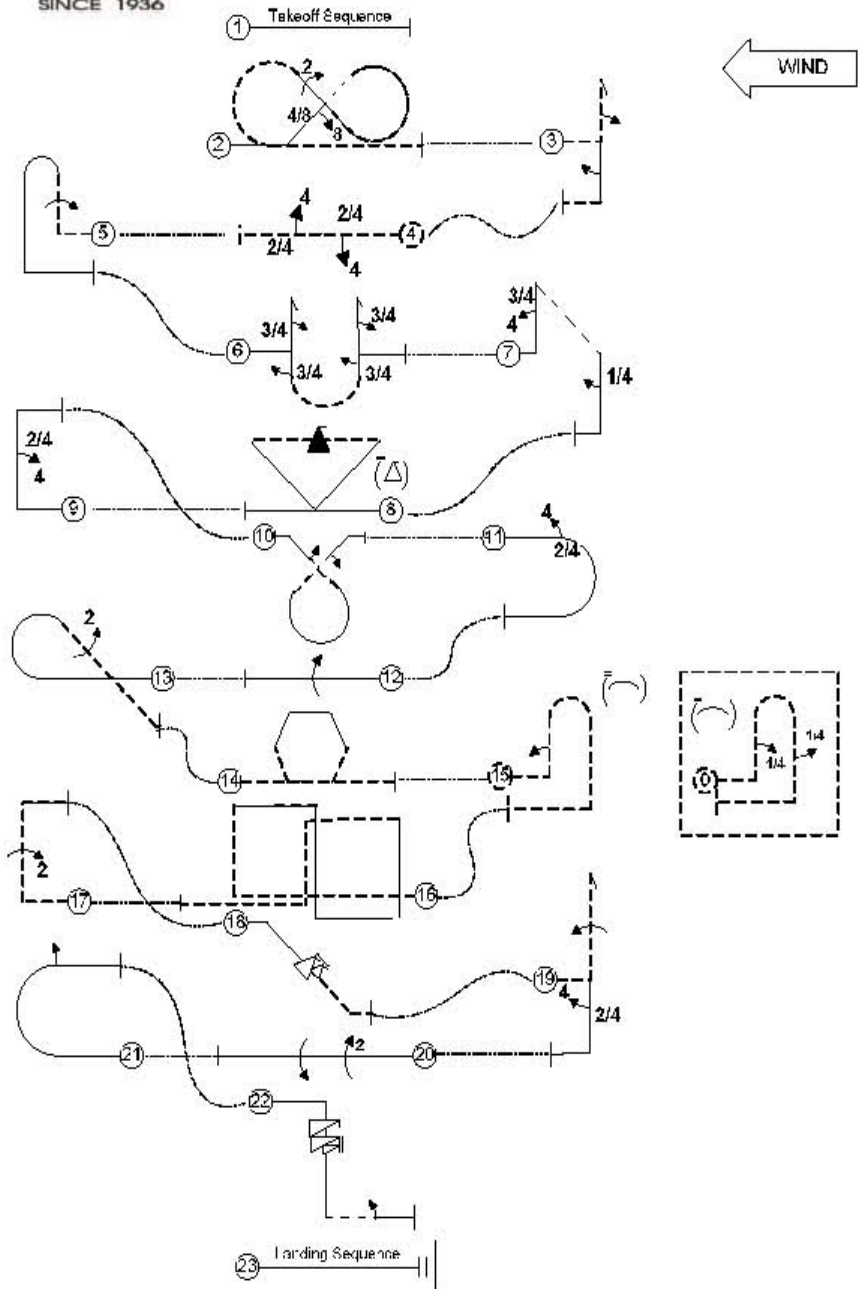


Advanced 2007-2008



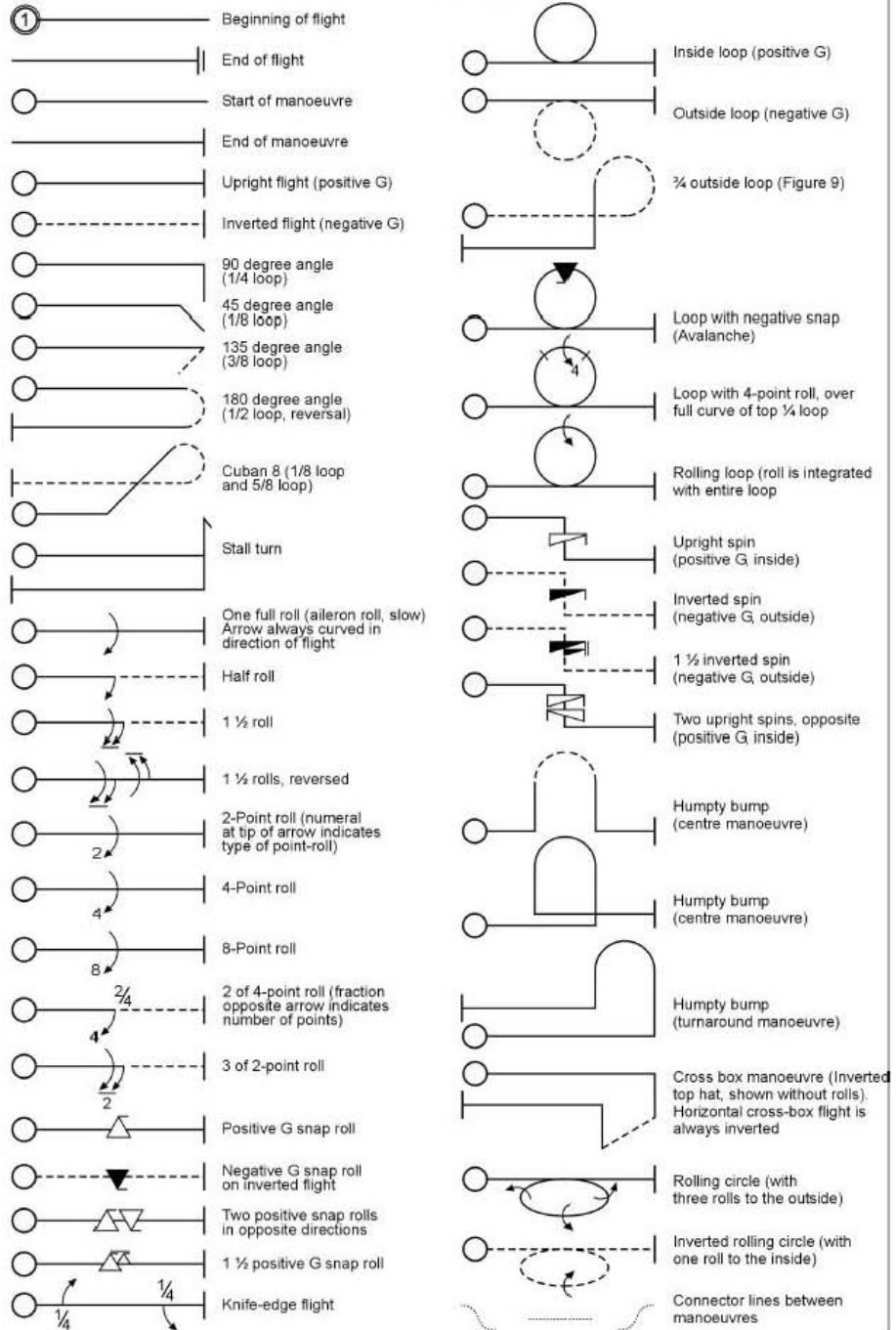


Masters 2007-2008



Created by Tom_Fox at 08:00 on 2005

EXPLANATION OF ARESTI SYMBOLS



● **15. Sportsman Pattern Maneuvers.**

401 Sportsman	
1. Takeoff (U)	K=1
2. Straight Flight Out (U)	K=1
3. Stall turn without rolls	K=2
4. Straight Flight Back (D)	K=1
5. Half Reverse Cuban 8	K=2
6. Two (2) Inside Loops (U) (Exit Box)	K=2
7. Two Point (2/2pt) Roll (D)	K=2
8. Half Cuban Eight	K=2
9. Cobra without Rolls (U)	K=1
10. Immelmann Turn	K=2
11. 45 degree Down line (D) (Exit Box)	K=1
12. Vertical Up line (on Center)	K=1
13. Split -S	K=2
14. One Horizontal Roll (D)	K=1
15. Half Reverse Cuban 8	K=2
16. Double Immelmann without Rolls (U)	K=2
17. Landing	K=1

Total K=26

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

● **16. Intermediate Pattern Maneuvers.**

402 Intermediate	
1. Takeoff (U)	K=1
2. Square Loop (U)	K=3
3. Half Reverse Cuban Eight	K=2
4. Two (2) Horizontal Rolls (D)	K=2
5. Half Square Loop with ½ Roll up	K=2
6. One Outside Loop from top (U)	K=2
7. Split S with 2/4pt roll (2/4pt roll, ½ Inside Loop)	K=2
8. Two Half Rolls Reversed (pause in middle) (D)	K=3
9. Humpty Bump with options	K=2
10. Non-Rolling Triangle Loop (U)	K=2
11. Stall Turn without Rolls	K=2
12. Top Hat with ½ rolls up and down (D)	K=3
13. Half Inside Loop, exit inverted	K=1
14. 45 Degree Down line w/1/2 roll in middle (U)	K=2
15. Half Cuban Eight	K=2
16. Double Immelmann with ½ rolls (D)	K=3
17. Reverse Shark's Tooth, Half Roll on 45 up line	K=3
18. Stall Turn with ¼ rolls (U)	K=3
19. Landing	K=1

Total K=41

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

● **17. Advanced Pattern Maneuvers.**

403 Advanced	
1. Takeoff (U)	K=1
2. Stall Turn with ¾ Rolls up and down (U)	K=3
3. Half Reverse Cuban Eight	K=2

4. Slow Roll (D)	K=3
5. Immelmann Turn	K=2
6. Six Sided, outside loop from top (U)	K=4
7. Bunt with ½ Roll out	K=2
8. Triangle Rolling Loop (1 roll) (D)	K=4
9. Stall Turn with ½ Rolls up and down	K=2
10. Avalanche (U)	K=3
11. Humpty Bump with options	K=2
12. Four Point Roll (D)	K=4
13. Half Square Loop with ½ roll up	K=2
14. 45 Degree down, One Positive snap (U)	K=3
15. Top Hat with ¼ rolls	K=2
16. Reverse Cuban 8 with ½ rolls (D)	K=3
17. Half Square Loop with 2/4pt roll up	K=2
18. Three Turn Spin	K=3
19. Landing	K=1

Total K=48

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

● **18. Masters Pattern Maneuvers.**

404 Masters	
1. Takeoff (U)	K=1
2. Reverse Cuban 8, 4/8pt Roll first, 2/2pt Roll second, exit Inverted (U)	K=4
3. Stall Turn with ½ rolls up and down, Exit Inverted	K=2
4. Two 2/4pt Rolls Reversed, Inverted to Inverted (D)	K=4
5. Humpty Bump (push, pull, pull) full roll up	K=3
6. Figure M with ¾ Rolls (U)	K=5
7. Top Hat 3/4pt Roll up, ¼ Roll Down	K=2
8. Triangle Snap Loop (1 snap) (D)	K=4
9. Half Square Loop, 2/4pt Roll	K=2
10. Reverse Golf Ball from top with ½ Roll (U)	K=4
11. Split S with 2/4pt roll (2/4pt roll, ½ Inside Loop)	K=2
12. Slow Roll (D)	K=3
13. Half Cuban 8, 2/2pt down, Exit Inverted	K=2
14. Six Sided Outside Loop, exit Inverted (U)	K=4
15. Humpty Bump w/Options, Exit Inverted	K=3
16. Square Horizontal Eight, exit Inverted (D)	K=5
17. Half Square loop, 2/2pt Roll up	K=2
18. 45 degree down, 1 ½ positive snap roll, exit Inverted (U)	K=3
19. Stall Turn, Full Roll up, 2/4pt Roll down	K=2
20. Two Point roll, Slow Roll Reversed (D)	K=4
21. Immelmann Turn	K=2
22. 2-1/2 spin, half roll exit (U)	K=3

23. Landing

K=1

Total K=67

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

19. FAI Pattern Maneuvers. The FAI class shall fly according to the current FAI RC Aerobatics (F3A) rules. The noise limit shall be the current noise limit used in AMA competition for classes 401-404, except in the case of a USA Team Selection contest, where the noise limit shall be the current FAI noise rule. The builder-of-the-model rule, if any, shall not be enforced. The AMA Competition Regulations will be applied when the FAI Sporting Code is silent on, or does not provide guidance concerning the conduct or rules of the FAI - F3A events.

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

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

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

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

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

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

20.4.2. Number one man shall have three (3) minutes from completion of preceding

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

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

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

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

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

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

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

20.7. Each flight should be judged by at least two (2) judges, with their scores averaged or totaled to give final score for the flight. Each maneuver will be scored immediately after it is performed. Judges shall score maneuvers individually and without consultation between them. There should be enough judges available to establish a rotational procedure which will average out variations in judging. Sets of judges shall judge all contestants an equal number of times. If different judges are used during the contest, all contestants shall have an equal

opportunity to fly before all judges. Substitution of judges which precludes equal exposure by all contestants shall be avoided. If adverse weather conditions preclude equal exposure for all contestants the results of these flights may be disqualified at the discretion of the Contest Director.

20.8 The contest director should make every effort to provide fliers with equal freedom from exposure to the sun in the maneuvering area. This may be done by orientation of the maneuvering area or by scheduling competition to avoid sun exposure.

Definitions

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

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

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

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

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

AMA RC PATTERN JUDGES GUIDE

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

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

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

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

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

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

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

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

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

constant radius as the model transitions from line to line. Higher marks should not be awarded for flying tight, high-g corners.

c. Positioning. All scored maneuvers except landing and takeoff must be performed within the maneuvering area. The center maneuvers in all classes should be performed in the center of the maneuvering area in a plane exactly perpendicular to the judges line of sight to the model. Turnaround maneuvers should not exceed the limits of the maneuvering area as defined in the RC Pattern rules (see 14).

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

While no bonus for exceptionally low altitude is justified, the entry and exit altitudes for all maneuvers should be the same (as noted in section E, Description of Maneuvers). In general, scored turnaround maneuvers are positioning maneuvers. Therefore, entry and exit altitude need not be the same if the pilot is making an altitude correction.

Unscored turnarounds, of course, may be used to position the aircraft in any manner required.

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

● **d. Size.** Flying so far out as to make evaluation of a maneuver difficult should be severely downgraded. The main criterion here is visibility. For a large, highly visible model, a line of flight approximately 175 meters in front of the pilot may be appropriate, while a smaller and less visible model might have to be flown at 140 to 150 meters. Maneuvers performed on a line approximately 175 to 200 meters in front of the pilot should be downgraded one (1) point,

from 200-250 meters downgraded 2 points and over 250 meters downgraded 3 points. Since the size of the maneuvering area varies proportionally with the distance from the judges to the model's line of flight, the size of the maneuvers will vary as well. In addition, maneuvers should be proportioned relative to the size of the other maneuvers in the flight. In other words, absolute maneuver size is of little importance; maneuver size relative to the available maneuvering area and other maneuvers in the flight is paramount.

Large maneuvers placed close in will suffer downgrading for exceeding the vertical 60 degree maneuvering area limit, and small maneuvers placed far out will suffer downgrading for appearing to hide the maneuver.

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

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

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

D. Judging individual maneuvers. The schedule of maneuvers to be performed is described in the RC Pattern rules. The description of a maneuver always takes precedence over the name of the maneuver. Each maneuver is to be scored individually on a basis of 10 to zero (0) points, in half point increments, according to the degree of excellence. When in doubt, give the lower score. A 10 should be

awarded only if no flaws are seen that would justify a lower score.

A common problem is failure to use the entire 10 point scale when scoring maneuvers, particularly within the same flight. The judge should not hesitate to reward an exceptional maneuver simply because it appears following a series of mediocre or poor maneuvers.

Conversely, a severely defective maneuver which appears in an otherwise impressive flight should be given the low score it deserves.

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

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

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

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

1. Flying behind flight line during or between maneuvers (see 6.2.)
2. Maneuver performed out of sequence (see 14.1.)
3. Execution of an illegal pass (see 14.2., 14.3., and 14.4.)
4. Touching the plane before completion of the flight (see 14.5.)
5. Maneuver not completed
6. Model ends up on back when landing
7. Any gear retracts or collapses during landing

8. Maneuver in progress and any remaining maneuvers scores zero (0) if any component of the aircraft falls off during the flight

9. Failure to take off (see 10.1.)

10. Landing outside of runway or landing zone lateral boundary

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

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

Stall Turns: Stall turns are subject to the One Point per 15 Degree Rule, i.e., a “flopped” turn (rotation through the pitch axis rather than the yaw axis) should be downgraded one point for each 15 degrees of deviation from defined maneuver geometry. A flop of 45 degrees would earn a 3 point downgrade, while a flop of 160 degrees or more would receive a zero. These downgrades should be applied in addition to downgrades for any other defects observed in the maneuver. For example, a pendulum movement following the stall would call for an extra full point of downgrade, while a slight difference in entry and exit radii might merit an added half point deduction.

Number of Loops, Spins or Axial Rolls: These maneuvers are also subject to the One Point per 15 Degree Rule. Where 3 loops or rolls are required and 2 or 4 are done, defined maneuver geometry has been violated by 360 degrees of rotation through either the pitch or roll axis, thus earning a zero. Rotation errors on spins should be penalized per the rule. For example, a 90 degree error would draw a 6 point deduction for that fault alone, and errors of over 160 degrees would score zero.

Major and Minor Defects: As it is not practical to deduct one full point for each minor flaw observed, a scale of half points is provided. A “minor” error such as a slight over rotation or heading correction of less than 15 degrees should be penalized a half point for each occurrence. A “major” error, such as no entry or exit line to a maneuver, a stall turn radius exceeding 1-1/2 wingspans, or a total lack of line segment after a roll where one is required, should earn a two point deduction for that fault alone.

Maneuvers Off-Center: Deduct two (2) points for each quarter of the total maneuver’s length

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

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

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

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

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

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

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

Lines—All aerobatic maneuvers are started and ended by a horizontal line. When no line is flown between two (2) scored maneuvers, the

upcoming maneuver should be downgraded by two (2) points.

All lines within a maneuver have a beginning and end which define their length. The length of a line should only be graded when a maneuver contains several lines with a given relationship, as in a square loop. Unequal or misrelated lines should be downgraded according to the severity of the defect. One (1) point is subtracted for a reasonable difference. More points are subtracted for greater differences.

Whenever a type of roll is placed on a line, the length of line before and after the roll must be equal. If there is a minor miss-relation, one (1) point is subtracted; more points are subtracted for greater defects.

• **Radii** – All radii of a maneuver must be the same. Minor differences should be downgraded a point where more severe defects may be downgraded 1-1/2 points or more. The first radius of a maneuver does not define the radii for the remaining radii of a maneuver. In order to define the radii of a maneuver and to ensure the integrity of the downgrade system there must be at least two (2) radii flown before an assessment can be made by the judge. All radii after the first two should be compared to those first two and downgrades applied if necessary. For example, if the first and second radii are different a downgrade should be applied. If the third radius is then the same as either the first or second no additional downgrade is applied. All radii after the first two are compared to those.

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

Partial loops flown as part of the same maneuver must have identical radii. Every loop or partial loop should be flown with a smooth, continuous radius. Each angular jerk or segmentation should be considered as a separate defect and each defect should downgrade the maneuver by one (1) point.

The following criteria apply:

1. All loops must be flown in a constant vertical plane throughout the maneuver.
2. A complete loop must have, by definition, a constant radius, i.e., it must be flown as a perfect circle. Partial loops must be flown as a perfect arc joining defined line to defined line. An out-of-round or egg-shaped loop or

partial loop should be downgraded in relation to the severity of the defect.

3. Complete square loops, flown with or without rolls, should have sides of equal length, i.e. they must be flown as a perfect square.

4. Both complete and partial square loops must have corners which are constant and identical radii, i.e., the corner loops must be perfect arcs which are equal in size. Any inequality in loop size or defect in circularity should be downgraded in relation to the severity of the defect.

5. Looping maneuvers which require snaps or rolls to be contained in the looping or circular portion of the maneuver, such as Avalanche, must maintain a constant overall radius as the snap or roll is executed, i.e., the circularity of the maneuver must be maintained, with the roll or snap replacing a portion of the defined arc.

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

1. Roll rate must be constant. Small variations in roll rate should be downgraded by 1 point, while more severe variations receive heavier downgrades.

2. Roll must have a well defined start and stop.

3. All rolls flown on lines between partial loops must be centered on the line.

4. Point rolls must hesitate with equal time on each point. One (1) point is subtracted for slight variations, while more severe mis-timing is further downgraded. If one or more points are not visible, or there are more than the required number of points, the maneuver is severely downgraded (five (5) or more points).

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

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

1. Lines must have exactly vertical and horizontal flight paths.

2. Entry and exit must consist of partial loops with equal radii.

3. Length of the vertical line is not a criterion.

4. All rolls must be placed in the center of the lines.

5. Maximum pivot radius is one-half (1/2) wingspan. A pivot radius of more than one and one-half (1-1/2) wingspan should be considered a major defect and be downgraded by at least two (2) points.

6. If the model shows a pendulum movement after the pivot, the maneuver is downgraded by one (1) point.

• **Snaps**—A Snap roll is a simultaneous, rapid autorotation in the pitch, yaw and roll axes of flight in a stalled wing attitude. The following criteria apply:

1. Since the maneuver is defined as a stalled maneuver, initiated by a stall of the wing induced by a rapid change in pitch attitude, the nose of the fuselage must show a definite break in pitch attitude from the flight path in the direction of the snap (positive or negative) while the track closely maintains the flight path. The lack of a discernable pitch break is downgraded by 5 points. Large deviations from the flight path, indicative of a delayed stall, are to be downgraded using the 1 point per 15-degree rule for each axis of the excursion before stall. For example, if the model pitches 15 degrees nose up and the wings rotate 15 degrees before the stall, the maneuver should be downgraded 1 point for pitch and 1 point for roll.

2. The track visualized as the path of the Center of Gravity (CG) should closely follow the geometric flight path of the maneuver while the nose and tail auto rotate through opposite helical arcs around the flight path. Lack of these helical arcs (or coning) is indicative of an axial roll and is scored zero.

3. If a stall does not occur and the model barrel rolls, the score is zero. A barrel roll can be identified when the CG, the nose, and tails scribe the same helical path through the required rotation of the maneuver

4. Snap rolls have the same judging criteria as axial rolls as far as start and stop of rotation, constant flight path

through the maneuver and centering on lines.

5. If the model returns to an unstalled condition during the maneuver, such that the autorotation is not visible and the model rolls or barrel rolls to complete the maneuver, it would be downgraded using the 1 point per 15 degree rule.

6. Airspeed is not a criteria which should be used to judge this maneuver. The wing of the model is stalled during this maneuver; therefore a significant decrease in speed may occur and is not a cause for downgrade.

Spins—All spins begin and end with a horizontal line. In order to accomplish a spin, the model must be stalled. The entry should be flown in a near horizontal path with the nose high attitude increasing as the speed decreases. The nose then drops as the model stalls. Simultaneously, the wing drops in the direction of the spin. Spin entry (i.e. stall/break) for center maneuvers should occur directly in front of the judges on the center line/pole. The stall may occur while the airplane has forward motion with respect to the ground. The following criteria apply to spins.

1. Snap roll or unstalled entry scores zero (0). A snapped entry is defined as the wing passing through the vertical plane before the nose passes through the horizontal plane. (Note that one wing tip will drop in the direction of spin faster than the other. The high wing may rise above the horizontal plane as long as it does not pass through the vertical plane). Unstalled entry is defined as a rotation (spiral or yaw) of 90 degrees before stall occurs.

• 2. The stop of rotation is judged according to the One Point per 15 Degree Rule. An error of more than 160 degrees in either direction scores zero (0).

3. A nearly vertical downward line of visible length must be flown after the rotation stops. The pull or push out is judged as a partial loop.

4. The attitude of the model during the spin is not a judging criterion as long as the model is stalled.

5. Once the model has entered the spin, drift caused by the wind is not a judging criterion.

• 6. After exiting from the preceding maneuver the model shall establish a wind corrected heading to maintain track parallel with the flight line. That heading should be maintained to the spin entry. As the model slows, drift from the flight path parallel with the flight line should not be downgraded since it is in a near-stalled condition. Changes in heading before spin entry should be downgraded using the 1 point per 15 degree rule.

Loop/Roll Combinations—The loop/roll combinations are widely used, especially in turnarounds. They are very diversified, but all are combinations of loops and rolls/snap rolls and lines. All judging criteria for these elements apply. There are, however, some judging criteria which should be explained further.

1. In Immelmann and Bunt maneuvers, the rolls should be flown immediately after the half loop. A visible line in between should be downgraded by two (2) points.

2. In Half Cuban Eights and Half Reverse Cuban Eights, the roll should be placed on the middle of the line. The radius of the 1/8 loop should be the same as the 5/8 loop.

3. In Humpty-Bumps, the loop on the top must be of a reasonable size and have a constant radius. Falling forward (or tight radius) should be downgraded.

• **Heading Changes:** Any reference to maintaining the same heading on turnaround maneuvers or loops in the following maneuver descriptions should be interpreted to mean in the same vertical plane. For example, a half loop turnaround is tracking South (180 degrees) to maintain a wind corrected path with the flight line. The crab angle is 15 degrees and the actual model heading is 195 degrees (180 degrees plus 15 degrees crab). After the half loop turnaround the model must now be heading 345 degrees and tracking North (360 degrees). This keeps the model in the same vertical plane (within reason). In order to make the required heading change the model may be rolled gradually so as to bring the wings perpendicular to the flight line midway through the turnaround and further rolled to establish the correct wind correction on exit without downgrade. This gradual roll, in effect, keeps the wings level and parallel to the flight track throughout the maneuver.

● **Avalanche, Upright or Inverted:** Model pulls or pushes up into a loop, at the top it executes a complete snap roll, positive or negative, recovers to complete the loop and finishes in level upright or inverted flight. Downgrades:

1. Loop not round.
2. Changes in heading during loop.
3. Wings not level during loop.
4. Snap roll not at 360 degrees.
5. Roll not snap roll scores zero
6. Over or under rotation of the snap roll, one point per 15-Degree Rule.

Avalanche with 1-1/2 Snaps. Model performs an Avalanche, however the snap roll is replaced with one and one-half snap(540 degrees of rotation) Downgrades are the same as Avalanche except::

1. Snap roll not 540 degrees, one point per 15- Degree Rule.

Bunt, Half or Two of Four Point Roll Out.

Model pushes from level flight and executes half (1/2) outside loop, immediately followed by prescribed roll, and finishes flying straight and level exactly 180 degrees from heading at entry. Downgrades:

1. Model not level at start or finish.
2. Prescribed roll not immediately after half loop.
3. Changes in heading after half loop or prescribed roll.
4. Model heading does not finish exactly opposite direction of entry.
5. Half loop not round.
6. Over or under rotation of prescribed roll, one point per 15-Degree Rule.
7. If prescribed roll is a two of four point roll and there is no hesitation between points scores zero (0).

Cobra with or without Rolls Up and Down.

Model pulls up and executes a one-eighth (1/8) loop to a 45 degree climb, hesitates, executes the prescribed roll, hesitates, performs one-quarter (1/4) loop to a 45 degree dive, hesitates, executes the prescribed roll, hesitates, performs one-eighth (1/8) loop to recover in level flight at the same altitude as entry.

Downgrades:

1. Climb and dive not 45 degrees.
2. Prescribed rolls not centered in 45 degree climb and dive segments.

3. Over or under rotation of rolls, one point per 15-Degree Rule.

4. Changes in heading.

5. Loop segments not round with same size radius.

6. Entry and exit not at same altitude.

Cuban Eight with Rolls (Half or Full): Model pulls up and executes five-eighths (5/8) of an inside loop, when at 45 degrees model hesitates, performs the prescribed roll, hesitates, executes a three-quarters (3/4) loop (inside if half roll, outside if full roll), when at 45 degrees model hesitates, performs the prescribed roll, hesitates and recovers with one-eighths (1/8) loop to level flight. Downgrades:

1. Loop segments not round with same size and radius.

2. Model not at 45 degrees before commencement of rolls.

3. Changes in heading in loop segments or rolls.

4. Rolls not centered in the 45 degree down lines and on each other.

5. Over or under rotation of rolls, one point per 15-Degree Rule.

Double Immelmann with or without Rolls.

Model pulls up into a one-half (1/2) loop then immediately performs the prescribed roll to level upright or inverted flight, hesitates, then pushes or pulls into a second half loop to return to the entry altitude, followed immediately by the prescribed roll to recover in level, upright or inverted flight. The horizontal leg, including any required roll, should be equal to the diameter of the half loops. Downgrades:

1. Half loops not of constant and equal radius.

2. Half loops not completed exactly above or below point of commencement of half loops.

3. Rolls (if required) are executed before completion of half loops.

4. Rolls (if required) not executed immediately after completion of half loops.

5. Roll rates not constant.

6. Changes in heading during half loop, rolls, or lines.

7. Entry and exit not at same altitude.

Double Immelmann, Half Roll First, Full Roll

Second, Exit Inverted. Model pulls through one-half (1/2) loop, immediately performs one-half (1/2) roll to level flight, hesitates, pushes

through one-half (1/2) loop, then immediately performs one full roll to recover in level, inverted flight. The horizontal leg including roll should be equal to the diameter of the half loops. Downgrades:

1. Half loops not of equal and constant radius
2. Rolls not immediately after half loops
3. Changes in heading during half loops and rolls
4. Rolls are executed before model is level
5. Roll rates not constant

Double Stall Turn with Three-Quarter (3/4)

Rolls. At center, the model pulls up into a one-quarter (1/4) loop to a vertical track, hesitates, performs a three-quarter (3/4) roll in either direction, hesitates, performs a stall turn through 180 degrees to a vertical down track, hesitates, performs a three-quarter (3/4) roll in either direction, hesitates, executes a one-half (1/2) inside or outside loop to a vertical track, hesitates, performs a three-quarter (3/4) roll in either directions, hesitates, performs a stall turn through 180 degrees, hesitates, performs a three-quarter (3/4) roll in either direction, hesitates, and pulls through one-quarter (1/4) loop to exit in level upright flight on the entry heading and altitude. Downgrades:

1. Model not vertical at start and finish of rolls and stall turns.
2. Stall turns not exactly 180 degrees.
3. Model does not execute prescribed rolls.
4. Rolls not centered in vertical lines.
5. Bottom of half loop not at same altitude as entry and exit.
6. Loop segments not the same size and radius.
7. Pendulum movement after stalls.

Figure M with or without Rolls: Model pulls up into one-quarter (1/4) loop to a vertical track, hesitates then performs prescribed roll, hesitates then executes a stall turn through 180 degrees, hesitates, performs prescribed roll, hesitates then executes one-half (1/2) outside loop to vertical track, hesitates, performs prescribed roll, hesitates, executes a stall turn through 180 degrees, hesitates, performs prescribed roll, hesitates then recovers with another one-quarter (1/4) loop to level flight. Direction of rolls and stall turns are pilot's option. The length of the

vertical segments is not a judging criterion.

Downgrades:

1. Model not vertical at start and finish of rolls and stall turns.
2. Stall turns not exactly 180 degrees.
3. Model does not execute prescribed rolls.
4. Rolls not centered in vertical lines.
5. Bottom of outside half loop not at same altitude as entry and exit.
6. Loop segments not the same size and radius.
7. Pendulum movement after stalls.

Figure "N," One-Half (1/2) Rolls on Verticals, 2/4 Point Roll on the 45, Exit Inverted.

Model pulls through one-quarter (1/4) loop to a vertical track, hesitates, half rolls, hesitates, pulls through 135 degrees to a 45 degree down track, hesitates, performs two (2) points of a 4-point roll, hesitates, pulls through 135 degrees to a vertical up track, hesitates, half rolls, hesitates, and pulls through one-quarter (1/4) loop to recover in level inverted flight. Figure described is the letter "N." Downgrades:

1. Vertical segments not equal length.
2. Loop radii not equal.
3. Roll rates not equal.
4. Rolls not centered on line segments.
5. Track not 45 degrees on center line segment.
6. Maneuver not performed in vertical plane throughout.

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

● **45 Degree Up or Down line with or without rolls.** From level flight model pushes or pulls and executes a one-eighth (1/8) loop to a 45 degree climb or dive, hesitates, performs prescribed roll, performs a one-eighth (1/8) inside or outside loop to recover in level flight.

The center of this maneuver is the mid-point of the 45 degree line.

Downgrades:

1. Loop segments not round or have the same radius.
2. Climb or Dive not 45 degrees. 45 degree line not centered
3. There is no length requirement for the 45 degree line.
4. Heading changes.
5. Roll(s) not centered on line

● **45 Degree Up or Down Lines with Snap Roll elements.** Same description as the 45 degree Up/Down line except the model executes a snap roll element, on the center of the 45 degree line. These snap elements can be positive or negative, and the number of rotations may vary, but are determined by the maneuver name. Downgrades:

1. Snap not the required negative or positive orientation as stated in maneuver name scores zero (0).
2. Snap roll element not centered in climbing/diving path.
3. Snap roll not a snap scores zero (0).
4. Snap roll not the required number of rotations stated in the maneuver name, one point per 15-degree rule

45 Degree Pyramid Loop with Half Rolls Up and Down. Model passes through center and pulls 135 degrees, climbs, hesitates, executes one-half (1/2) roll, hesitates, then pushes through 90-degrees loop, hesitates then executes one-half (1/2) roll, hesitates, then pulls through 135 degrees to level flight.

Downgrades:

1. Climbing and descending paths not 45 degrees.
2. Climbing and descending paths not of equal length.
3. Half rolls not 180 degrees.
4. Rolls not centered in corresponding legs.
6. Model changes heading during loops and rolls.
7. Maneuver does not start and finish at same point.
8. Loop segments not round and of equal radius.
9. Roll rates not constant.

Full Roll, Half Outside Loop. Model rolls through 360 degrees, then immediately pushes through one-half (1/2) outside loop to recover in level inverted flight at a lower altitude than entry.

Downgrades:

1. Model not level at start or finish.
2. Half outside loop not immediately after full roll.
3. Changes in heading during full roll or half outside loop.
4. Model heading on exit not exactly opposite direction of entry.
5. Half outside loop not round.
6. Over or under rotation of full roll, one point per 15-Degree Rule.

● **Half Cuban Eight.** Model executes a five-eighths (5/8) loop, to a 45 degree dive performs a half (1/2) roll, then executes a one-eighth (1/8) loop to recover in level flight. This maneuver is modified with more complex roll elements as required by the maneuver title and schedule. In these instances the half (1/2) is replaced with the more complex roll elements as described in the maneuver title (i.e. Two Point (2/2pt) roll, Full roll, Two of Four (2/4pt) roll).

Downgrades:

1. Loop not round
2. Model not at 45 degrees before and after prescribed roll
3. Changes in heading during prescribed roll
4. Prescribed roll not on center of 45-degree line

Half Loop. Model pulls up and executes one-half (1/2) inside loop to recover in level inverted flight in the opposite direction as entry.

Downgrades:

1. Changes in heading during half loop.
2. Half loop not a constant radius.

Half Inside or Outside Loop with 1/2, 2 of 4 point roll or full roll on exit. Model pulls or pushes from upright or inverted flight and executes a 1/2 inside or outside loop immediately followed by a 1/2, 2 of 4 point or full roll and finishes flying straight and level exactly 180 degrees from heading at entry.

Downgrades:

1. Model not level at start or finish.
2. Prescribed roll not immediately after half loop.
3. Changes in heading after half loop or prescribed roll.
4. Model heading does not finish exactly opposite direction of entry.
5. Half loop not round.

6. Over or under rotation on prescribed roll, one point per 15-Degree rule.

Half Reverse Cuban Eight. Model pulls up and executes one-eighth (1/8) inside loop to 45 degrees, hesitates, does one-half (1/2) roll, hesitates, then performs five-eighths (5/8) inside or outside loop back to level flight in opposite direction as entry. This maneuver is modified with more complex roll elements as required by the maneuver title and schedule. In these instances the half (1/2) is replaced with the more complex roll elements as described in the maneuver title (i.e. Two Point (2/2pt) roll, Full roll, Two of Four (2/4pt) roll).

Downgrades:

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

• **Half Square Loop with or without Rolls (roll elements may include but are not limited to 1/2, 2/4, 4/8, Full, 2/2 up or down as determined by the maneuver title and schedule requirements):** Model executes one quarter (1/4) inside or outside loop to a vertical track, executes a prescribed roll, hesitates, then executes one-quarter (1/4) inside or outside loop to recover in level flight in the opposite direction as entry at a higher (or lower) altitude.

Downgrades:

1. Corner loop segments not of equal radius.
2. Model not vertical before and after prescribed roll.
3. Model does not execute prescribed roll.
4. Changes in heading in loop segments or during roll.
5. Roll rate not constant.
6. Up line track not vertical.
7. Hesitations in point roll required roll elements not equal length.

• **Humpty Bump with Options.** From upright or inverted flight, model executes one quarter (1/4) loop to vertical climb, hesitates, performs one half-roll, or optionally one-quarter (1/4) roll on this upline, model pushes or optionally pulls through one-half (1/2) loop to vertical down line. If the one-quarter (1/4) roll option was chosen,

the one-quarter roll is performed on the downline. The model then recovers with one-quarter (1/4) loop to level flight in the opposite direction of entry. This maneuver can have an upright or inverted entry.

Downgrades:

1. Track not vertical in climb and dive.
2. Rolls (as specified) not centered in vertical lines.
3. Over or under rotation on prescribed roll, one point per 15-Degree rule.
4. Loop segments not round with equal radius.
5. If optional cross box roll is used (1/4), (1/2) loop not 90 degrees to the flight line.

Immelmann Turn. The model starts the Immelmann flying straight and level, pulls up into one-half (1/2) loop immediately followed by one-half (1/2) roll and finishes flying straight and level exactly 180 degrees from the heading at entry. Downgrades:

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

Inside Loops (any number). Model pulls up and executes prescribed number of 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.

Inside-Outside Diamond Eight with 1/1, Full Rolls, on center 45s.

Model passes through center and pulls one eighth (1/8) loop to 45-degree up line, draws

another straight line then pulls quarter (1/4) loop, draws straight line and pulls one quarter loop (1/4). Model hesitates and performs one roll (1/1), hesitates and pushes one quarter loop (1/4) to 45-degree up line, draws line and then pushes one quarter loop (1/4), draws straight line, pushes one quarter loop (1/4), hesitates and performs one roll (1/1), hesitates pulls one-eighth loop (1/8) to level flight.

Downgrades:

1. Lines not 45 degrees
2. Changes in heading in loop segments or rolls.
3. Rolls not centered in the center 45-degree down lines
4. Over or under rotation of rolls, one point per 15-Degree Rule.
5. Loops not square.
6. Loops not equal in size
7. Lines of square components not same size.
8. Changes in headings.
9. Wings not level.
10. Corner loops not of equal radius.
11. 1/1 rolls not centered on lines.
12. Roll rates not constant.
13. Loops not same height or base.

• **Inverted Four Point Roll.** Same judging criteria as Four Point Roll, except model enters and exits inverted. Center of the maneuver is the middle of upright flight on the second hesitation.

• **Landing.** The landing maneuver will be scored in half point increments from 10 to 0. The maneuver will start two (2) meters from the ground. The model flares smoothly to a nose high altitude, dissipating flying speed, and then smoothly touches the ground, within the landing zone. The maneuver should be considered complete once the plane has slowed below flying speed and rolled 10 meters or comes to a stop and no further downgrades shall be applied after that point.

The landing zone shall be marked by lines placed perpendicular across the runway and spaced 30 meters apart. The width of the landing zone is normally the width of the runway but in no case shall exceed 30 meters. Landing is not a centered maneuver and there is no downgrade for displacement of the touchdown point left or right from center as long as the landing is in the landing zone. If the touchdown is within the runway but not in the landing zone it should be

downgraded proportionate to the distance outside the landing zone. The Contest Director may designate any landing zone appropriate to the field if safety considerations dictate. If the landing zone is anything other than standard it should be thoroughly discussed with the pilots and judges before flying is started and no downgrade shall be applied due to the touchdown in the non-standard landing zone.

The landing will not be downgraded if:

1. Wing dips which are caused by air turbulence unless they are not immediately corrected.
2. The pilot “slips to a landing” to handle a crosswind condition in which case a wing will be low.
3. The model rolls to a controlled stop within 10 meters.

Downgrades:

1. Model passes behind the judges line, zero (0) points.
2. Model impacts the runway due to lack of flare.
3. Model bounces.
4. Changes in track.
5. Model ends on its back, zero (0) points.
6. Model lands outside landing zone.
7. If any undercarriage retracts before the landing is complete, zero (0) points.
8. Aircraft “porpoises” and/or wanders during approach or flare.
9. Aircraft lands outside the landing area or runway, zero (0) points.
10. Aircraft touches down while not straight to runway and ground track.

Mid-entry Figure Nine, Pull 3/4 Loop First, 1/2 Roll Down. Model pulls 3/4 loop, hesitates, performs 1/2 roll on down line, hesitates pulls 1/4 loop. (Note loop entry point does not have to dissect down line.)

Downgrades:

1. Loop components not round.
2. Radii of loop components not equal.
3. Half (1/2) roll not centered on down line.

One (1) Horizontal Roll. Model rolls at a uniform rate through one (1) complete revolution in either direction. Center is inverted portion of maneuver.

Downgrades:

1. Changes in heading during roll.
2. Changes in altitude during roll.
3. Roll rate not constant.

4. Model does not perform exactly one roll, one point per 15-Degree Rule.

Outside Immelmann Turn. From straight, inverted flight, model pushes through one-half (1/2) outside loop, then immediately executes one-half (1/2) roll to recover in level, inverted flight exactly 180 degrees from the heading at entry.

Downgrades:

1. Model not level at start or finish.
2. Half roll not immediately after half outside loop.
3. Half roll not completed exactly above point of commencement of half loop.
4. Changes in heading during half outside loop or half roll.
5. Model heading on exit not exactly opposite direction of entry.
6. Half outside loop not round.
7. Over or under rotation of half roll, one point per 15-Degree Rule.

One Outside Loop from the Top. Model pushes and completes One Outside Loop, finishing in level flight at the same altitude as entry.

Downgrades:

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

Outside Square Loop from Top with 1/2 Rolls in First and Third Legs. Model pushes through one quarter (1/4) loop and executes outside square loop with corner segments of equal radius. In each vertical leg, model hesitates, performs one-half (1/2) roll, and hesitates again before performing the next loop segment. Rolls should be centered in vertical legs. Roll rate should be constant throughout maneuver.

Downgrades:

1. Loop not square.
2. Rolls not 180 degrees, one point per 15-Degree Rule.
3. Wings not level during one-quarter loops.
4. Changes in heading during rolls and loops.
5. Sides of square not of equal length.
6. Corner loops not of equal radius.

7. Roll rates not constant.

Pull-Push-Pull Humpty Bump, One-Half (1/2) Roll Down, 2/4 Up. From level, inverted flight, the model pulls through one-quarter (1/4) loop to a vertical down track, hesitates, half rolls, hesitates, pushes through a half outside loop to a vertical track, hesitates, performs two (2) points of a four (4) point roll, hesitates, and pulls through one-quarter (1/4) loop to exit in level, inverted flight on the entry heading and altitude. Downgrades:

1. Track not vertical at beginning and end of half roll and 2/4 point roll.
2. Radius of half inside loop not constant.
3. Radii of loop segments not equal.
4. Over or under rotation of rolls, one point per 15-Degree Rule.

Pull-Push-Pull Humpty Bump with One-Quarter (1/4) Rolls. Model pulls through one-quarter (1/4) loop to a vertical track, hesitates, quarter rolls in either direction, hesitates, pushes through a half outside loop to a vertical down track, hesitates, quarter rolls in the opposite direction from the entry roll, hesitates, and pulls through one-quarter (1/4) loop to recover in level upright flight on a heading opposite that of entry. Downgrades:

1. Model not vertical at start and finish of 1/4 rolls.
2. 1/4 rolls not exactly 90 degrees.
3. Rolls not centered on line segments.
4. Loop segments not round with same size and radius.

Pull-Push-Push Humpty Bump, Half Roll Down, Full Roll Up. From straight, inverted flight, model pulls through one-quarter (1/4) loop to a vertical down line, hesitates, executes one-half (1/2) roll, hesitates, pushes through one-half (1/2) outside loop to a vertical up line, hesitates, executes a full roll, hesitates, then pushes through one-quarter (1/4) outside loop to recover in level, upright flight. Downgrades:

1. Track not vertical at beginning and end of half and full rolls.
2. Loop segments not round and of equal radius.
3. Over or under rotation of rolls, one point per 15-Degree Rule.
4. Final one-quarter loop does not end at the same point first one-quarter loop began.
5. Roll rates not constant.

Push-Pull-Pull Humpty Bump. Model pushes to a vertical climb, performs any required rolls per the maneuver name, pulls a half loop to a vertical dive, performs any roll elements as required by the maneuver name, then pulls to recover in level, upright flight.

Downgrades:

1. Track of up and down line not vertical.
2. Loop segments not round and of equal radius.
3. Changes in heading during loop segments or lines.
4. Roll elements, if required, not centered in vertical lines.

Push-Pull-Push Humpty Bump, Half Roll

Down. Model pushes through one-quarter (1/4) outside loop to a vertical track, hesitates, pulls through one-half (1/2) inside loop to a vertical down line, hesitates, performs one-half (1/2) roll, hesitates, then pushes through one-quarter (1/4) loop to recover in level, inverted flight.

Downgrades:

1. Track of up line or down line not vertical.
2. Loop segments not round and of equal radius.
3. Over or under rotation of 1/2 roll, one point per 15-Degree Rule.
4. Half roll not centered in vertical line.

Quarter, Half, Quarter Roll. Model rolls through 360 degrees, in the same direction, hesitating at 90 degrees and 270 degrees. At each hesitation wings are perpendicular to the horizon. Center is when wings are level and model is inverted. Downgrades:

1. Model does not hesitate at 90 and 270 degrees of rotation.
2. Wings not perpendicular to horizon at hesitation.
3. Roll rate not constant.
4. Changes in heading.
5. Changes in altitude.

Reverse Avalanche with 1 Positive Snap at

Bottom. Model pulls down into a loop. At the bottom it executes One positive snap roll, recovers to complete the loop and finishes at top to level inverted flight.

Downgrades:

1. Loop not round.
2. Changes in heading during loop.
3. Wings not level during loop.
4. Snap roll not 360 degrees, one point per 15-Degree Rule.

5. Roll not snap roll scores zero 0).

• **Reverse Cuban Eight:** Model executes a one-eighth (1/8) loop to a 45 degree line. On this line the model performs the required roll elements, followed by three-quarter (3/4) loop to a 45 degree line. On this line the model performs the required roll elements, then recovers with five-eighths (5/8) loop to level flight. Note: The roll elements are defined in the maneuver name. If the name does not specify different roll elements on the 45 degree line the roll elements will be the same type. (i.e. Reverse Cuban Eight with 1/2 rolls indicates Half (1/2) rolls on both 45 degree legs). Different roll elements will be designated as such in the maneuver name (i.e. Reverse Cuban 8, 4/8pt. Roll first, 2/2pt Roll second) The loop elements are either inside or outside as required to meet orientation needs of the schedule. Center of this maneuver is the crossover of the two 45 degree legs.

Downgrades:

1. Loop segments not round and of equal radius
2. Model not at 45 degrees at start and finish of rolls
3. Changes in heading
4. Roll elements (if any) not centered on 45 degree lines
5. Under or over rotation of roll elements, one point per 15-Degree Rule
6. Hesitations on point roll elements (if required) not equal

• **Reverse Golf Ball from top, with 1/2 rolls:**

Model pushes through one eighth (1/8) outside loop to a 45 degree dive, on this 45 degree dive model performs a half (1/2) roll, then pulls three quarters (3/4) inside loop to a 45 degree climb, on this 45 degree climb the performs a half (1/2) roll, then pushes one eighth (1/8) outside loop to recover in upright straight flight at the same altitude. Center of this maneuver is the middle crossover of the 45 degree lines.

Downgrades:

1. Loop segments not round and of equal radius
2. Model not at 45 degrees at start and finish of rolls
3. Changes in heading
4. Roll elements not centered on 45-degree lines
5. Under or over rotation of roll elements, one point per 15-degree rule

Reverse Knife Edge. Model rolls 90 degrees and hesitates, then rolls 180 degrees in opposite direction and hesitates, then rolls 90 degrees to finish in level flight. Downgrades:

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

Shark's Tooth, Half Roll on 45. Model quarter loops to a vertical track, hesitates, loops through 135 degrees to an inverted 45-degree down track, hesitates, half rolls, hesitates, and pulls up to recover in level upright flight on a heading opposite that of entry. Downgrades:

1. Ascending line segment track not exactly vertical.
2. Loop radii not equal.
3. Half roll not centered on 45-degree line segment.
4. Descending line segment track not 45 degrees.

• **Reverse Shark's Tooth, Half Roll on 45 up line.** From Straight and level upright Flight model performs one-eighth (1/8) inside loop to a 45 degree climb, performs one-half (1/2) roll, pulls three-eighths (3/8) inside loop to vertical dive, hesitates, pulls one-quarter (1/4) inside loop to recover in level upright flight in the opposite direction.

Downgrades:

1. Loop segments not round or have the same radius
2. Climbing path not 45 degrees
3. Vertical diving path not vertical
4. Model changes heading
5. Half roll not exactly 180 degrees of roll
6. Roll not centered on 45 degree line

Six of Four Point Roll, Exit Inverted. From level upright flight, model rolls through 540 degrees, hesitating at each 90-degree point; at each hesitation, wings are parallel or vertical to the horizon. Recovery is in level, inverted flight. Center is the middle of knife-edge flight between the third and fourth point. Downgrades:

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

• **Six Sided, outside loop.** From Straight and level flight model pushes to complete a six sided outside loop. Each angle of the six sided Loop is 60 degrees.

Downgrades:

1. Loop segments not round or have the same radius

2. Climbing and descending paths not 60 degrees
3. Model changes heading
4. Model does not start and finish the loop at the same point
5. All six sides of the loop not same length

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

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

• **Spin, any Number of Rotations, Upright or Inverted.** Model performs the required number of rotations and stops with the wings perpendicular to the flight line. If required, one-half (1/2) roll is performed after a slight hesitation to return to upright flight. Stall is the center of the maneuver and should occur directly over the center pole for Center Box presentation.

Downgrades:

1. Model climbs or dives during entry or exit, one point per 15-Degree Rule. Entry ends with the stall and exit begins at completion of one-quarter (1/4) loop recovery to level flight.
2. Wings not level during entry or exit.
3. Wings not perpendicular to flight line at end of required number of turns, one point per 15-Degree Rule.
4. Spiral dive or pure rotation around roll axis of more than one-half (1/2) turn - zero (0).
5. Tail of model does not describe a cone during rotation - zero (0).
6. Wing passes through vertical plane before nose passes through horizontal plane (snap roll entry) - zero.
7. Fuselage reaches a vertical attitude before rotation begins (simulation of stall by application of elevator) - zero (0).
8. See Description of Maneuvers (Spins) for additional criteria.

Split "S." Model performs one-half (1/2) roll in level light then immediately executes one-half inside loop to level flight in opposite direction as entry.

Downgrades:

1. Half roll not 180 degrees.
2. Half loop not started immediately after half roll.
3. Half loop not constant radius.
4. Changes in heading.
5. One-half (1/2) roll not in level flight.
6. Model heading does not finish exactly opposite the direction of entry.

• **Split S with 2/4pt roll.** Model performs the same elements as the Split “S” except the model performs a 2 of 4 point roll in place of the ½ roll. Downgrades:

1. Same as Split S
2. One-quarter 1/4 rolls more or less than 90 degrees; downgrade on one point per 15 degree rule.

• **Square Horizontal Eight:** Model pulls up and commences a square loop, when at the bottom of the first vertical downline the model completes a square outside loop behind the inside loop before pulling up to level flight after the second vertical downline. A Square Horizontal Eight with Inverted entry is the same as above with the exception that the first square loop is an outside square loop and all corners are opposite orientation due to the inverted entry. Downgrades:

1. Loops not square.
2. Vertical downward paths do not coincide or are not centered.
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.
8. Corner loops not of equal radius.

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

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

Square Loop on Corner with Two Half Rolls.

Model pulls through one-eighth (1/8) loop to a 45-degree climb and completes a square loop. Model executes a half roll in the first and third legs. Downgrades:

1. All sides not at 45 degrees to horizon.
2. Loop not square with sides of equal length.

3. Loop segments not round and of equal radius.
4. Half rolls not 180 degrees.
5. Wings not level during one-quarter loops.
6. Changes in heading during rolls and loops.
7. Rolls not centered in legs.
8. Rolls not in first and third legs score zero (0).
9. Roll rates not constant.

Square Loop with 2/4 Point Rolls on all Sides.

First 2/4 on Up Line Square Loop. Model passes through center and pulls through one-quarter (1/4) loop and executes square loop with corner segments of equal radius. In each leg, model hesitates, performs a 2 of 4 point roll, hesitates again before performing the next loop segment.

Downgrades:

1. Loop not square. Point rolls not 90 degrees, one point per 15- Degree Rule.
2. Wings not level during one-quarter loops.
3. Changes in heading during rolls and loops.
4. Sides of square not of equal length.
5. Corner loops not of equal radius.
6. Roll rates not constant.

Stall Turn With or Without Roll(s): Model executes one-quarter (1/4) loop to a vertical track, performs a stall turn through 180 degrees, then recovers with another one-quarter (1/4) loop to level flight in the same or opposite direction. Model may perform no rolls or multiple combinations of roll elements to include but not limited to: half (1/2) rolls, Full rolls, Multiple rolls (i.e. 1-1/4 or 1-3/4 rolls) or any partial or complete quarter point (1/4, 2/4pt, 3/4pt, 4pt) roll, or any partial or complete eighth point (1/8th, 2/8pt, 4/8pt etc...)rolls on the up and down vertical legs of the maneuver. The maneuver name will determine the required roll elements. This maneuver may also switch upright or inverted orientation as required by the schedule and the maneuver name.

Downgrades:

1. Model not level at start and finish.
2. Track does not become exactly vertical.
3. Model track not vertical at start and finish of rolls and stall turn.

4. Return path not parallel to entry path.
5. Exit not same altitude as entry on Center Box stalls only.
6. Pivot radius greater than 1/2 wingspan.
7. Pendulum movement after stall.
8. Loop segments not round with same size and radius.
9. When maneuver includes roll elements the roll rates not equal.

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

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

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 turnaround maneuver. (Distance does not have to be accurate.)

Downgrades:

1. Plane deviates left or right.
2. Does not hold constant altitude.
3. Gallops in yaw, roll, or pitch.

Straight Inverted Flight. Model performs one-half (1/2) roll to inverted and flies straight and level inverted for a minimum of four (4) seconds, then performs one-half (1/2) roll back to level flight. Half rolls may be in either direction.

Downgrades:

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

Takeoff: The takeoff maneuver will be scored in half point increments from 10 to 0. The model smoothly, not suddenly, accelerates to takeoff speed. When flying speed is reached it gently lifts off the ground and climbs at a gradual angle. The lift off should be within two (2) meters of center for maximum points. The aircraft must not deviate in track during takeoff but may change heading after lift off to maintain a straight track with the takeoff roll. The maneuver is complete when the model is

approximately two (2) meters (6-1/2 feet) from the ground.

It is not necessary for the model to stand still on the ground with the engine running without being held before the takeoff begins. It is also not necessary for the model to reach 2 meters in the same distance as the takeoff role. The takeoff should not be downgraded for wing dips caused by air turbulence unless the wings are not immediately leveled.

Downgrades:

1. Model jumps from the ground.
2. Retouches the ground after becoming airborne.
3. Steep climb angle.
4. Gallops in elevation during climb.
5. Wings not level at any time.
6. Throttle not smoothly accelerated.
7. Model passes behind the judges line, scored zero (0) points.

Top Hat with One Quarter (1/4) Rolls, Upright or Inverted Entry or Exit: Model executes one-quarter (1/4) loop to a vertical track, hesitates, one-quarter (1/4) rolls left or right, hesitates, executes one quarter (1/4) loop to level inverted flight, hesitates, pulls down through one-quarter (1/4) loop, hesitates, one-quarter (1/4) rolls left or right, hesitates, then pulls (upright exit) or pushes (inverted exit) through one-quarter (1/4) loop to recover in level upright or inverted flight in the opposite direction as entry. 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 and at 90 degrees to the flight line.
4. Rolls not centered on line segments.
5. Loop segments not round with same size and radius.

Top Hat with 3 of 4 Point Roll or three-quarter (3/4) Roll up, Upright or Inverted. Model pulls through one-quarter (1/4) loop to a vertical track, hesitates performs the prescribed roll, hesitates, pulls through one-quarter (1/4) loop to level, inverted flight, hesitates, pulls through one quarter (1/4) loop to a down line, hesitates, performs one-quarter (1/4) roll, hesitates, then pulls (upright exit) or pushes (inverted exit) through one-quarter (1/4) loop to recover in level upright or inverted flight.

Downgrades

1. Model not vertical at start and finish of rolls

2. Over or under rotation on prescribed roll, one point per 15-Degree rule
3. Model does not fly straight and level inverted and 90 degrees to the fight line.
4. Rolls not entered on line segments.
5. Roll rates not constant.
6. No hesitation between 3 of 4 point rolls.
7. Loop segments not round and of equal radius.
8. Hesitations at each defined point of rotation not equal.

• **Top Hat with ½ rolls.** From Straight and Level Upright Flight model performs one-quarter (1/4) inside loop to vertical climb, performs one-half (1/2) roll in vertical, pulls one-quarter (1/4) inside loop to level inverted flight, model passes through center, pulls one-quarter (1/4) inside loop to a vertical dive, performs one-half (½ roll), pulls one-quarter (1/4) inside loop to recover in level upright flight. Top Horizontal line must be inverted.

Downgrades:

1. Loop segments must be round and have the same radius.
2. Climbing and descending paths not vertical
3. Model changes heading
4. Half rolls in vertical not exactly 180 degrees of roll
5. Rolls not centered in vertical lines
All three legs of top must be the same length

• **Non-Rolling Triangle Loop.** Model pulls through one-eighth (1/8) loop to a 45 degree climb, hesitates, pulls through three-eighths (3/8) loop to level, inverted flight, pauses, pulls through three-eighths (3/8) loop to a 45 degree dive, pauses, then pulls through one-eighth (1/8) loop to recover in level flight at the same altitude as entry. Downgrades:

1. Climbing and diving paths not 45 degrees.
2. Climbing and diving paths not of equal length.
3. Loop segments not round and of equal size and radius.
4. Wings not level during loop.
5. Changes in altitude during inverted flight.
6. Changes in heading during loop.

• **Triangle Rolling/Snap Loops.** Model performs the same geometry of the Non-rolling

Triangle loop with rolling elements, or snap roll elements added to the line segments. This figure must meet the same geometric criteria with the addition of the rolling elements. The maneuver name will determine where the rolls are placed. If the rolls are not specified on the 45 degree elements then the roll/snap roll elements are performed on the top horizontal line. All rolls must be centered on the lines designated in the maneuver name. Entry, and exit orientation (upright or inverted) is determined by the specific maneuver, and dictated by the rolling elements. The orientation of the loop elements (positive or negative) is also determined by the required rolls. Downgrades:

1. Rolls not centered on lines.
2. Rolls not the required type or number of rotations based on the maneuver name.
3. Snap rolls if required not a snap scores (0). See Description of Maneuvers for snap roll criteria.

Two (2) Horizontal Rolls. Model rolls at a uniform rate through two (2) complete revolutions in either direction. Center is that point when the airplane is upright between the rolls.

Downgrades:

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

Two (2) Point Roll. Model performs one-half (1/2) roll to level, inverted flight, pauses, then performs another one-half (1/2) roll in the same direction to level, upright flight. Center of maneuver is middle of inverted hesitation.

Length of inverted hesitation is not a reason for downgrade as long as it exists. Downgrades:

1. Model does not hesitate at inverted.
2. Roll rate not constant.
3. Over or under rotation of rolls, one point per 15-Degree Rule.
4. Change is altitude.
5. Changes in heading.
6. Roll rates not constant.

Two (2) Half Rolls in Opposite Directions, Pause in Center. Model rolls 180 degrees to level, inverted flight, pauses, and then rolls 180 degrees in the opposite direction to recover in level flight. Center of maneuver is middle of inverted hesitation. Downgrades:

1. Over or under rotation of rolls, one point per 15-Degree Rule.
2. Changes in heading or altitude.
3. Roll rate not constant.
4. Model does not hesitate at inverted.

• **Two (2), Two of Four (2/4pt) Point Rolls Reversed.** From inverted flight. Model rolls through 180 degrees, hesitating at each 90 degree point. Then rolls through 180 degrees in the opposite direction hesitating at each 90 degree point. At each hesitation wings are parallel or vertical to the horizon. Center is middle of upright flight.

Downgrades:

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

• **Two point (2/2pt) roll – slow roll reversed.** Model performs a two point (2/2pt) roll, immediately performs a slow roll in the opposite direction. See descriptions of two point roll and slow roll for requirements and downgrades for all elements except centering. Roll rates need not be the same for the two point (2/2pt) and the slow roll.

Downgrades:

1. Centering. The center of the maneuver is determined as the middle of combined roll elements. Center is determined by the midpoint between the start of the two point (2/2pt) roll and finish of the slow roll.
2. Roll reversal not immediate

• **Vertical Up line (on Center).** From level upright flight model Pulls and executes a one-quarter (1/4) inside loop to a Vertical flight path, hesitates, performs a one-quarter (1/4) outside loop to recover in upright level flight at a higher altitude. The vertical line is center of the maneuver.

Downgrades:

1. Both one-quarter loop segments must be round and have the same radius.
2. Vertical flight path not vertical
3. Vertical line offset right or left of center
4. There is no length requirement for the Vertical Line
5. Heading changes

Vertical Square Eight from the Middle, Pilot's Option. Model passes through center and

pulls or pushes to commence a square loop. When first square loop is complete the model passes through center again and performs a second square loop exactly below or above, opposite to the first loop. 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 both squares not same size.
8. Corner loops not of equal radius.