Radio Control Aerobatics

2020-2021

RULES GOVERNING MODEL AVIATION COMPETITION IN THE UNITED STATES

Amendment Listing

Amendment Topic	Publication Date	Description
Original Issue	1/1/2015	Publication of Competition Regulations
RCA 13-1 URG Lowe	4/23/2013	4.4 Equipment Functions
Rules cycle change	1/1/2014	Added 1 year to current regulations version to match FAI rules cycle beginning in 2015
Remove dates for Issue	7/1/2014	Regulations will no longer have date, but will have all amendments listed as changes are made
Identification	1/1/2016	4.7 Changed to follow the General Section of Competition Regulations
Scores and Placement	1/1/2016	13.3 Delete last sentence
Move to lower class	1/1/2016	8.1.2 Added section to allow selection of any class if they have not competed for 7 years
Pattern Event Classes change	1/1/2016	7. Requirements for changing of sequences
Inclement weather	1/1/2016	13.3 Inclement weather paragraph removed

Safety	1/1/2016	6.9 Added paragraph concerning electric models
Equipment Functions	1/1/2016	4.4 Section re-written
Fail Safe	1/1/2016	6.10 Fail Safe
Frequency Control	1/1/2016	17.2 Frequency Control re-written
Weighing Aircraft	1/1/2016	4.3 50 gram tolerance
Weight Limit	1/1/2018	4.3 changed to no weight limit for Sportsman and Intermediate classes
Contestant Classification	1/1/2018	8.0 Contestant Classification based on 1st contest of the year
Use of TBL at contests	1/1/2018	13. Determining the Winner
Changes in the Matrix System	1/1/2018	13.3 The Matrix System
Change in Pattern Event Classes	1/1/2018	7. Pattern Event Classes
Change Judging Individual maneuvers	1/1/2020	Section D, last paragraph
Rounds counted to determine contest results	1/1/2020	13.1 Determining the winner

Downgrades on Immelmann and Bunt	1/1/2020	Judges Guide – Paragraph E Description of Maneuvers– Loop/Roll Combinations- 1
Propulsion source limitations	1/1/2020	Section 4.1

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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, 407.

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 the 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

Failure to comply with the following could result in disqualification of the contestant’s plane by the Contest Director (CD).

4.1. Propulsion source limitations

Any suitable propulsion source may be used except those requiring solid expendable propellants, gaseous fuels (at room temperature and atmospheric pressure) or liquefied gaseous fuels. Electrically-powered model aircraft are limited to a maximum of 45.0 volts for the propulsion circuit, measured prior to flight while the competitor is in the ready box. A tolerance of 1% will be allowed for possible inconsistencies in measurement instruments and measurement operator error for battery voltage. A CD may waive all or some of the requirements for voltage measurement if not practical.

If voltage measurement is being enforced, random checks may be conducted at any time during the contest. If a model fails to meet the requirements, the contestant's flight is zeroed. In this case, the contestant may be subject to the measurement test for every remaining contest round at the CDs discretion.

If an enforced event utilizes a Preliminary and Finals format, a contestant's model that qualifies for the Finals must be checked before the first Finals round prior to a flight while the contestant is in the ready box. If a model fails to meet the requirements, the contestant's flight is zeroed. In this case, the contestant is subject to the measurement test for every remaining Finals round. All other contestants may be subject to random measurement tests for the remainder of the Finals rounds.

4.2. Noise Limit

Each internal combustion engine shall be equipped with an effective silencer. The maximum noise level for all AMA classes shall be 96 decibels measured at three (3) meters from the centerline of the model. All measurements will be taken perpendicular to the fuselage centerline from the right hand side of the model. The nose of the model will be pointed directly into the wind and the microphone will 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 the model or microphone. The measurement will be made while the throttle is at full power. If the noise level is exceeded during the test the contestant will be allowed to fly the flight. Immediately after the flight the model will be tested again. The model may be refueled if necessary. If the model again exceeds the noise limit 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 CD or Event Director (ED) shall have the option of deleting the noise level requirement at any sanctioned event. The CD or ED will be responsible for the calibration of the equipment used during the contest.

At any contest that will enforce the noise limits, all contestants must have access to the equipment to check their models prior to the start of the event. If this cannot be done then the noise limits will not be enforced

4.3. Weight and Size

In Sportsman and Intermediate Classes, there is no weight limit, the 2 meter wingspan and total length limits are in effect for all classes.

For all other class, no model may weigh more than 5000 grams gross, excluding fuel, ready for takeoff. Electric models are weighed with batteries. In Advanced an allowance of 115 grams is permitted. No model may have a wingspan or total length longer than two (2) meters (78.74 inches).

Wherever practical, all aircraft should be weighed prior to the start of the contest. If weight is being enforced then all planes competing in that class must be weighed before the same round (round 1 or otherwise) for a baseline. Only two attempts at making weight will be allowed on the day specified for weigh-in. A tolerance of 50 grams will be allowed for possible inaccuracies in the measurement instrument. Random checks may be conducted at any time during the contest. An aircraft that has been damaged and repaired during the contest, after the initial weigh-in has been made, is subject to being reweighed. Repaired models failing the weight and/or size limits shall be disqualified for competition but recorded scores with the legal aircraft will stand. Aircraft qualifying for a Final shall be weighed and size-checked prior to the commencement of the Finals and may be checked again at any time during the Finals at the discretion of the CD/ED. Only one attempt at making weight will be allowed for a Finals weigh-in prior to the commencement of the Finals. In the event that the disqualification occurs amongst the Finalists at the Nationals, the next highest competitor shall be allowed to replace the disqualified competitor in the Finals. In the event that more than one or more Finals rounds have been flown at the time of a disqualification, no additional pilot will be invited to replace the disqualified contestant. Models shall be weighed in a manner that does not cause damage to the aircraft.

4.4. Equipment Functions

There are no limitations to the type of control equipment or to the number of control functions. Limitations of other functions are as outlined. As used below, telemetry is defined as a RF communication link that passes data from a model to a receiver on the ground

4.4.1.
Telemetry that is communicated to the pilot or their caller will only be permitted in competition for the purpose of model safety. Any telemetry communicated to the pilot or their caller for a competitive advantage is not allowed during competition. Telemetry data shall not be used as a basis to request a re-flight.

Examples of telemetry that can be communicated to the pilot or caller:

1. Receiver power supply voltage.

2. Total fuel or motor battery voltage or capacity consumed/remaining.

3. Radio link status or fail-safe activation.

Examples of telemetry that cannot be communicated to the pilot or caller:

1. Airspeed, altitude or attitude data.

2. Position data such as GPS.

3. Power plant data such as RPM limits, throttle setting, current draw, etc.

4.4.2.
The intent of this section is that the pilot must initiate all input commands to the aircraft. Use of autopilot control or aircraft axis stabilization during competition is prohibited. Automatic control sequencing either in the transmitter or the model is prohibited. Any equipment containing such abilities must have them disabled during competition and are subject to spot-checking by the CD.

Examples of control functions allowed:

1. Control surface throws or power plant limits that are changed by the pilot.

2. Any control that is initiated and terminated by the pilot using any sort of transmitter control such as transmitter switches or sticks, accelerometers in the transmitter or voice commands.

3. Programmable mixes either in the transmitter or the aircraft systems. Any form of manual input by the pilot can adjust these mixes.

4. Power plant management such as mixture control or systems that normalize the power delivered to a motor over time.

5. Timed functions that delay or transition a single command.

Examples of control functions not allowed:

1. Preprogramming that will automatically perform a series of commands based on a timeline.

2. Automatic leveling or electronic stabilization in any axis.

3. Power plant management systems that adjust power with regards to model performance, position or attitude.

4. Positioning systems utilizing any sensors such as air data, GPS, distance, etc.

5. Learning functions involving maneuver-to-maneuver or flight-to-flight analysis.

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 per AMA Competition Regulations General Information All Categories, General section, paragraph 4 Identification.

4.7.1.
Borrowed or shared aircraft shall carry temporary identification, as shall repaired aircraft if deemed necessary by the CD. 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 contestant 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 contestant 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. Failure to comply with the following could result in disqualification of the contestant's plane by the CD.

6.1.

The CD 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 CDs opinion is deemed unsafe.

6.2.

The "flightline" 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 contestant shall be ordered to land the plane. Continued flying behind the flight line shall result in disqualification of the contestant by the CD.

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 contestants shall remain in the pilot box while flying and in particular shall stay off the runway and/or landing area. The contestant 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.

6.7.

The maximum sustained winds during a pattern contest shall be 30 knots. The CD 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 CD 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.

6.9.

At no time will a model be left unrestrained or unattended while running or with the electric motor power circuit(s) physically connected unless the model is on the runway. If maintenance or testing needs to be done and the model must be running or have the electric motor power circuit(s) physically connected, this must be done in an area designated by the CD, be physically restrained, and must be attended at all times. First infraction of this rule will result in a warning. Second infraction will result in loss of the highest round. Subsequent infractions will result in loss of the highest round remaining and, at the CD's discretion, disqualification of the pilot.

6.10.

All models that have the capability of Fail Safe in the radio shall have the throttle set to Fail Safe in a way that the motor/engine comes to a complete stop or a minimum idle if it were to lose signal from the transmitter. The CD may spot check the Fail Safe function at any given time during the contest.

7. Pattern event classes

The outdoor Radio Control Aerobatics event shall be divided into five (5) classes. The first four (4) classes 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. 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.

The Indoor Radio Control Aerobatics event shall be divided into three (3) classes. The first two (2) classes shall (in order of increasing difficulty) be referred to as Sportsman and Intermediate. The maneuver schedules and definitions for the two classes will be developed and published by the NSRCA in a similar manner to the standard outdoor pattern schedules. The third class shall be referred to as F3P (407). The indoor aerobatics classes will follow all the rules and guidelines of the current F3P Radio Controlled Aerobatics rules that are published by the FAI and CIAM. 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 - F3P events.

8. Contestant classification

The contestant's first contest of the calendar year will establish the contestant's competition class for that year. This class may be one class lower than his or her class from the previous year or may be any higher class relative to their class from the previous year. A contestant who has not previously flown in a competition may select any class as their class. Contestants may enter their current AMA class or the FaiF3A class at any contest but not both. The class advancement sequence is Sportsman, Intermediate, Advanced, and Masters. A contestant may voluntarily move to any higher class at any time but must remain in that higher lass at least until the contestant's first contest of the following calendar year. If the contestant's declared class is not offered at a contest or that contestant is the only entrant in a class, that contestant has the option to fly in any higher class for that contest and then resume the declared class thereafter.

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 contestant 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 contestant 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 contestant is entitled to one (1) attempt for each official flight. The CD shall have sole discretionary authority to grant a single repeat attempt if for some unforeseen reason beyond control of the contestant, the model fails to become airborne (i.e., safety delay due to other aircraft traffic, weather or etc.). If the flight is interrupted by an unforeseen reason beyond control of the contestant (i.e. sudden deteriorating weather or air traffic but excluding any mechanical failure of the aircraft) the competitor is entitled to a re-flight with only the remaining unscored maneuvers being scored. The re-flight must occur by the end of the current round and the result of the re-flight will be final.

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/she 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 contestants 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.

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

Score y=points awarded to the contestant

Sy=raw score of the contestant

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/she 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. The ED may elect to use Tarasov-Bauer-Long (TBS) statistical averaging scoring system for any class assuming there are at least 5 competitors and 5 judges.

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 CD, 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; the highest total of the best four (4) flight scores when five (5), or six (6) rounds are flown; the highest total of the best five (5) flight scores when seven (7) rounds are flown; and the highest total of the best six (6) flight scores when eight 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 judge 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 contestants 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.

Pilot Groups and Seeding: The contestants shall be grouped by seeding the top 16 contestants using their finishing positions at prior year's Nationals, irrespective of class. The ED shall determine the seeding using this, and any other means they deem appropriate. The final seeding is ultimately subject to the EDs discretion. The seeding of the contestants shall be published and made available upon request no later than the end of the Pilot's Meeting held the day prior to the start of competition.

Each pilot group shall be populated as follows:

Pilot Group A: Seed #1, Seed #8, Seed #9, Seed #16.

Pilot Group B: Seed #2, Seed #7, Seed #10, Seed #15.

Pilot Group C: Seed #3, Seed #6, Seed #11, Seed #14.

Pilot Group D: Seed #4, Seed #5, Seed #12, Seed #13.

The remaining contestants shall be evenly divided among each group, keeping the total number of contestants in each group as even as possible.

The explanation, construction and scoring instructions for the Matrix system are in 13.3. Where possible and practical, each contestant will fly 6 matrix rounds. 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. 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 contestants 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 contestants while using 2 sites and 4 flight lines.

Matrix Construction:

A simple matrix can be constructed using 4 groups.

2 Sites with 2 flight lines each equals 4 flight groups.

Flight Groups:

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

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

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

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

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

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

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

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

Flight Orders:

Flight orders are created from the flight groups. The flight orders are rotated to avoid having the same contestant 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 (C) 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 (C) moves to Line (A). When flying resumes Group (C) will complete Round #1 and Group (A) will complete Round #2. The result is group A and C have all flown round #1 and Round #2 in front of the same set of judges.

Determining Finalists: 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 from Round #1 on Site #1, those normalized scores will determine where each contestant ranked in numerical order from 1 through however many contestants flew in front of that set of judges. The same procedure of normalizing scores and ranking contestants will be used for Round #2 on Site #1. Each contestant will keep his/her single best ranking (1, 2, 3, etc) score from those two rounds. The same procedure will occur on Site 3 for their Rounds #1 and #2. At the end of Day 1, each contestant will have a ranking number (1, 2, 3) assigned to them based on their performance in front of the same judges against the contestants they actually flew against. That number will be used and tabulated later to determine the finalists.

The same procedure will be used on Days 2 and 3. At the end of Day 3, every contestant will have flown 2 rounds against every other contestant outside of his/her group and have a ranking for each flight based on normalized scores and equal judging exposure. Each contestant will keep his/her three best ranking numbers (lowest number) plus his/her single best discarded ranking number. The three best ranking numbers must come from one of the two rounds flown each day. The single best discarded ranking number may come from any of the three days. Those four numbers will be tabulated and the 8 contestants, or ED predetermined number, with the lowest numbers will go to the Finals. In the event of a tie

for the 8th or final contestant, the tie-breaker will be determined by using both scores the contestants earned on the day they actually flew on the same line in front of the same judges. In the event that two or more contestants are still tied for the final position, the tied contestants will all fly in the Finals. The Finals winner will be determined as detailed in 13.1. No preliminary scores will be carried over to the Finals.

Conventional Non-Matrix Judging: In the event that the seeded groups are small enough, the Event Director may elect to utilize conventional, non-matrix judging spread out over two sites with equal judging exposure. If this preferred method is feasible, the preliminaries will be scored as detailed in 13.1. It is suggested that seeded groups be utilized in the same fashion as the matrix system with only one flight line operating on each of the two sites. When all of the contestants on Site 1 have been judged by the first set of judges, those judges would then report to Site 3 and judge the remaining contestants to complete the round. The second set of judges who originally started on Site 3 would likewise report to Site 1 to judge the remaining contestants to complete a second round.

The decision to utilize matrix or non-matrix judging rests solely with the ED.

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 contestant'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 contestant. The judges shall be seated not more than 10 meters behind the contestant’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 contestant. 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).

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 contestant'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 contestant or helper may request a different landing direction to that used for takeoff without penalty to avoid downwind landings. This option may only be used if the wind direction changes after the takeoff has started. 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 may 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 contestant 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/she 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 helper) may not touch his/her plane after it has become airborne until completion of the flight; i.e., he/she may not land the plane between maneuvers in order to make adjustments to engine, trim, etc. Failure to comply with this shall result in disqualification of the contestant for that round.

14.6.

In all classes, the contestant or helper must call out the initiation of the takeoff and landing maneuvers and box entries. Failure to call the initiation of the takeoff and landing or box entry will result in a one (1) point deduction for the upcoming maneuver.

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 CDs 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 exits the box downwind. The contestant makes an un-scored 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 CD 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.

15. Sequences

The Radio Control Aerobatics sequences will be developed periodically by the National Society of Radio Control Aerobatics (NSRCA) Sequence Committee which is appointed by the NSRCA Board of Directors. The NSRCA Board of Directors will supervise the sequence development and will submit the proposed sequences to the membership for approval before they approve all sequences for use in RCA competition. All current sequences can be found at the NSRCA website. The NSRCA will modify the sequences for classes 401, 402 and 403, Indoor R/C Aerobatics Sportsman and Indoor R/C Aerobatics Intermediate at least every four years and the sequence for class 404 will be modified at least

every two years, but sequences may be updated more frequently as required. Sequences will be published no later than December for the following year. A description of each maneuver for all sequences can be found on the NSRCA website at: http://nsrca.us/index.php/sequences.

16. 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.

17. Suggested Field Procedure

The procedures listed below are suggestions to CDs for operation of an RC Pattern event and may be altered to fit local conditions.

17.1.

All contestants shall be set up in “pits” at the spot assigned by the CD so they will be under his/her immediate control.

17.2.

Frequency control, if needed, will follow the established procedure at the host club flying site. Any entrant causing interference will be subject to disqualification.

17.3.

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 CD or his/her designated representative is not allowed. When multiple flight lines are used, a separate flight order shall be established for each flight line.

17.4.

The CD shall carry out the following procedure.

17.4.1.
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 person to fly, etc.

17.4.2.
Number one contestant shall have three (3) minutes from completion of preceding flight in which to release model for the start of his/her flight, unless the preceding flier's aircraft is on the same frequency. In this case, the contestant 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 the flight within this limit, the contestant must immediately remove his/her plane and equipment to the pits. It shall be the responsibility of the CD or his/her representative to notify the contestant of the start and end of the three (3) minute period.

17.4.3.
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 contestant becomes number three and shall be requested to move his/her model and equipment onto the flight line. If he/she is not on hand to do so, he/she shall be dropped from the flight order, and the order advanced to fill his/her place. The CD or his/her representatives shall be responsible for notifying contestants when they are to move to the ready box or flight line.

17.5.

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.

17.5.1.
Separate takeoff and landing areas sufficiently spaced from each other to minimize engine noise and flight path interference.

17.5.2.
Individual maneuvering area markings are established for each flight line.

17.5.3.
The CD shall arrange the multiple flight orders so that delays due to frequency conflicts are minimized as far as possible.

17.6. Officials

A CD, a Dispatcher–Recorder and Judges are the essential officials for an RCA Event. If possible, the Dispatcher–Recorder should have at least two (2) helpers.

17.7.

Each flight should be judged by at least two (2) judges, with their scores averaged or totaled to give a 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 CD.

17.8.

The CD 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 contestant’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 contestant will help him/her 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 aerobatics 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 box entries is required (see 14.6.).

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 judge's 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).

"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 contestant 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 contestant 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 contestant 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 CD 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 (sequences) may be found on the NSRCA website. Any related documents, including descriptions, interpretations, and/or clarifications will also be maintained by the NSRCA and will be posted on their website. 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 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 maneuvering area and is applied to the quality score for the maneuver. e.g. An end maneuver is 75% out of the box but the quality of the maneuver was an 8. The recorded score would be 8 minus 6 (75% of 8) for a score of 2.

E. Description of Maneuvers

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 track 180 degrees from the entry. In general, turnaround maneuvers are positioning maneuvers. Therefore, entry and exit altitude need not be the same if the contestant 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 track.

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 is provided 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. If no defined line is flown at the exit of a maneuver and it is the last maneuver flown prior to landing, then a two (2) point deduction should be given to the maneuver just completed.

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 deducted for a minor difference and two (2) or more points are deducted for major 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 deducted and two (2) or more points are deducted for major differences in line length.

In addition to meeting all of the above criteria, the straight flight out/back combination of maneuvers has the requirement that the straight flight back be coincident in altitude and distance with straight flight out.

Radii: All radii of a maneuver must be the same. Minor differences should be downgraded a point and 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 but it is a starting point. As the maneuver progresses, the judge will compare each radius that was just flown to the last radius flown and if there is a difference, then a downgrade will be given based on the severity of the difference. For example, in a square loop, the first radius flown will be compared to the second radius only. If the first and second radii are different a downgrade is applied. The third radius flown is then compared to the second radius and if it is the same then no additional downgrade is applied. The fourth radius flown is then compared to the third radius and if different then a downgrade is applied, otherwise no downgrade is given.

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 larger 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 miss timing is further downgraded. If one or more points are not visible, or there are more that 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) wingspans 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 rapid rotation where the fuselage nose makes a detectable break in heading from its track in pitch and yaw for the duration of the roll but the track follows the line of the maneuver (straight or arced):

1. 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. For example, it the model pitches its track 15 degrees nose up and the wings rotate 15 degrees before the yaw is applied, 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 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 the track corkscrews or barrel rolls, it is severely downgraded (more than 5 points).

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 heading does not remain deviated for the entire roll it is downgraded 1 point per 15 degrees.

6. Airspeed is not a criterion 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 un-stalled 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). Un-

stalled 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 according to the severity of the defect. A very short line should be downgraded 1/2 point where a more defined line should be downgraded 1 or more 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.