Section 1, General Rules, Scale Aerobatics

Radio Control Scale Aerobatics

For event 411, 412, 413, 414, 415

1. Objective

To duplicate full-scale aerobatics with miniature radio controlled aircraft in a realistic manner that is challenging for the contestants as well as interesting for the spectators.

2. General

All AMA regulations and FCC regulations covering the RC flier, airplane and equipment, shall be applicable to this event.

2.1. Consideration of safety for the spectators, contest personnel, and other contestants is of the utmost importance in this event. Any unsportsmanlike conduct or hazardous flying over a controlled spectator area will be cause for immediate disqualification of that flight. Further infractions will result in the removal of that pilot from the contest.

3. Open Events

3.1. The events accommodate aerobatic monoplanes and biplanes which are replicas of types known to have competed in International Aerobatic Club (IAC) competition, or replicas of types known to be capable of aerobatic competition within the airspace known as the "Box."

3.2. All classes except Basic require that the pilot must meet the requirements defined in Rule 3.1. The Basic Class is open to all competitors with a monoplane or biplane aircraft. There is no minimum size requirement for any class. Contest Directors may make an exception for a model of a full-scale aircraft that was built for IAC competition, but has not yet competed. Proof of the latter is the responsibility of the contestant.

3.3. The known sequences will be developed, annually, by the IMAC Sequence Committee, in accordance with the current FAI "Aresti System (Condensed)". The IMAC Board of Directors must approve all known sequences for use in IMAC competition.

3.4. The unknown sequences will be drawn from the Catalog of Legal Unknown Figures for each class. The Catalog of Legal Unknown Figures is located in the Rules Section of the IMAC website.

3.5. Difficulty or "K" factors for known and unknown sequences will be derived from the current FAI "Aresti System (Condensed)".

4. Model Aircraft Specifications

4.1. Only one (1) propeller per aircraft shall be allowed. Internal combustion reciprocating engines and electric motors shall be allowed. If the aircraft is utilizing an internal combustion engine, only one (1) engine shall be allowed. If the aircraft is utilizing electric motors, more than one (1) electric motor may by used.

4.2. The model shall comply with all AMA Safety Codes.

4.3. There shall be no airborne devices fitted to the aircraft which place the aircraft under less than total control by the pilot. These devices will include, but are not limited to, gyros, automatic pilots and timing devices. Non-airborne aids such as transmitter-based functions are permissible.

4.4. The Builder-of-the-Model (BOM) rule shall not apply.

5. Scale Aerobatic Sound Limits

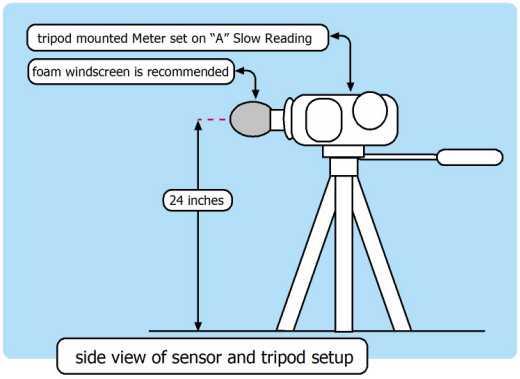
5.1. Maximum Sound Levels

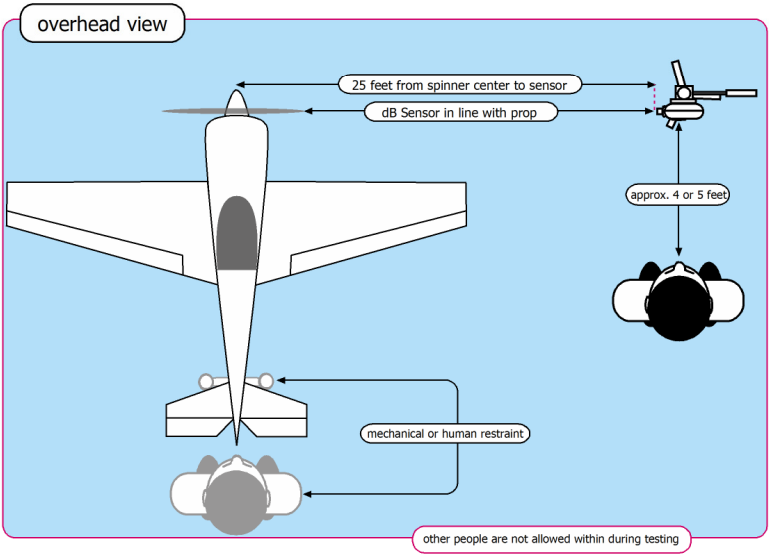
The maximum ground sound level for all classes shall be: 96dBA measured on soft surfaces and 98dBA measured on hard surfaces. Contest Directors may implement a correction factor due to unusual conditions.

5.2. Standard Method of Sound Measurement

The sound measurement shall be taken with the sound meter set to the "A" weighting, slow response with windscreen installed. The sound meter shall be placed downwind, twenty-five feet from the model centerline and positioned in line with the prop arc at twenty-four inches in height (see Fig. 1). The sound meter shall be pointed di-

Fig.1


tripod mounted Meter set on "A" Slow Reading
foam windscreen is recommended
24 inches
side view of sensor and tripod setup


overhead view
25 feet from spinner center to sensor
dB Sensor in line with prop
approx. 4 or 5 feet
mechanical or human restraint
other people are not allowed within during testing

rectly at the model and perpendicular to the fuselage. The model being measured shall have its engine run at full power for the sound test. No noise reflecting objects will be allowed within three feet of the sound meter.

5.3. Ground Sound Level Test

Prior to flying the first round of a contest; each competition model must pass the Ground Sound Level Test. The Ground Sound Level Test must be completed at the sanctioned contest site by the Contest Director or his/her designee. Testing shall be done in an area designated by the Contest Director and may be completed prior to or during the first round. Models successfully completing the test will not be measured again during the contest unless their sound level is deemed to have increased significantly since the initial check by the Contest Director. Any plane that fails the test will not fly, but will be moved to the back of the flight order, and allowed one more attempt to pass the test. Any model that fails the second test will zero all judged sequences he would have flown during the current round. Any model that fails the second test may be tested again during future rounds with the same Ground Level Sound Test criteria being applied. No model will fly any judged sequences at any Scale Aerobatics contest until it passes the Ground Sound Level Test.

5.4. In-Flight Judging Criteria, Known and Unknown Sequences

Judges will evaluate each individual sequence flown in its entirety for overall sound presentation. Each judged Known and Unknown sequence, shall have one "figure" added to the end of the score sheet after individually judged maneuvers. This figure shall be known as the *Sound Score.* The Sound Score will have a K value dependent on the class flown. Individual class K values shall be: Unlimited 5 K, Advanced 4K, Intermediate 3K, Sportsman 2K, and Basic, 1K. The bottom of each score sheet shall contain three boxes, *Too Noisy, Acceptable* and *Very Quiet.* Judges will mark one of the boxes for each sequence flown. These boxes shall translate in the computer to a score of: Too Noisy - 0, Acceptable – 5, Very Quiet - 10. This score will then be multiplied by the K value for the individual class. If two judges are utilized, both judges' scores must concur to issue a *Too Noisy* penalty or a *Very Quiet* bonus. In absence of a *Too Noisy* or *Very Quiet*" concurrence, an *Acceptable* will be scored for each sequence flown. If three or more judges are utilized, a simple majority concurrence will issue a *Too Noisy* penalty or *Very Quiet* bonus. All

Pilots that receive a *Too Noisy* penalty shall be notified of the penalty by the Contest Director prior to the next round. Pilots that receive a *Too Noisy* penalty will be allowed to adjust the aircraft setup and fly the next round (Known Unknown). Any pilot, who receives a second *Too Noisy* penalty during any Known, or Unknown, will be disqualified from further competition at that contest.

6. Proof of Scale

6.1. To prove that the model resembles a particular aircraft some proof of scale is required.

6.2. Proof of scale is the responsibility of the contestant.

6.3. The general outlines of the model shall approximate the full size outlines of the subject aircraft. Exact scale is not required. The model shall be judged for likeness at a distance of approximately 10 feet.

6.4. If the contestant presents no proof of scale material with the model, and the CD can determine that the aircraft is a replica of a full-size aircraft, then the contestant will be allowed to have his/her entry considered.

6.5. Scale shall be determined by the wingspan. A change in wingspan will become a change in overall Scale. Fuselage width, height and aircraft planform or any other variations shall not exceed 10% of scale, with the exception of airfoils and size/shape of control surface within the scale outline rule.

6.6. A realistic 3 dimensional human pilot and viewable instrument panel shall be appropriately installed in all Scale Aerobatic aircraft. (A one (1) percent flight score penalty will be assessed for non-compliance.)

7. Material and Workmanship

Workmanship must be of satisfactory standards. The Contest Directors are empowered to refuse permission to fly, or to disqualify any aircraft which, in their opinion, is not up to reasonably safe standards in materials, workmanship, or radio installation.

8. Competition Classes

8.1. The event shall be divided into five (5) classes, in order of increasing difficulty. The classes are Basic (411), Sportsman (412), Intermediate (415), Advanced (413), and Unlimited (414).
8.2. An Optional Four (4) Minute Freestyle may also be offered. A pilot must compete in one of the above classes to be eligible for the freestyle event.
8.3. Contest Directors and/or the sponsors of a sanctioned meet shall determine which of the classes and events will be flown. Such information must accompany all advance notices pertaining to the contest, including any planned deviation from standard rules, at least 30 days prior to the date of the contest.

9. Contestant Classification

9.1. A contestant may enter any one competition class at their own option. Once entered, a contestant may not move down in class without written permission from their regional director.

Should their class not be offered at a contest, the contestant may enter the next higher class, and then return to their normal class at the next contest where their normal class is offered.

If a Basic thru Advanced class contestant wins 5 contests with 4 or more competitors in a calendar year, they must advance to the next higher class at the beginning of the next calendar year.

9.2. The new contest season begins when the annual aerobatic sequence changes are approved by the IMAC Board of Directors and made available to the IMAC membership on the IMAC website at the start of each calendar year.

9.3. There shall be at least four (4) entries in the winning contestants class who make official flights before the first place victory is counted towards advancement.

10. Official Flights

10.1. Official Flight for Known Program

10.1.1. An official flight (round) for the known program is defined as two (2) sequences. When time constraints prevent two (2) sequences from being flown, a round may consist of one (1) sequence. Contestants shall have one attempt per sequence to complete the sequence. An attempt is made when the pilot or caller announces that he/she is entering the aerobatic airspace or the aircraft rocks the wings at entry.

10.1.2. If a known sequence in progress is determined by the judges to have been interrupted by a circumstance beyond the control of the contestant, the contestant may resume the sequence with the next unscored maneuver.

10.1.3. If a known sequence in progress cannot be completed due to mechanical problems with the aircraft (including but not limited to, engine failure, radio malfunctions, etc.) the contestant will receive zeros (0) for each unscored maneuver in that sequence. If the second sequence is yet to be flown and the aircraft can be made ready to fly (Refer to Rule 8), the contestant may attempt the second sequence.

10.1.4. An official flight (round) is two (2) sequences and the contestant is expected to be able to fly both sequences without refueling between sequences. If the second sequence cannot be completed the contestants will receive zero (0) for each unscored maneuver in that sequence. The only exception is if Rule 10.1.2 is in effect.

10.2. Official Flight for Unknown Program

10.2.1. An official flight (round) for the unknown program is defined as one (1) sequence. Contestants shall have one attempt to complete the sequence. An attempt is made when the pilot or caller announces that he/she is entering the aerobatic airspace or the aircraft rocks the wings at entry.

10.2.2. If an unknown sequence in progress is determined by the judges to have been interrupted by a circumstance beyond the control of the contestant, the contestant may resume the sequence with the next unscored maneuver.

10.2.3. If an unknown sequence in progress cannot be completed due to mechanical problems with the aircraft (including but not limited to, engine failure, radio malfunctions, etc.) the contestant will receive zeros (0) for each unscored maneuver in that sequence.

11. Number of Flights

There shall be no limit on the number of flights (other than that imposed by time available).

12. Aerobatic Airspace

Refer to Flying and Judging Guide, Rule 4.

13. Time Limits

13.1. The contestant has two (2) minutes to start his/her engine and become airborne. If after two (2) minutes the contestant is unable to start the engine, they will move to the end of the round rotation. If the contestant fails to start a second time, they shall receive zero for the round.

13.2. The contestant has one (1) minute from the time the wheels leave the ground during takeoff to enter the aerobatic airspace.

13.3. There shall be no time limit while in the aerobatic airspace.

13.4. The contestant has two (2) minutes between leaving the aerobatic airspace and touchdown for landing, unless required to hold upon command from the appropriate official.

13.5. Prior to entering the aerobatic airspace, pilots shall be allowed to perform only the following trim and positioning maneuvers; turns; ½ cubans (or reverse), with only a single ½ roll on the 45 line; ½ loops, up or down, with only a single ½ roll on entry or exit; single ½ roll to inverted immediately prior to entering the aerobatic airspace. Such maneuvers may not be performed at low altitude or directly in front of the judges. No other aerobatic maneuvers are allowed immediately following the airplane breaking ground (except for the Four Minute Freestyle). Upon exiting the aerobatic airspace pilots shall be allowed to perform only the following positioning maneuvers; turns; ½ loops down, with only a single ½ roll on entry or exit; single ½ roll to upright; in preparation for executing a safe landing. No other aerobatic maneuvers are allowed. Any infraction shall result in a penalty of zeroing the round.

14. Point System

14.1. All classes shall have the scheduled maneuvers scored on a scale of 10 - 0. Half (.5) points may be used in judging. Points are deducted for imperfections as per the Flying and Judging Guide.

14.2 Degree of difficulty factor (K-factor) values shall be assigned to individual maneuvers based upon the current FAI catalog of maneuvers, with modifications as required by the International Miniature Aerobatic Club (IMAC). When calculating contestant scores, each individual maneuver score shall be multiplied by its K-factor. The flight score shall be the result of summing the "K-factored" (maneuver score multiplied by K-factor) scores.

15. Determining Placement

15.1. Sequence Scoring

a. Scoring - The Official IMAC Contest Guide shall be used to determine the number of sequences to be scored (drop schedule) and the weight of the unknown(s) based on contest category (2 day, multi-day, regional, etc.)

b. Unknowns – Each unknown sequence shall be flown once. The Official IMAC Contest Guide shall be used to determine how the known scores and unknown scores are combined based on contest category.

c. Combined Scores – The highest combined scores will determine the winner.

d. Normalization – All sequences will be normalized to 1000 as outlined in Rule 15.4.

15.2. In the case of ties, the best non-scored sequence of the contestant shall be used to determine the winner.

15.3. The same set of judges shall judge each round. Judges may be rotated between rounds.

15.4. Each sequence shall be normalized to a standard 1000 points. The pilot with the highest raw score receives 1000 points for the round. Each pilot thereafter shall have their raw score divided by the high raw score giving a percentage of that high raw score, which is then multiplied by 1000 to get the normalized score. Scores shall be rounded to two (2) places of decimal accuracy. For example: Contestant A wins the round with a raw score of 4850 points. Contestant B is second with 4766.5 points. Contestant A receives 1000 points for the sequence. Contestant B's score is 982.78 points (4766.5 divided by 4850 = 0.982783 * 1000 for 982.783, which rounded to two (2) places of decimal accuracy for a final score of 982.78).

16. Flight Pattern

16.1. A contest shall include one (1) or more rounds of known sequences and may include one (1) or more unknown sequences. Any given unknown sequence can only be flown once per contest.
16.2. Compulsory Known Maneuver Sequences are defined by Rule 3.3.
16.3. Optional Unknown Maneuver Sequences shall include separate Sportsman, Intermediate, Advanced, and Unlimited sequences, each consisting of up to 15 maneuvers.

a. Unknowns shall be distributed the day of the contest or the night before to allow pilots to mentally fly and visualize them. If a contestant is found to have practiced the Unknowns with a flying model or on a computerized flight simulator, that contestant will be disqualified from the entire contest.
b. Flight order for the Unknowns should be established by random drawing.
16.4. .The contestant must fly his entire flight according to the established flight schedule for his particular class and in the sequence listed. Maneuvers that are executed out of sequence, or not executed as required by the sequence, will be zeroed. Remaining maneuvers that are flown in their appropriate area and in the appropriate order following the zeroed maneuver will be scored.
16.5. Takeoff and landing are not to be considered judged maneuvers. It is not necessary for the judges to see the aircraft takeoff or land. The aircraft may be carried to the takeoff point, and carried from the landing area, if so desired.

17. Four (4) Minute Freestyle Program

17.1. The Four (4) Minute Freestyle Program is a “Show Time” separate event. It is an unrestricted, individually created sequence in which “Anything Safe Goes!” To be eligible to participate and compete in this event, the competitor must also compete in one of the five IMAC categories of precision sequence flying at the same event. It should have separate awards when offered. It is graded on the following criteria:

A. Technical Merit {90K}

a.1. Complete Use of the Flight Envelope Utilizing the Exploitation of Aerodynamic and Gyroscopic Forces (20K)

The pilot is expected to make full use of the flight envelope of the aircraft. This means flying the full range of airspeeds and accelerations permitted. Program time should be divided between high and low speeds, high and low G maneuvers, and both positively and negatively G loaded flight segments. The flight should include the demonstration of controlled flight beyond the stall boundary by use of autorotation or other high angle of attack maneuvers. The judge will deduct points if any of these areas are noticeably under utilized.

The pilot is expected to show movement of the aircraft about all axes using both conventional aerodynamic controls and propeller-generated gyroscopic forces. Higher grades will be given to pilots able to make use of all these effects through a wide range of aircraft attitudes and flight paths. Repeated use of any such forces in the same or similar attitudes should result in lower scores.

a.2. Execution of Individual Maneuvers (40K)

It should be clear that the maneuvers flown were, in fact, intended and fully under the pilot's control. Higher marks will be given for this objective when individual maneuver elements are started and finished on obviously precise headings and in well-defined attitudes. When, for example, gyroscopic maneuvers are allowed to decay into imprecise, poorly defined autorotation, marks should be deducted for poor execution. Marks should also be deducted if it appears that the pilot has relinquished control of the aircraft at any time.

a.3. Wide Variety of Figures Flown on Different Axes and Flight Paths (30K)

Many different figures should be completed in the time available. These should include maneuver elements of many different kinds and should use many different flight paths and axes. Lower marks should be given to a pilot who used only one or two principal axes of flight. However, the use of additional axes within the performance zone must be clear and precise, not giving the appearance of being used by chance. Marks should also be deducted if any particular maneuver element is over-used or continues for an excessive period of time. For example, higher marks would be given in the event of a two-turn flat spin followed by something else, than to a multi-turn spin that simply took up more time.

B. Artistic Impression {90K}

b.1. Pleasing and Continuous Flow of Figures with Contrasting Periods of Dynamic and Graceful Maneuvers (50K)

In a precisely flown sequence, the completion of a figure will be well described when movement about an axis ceases and a particular attitude is briefly held. The start of the next figure or maneuver should then begin without any prolonged period of inactivity caused by the need to reposition the aircraft or reorient the pilot. Marks will be deducted for any obvious period of level flight, or inactivity, required between figures.

In a musical symphony, the listener's mood may be changed by contrasting fast and slow movements. Similarly, in a 4-Minute Free Program, the judge should be treated to a flight that causes different reactions. While some maneuvers involve very high speeds, sudden attitude changes and rapid rotations, others involve slower speeds or more gentle transitions. Higher marks will be given to a pilot who finds time in his program for showing such differences of mood and pace. Marks should be deducted in this category for a flight that shows no such distinctions. Higher marks should be given for choreography with the music to enhance the flight, and the flight choreographed to enhance and present visual impressions where both the music and aircraft are flowing together with each other and acting as a unified entity to display a harmonious presentation.

b.2. Presentation of Individual and Combinations of Figures in Their Best Orientation and Optimal Position (40K)

Figures can give different impressions when seen from different viewpoints. For example, a climbing inverted flat spin looks most impressive when the top surface of the aircraft can be seen. A loop flown in a plane inclined at 45 degrees to the vertical is best appreciated when it is flown on the Y-axis. Marks should therefore be deducted if the judge is not shown a figure in its best orientation.
Each figure has an optimum from which it is best viewed. For example, a loop flown overhead does not give the same pleasing geometry as one flown further distant. Similarly, a figure flown near the upper height limit will cause discomfort when flown at the near edge of the performance zone; a low-level horizontal figure is better seen from close by than far away. Higher marks will therefore be given when individual figures are optimally placed, while judges should deduct marks when it appears that a figure is not well placed or positioned.

C. Positioning {20K}

c.1. Symmetry of the Presentation Utilizing the Performance Zone to Maximize the Audience and Judges Perception, Reception, and Viewing of the Program (20 K)

Highest marks will be given when the sequence as a whole is balanced evenly to the left and right of the judges' direct line of vision towards the center of the performance zone. Marks should be deducted if, by design or by the influence of the wind, a pilot's program is noticeably biased to left or right. The greater the degree of asymmetry, the greater should be the deduction.

Even though a flight might be symmetrical, it may also be spread too far to either side, so that some maneuver elements are flown outside the performance zone, thus making them difficult to see and interpret. Figures may also be flown on the direct line of vision but very distant. Any part of the flight that is flown at such distances should be penalized for each excursion. The entire program should be positioned so as to maximize both the audience and judges perception and reception of the flight as a whole.

17.2. Judging the Four (4) Minute Freestyle Program

a. Any number of judges can be utilized. As more judges that are used, the overall score average will be less influenced by a single judge. It is recommended that seven (7) be used. For final score tabulation it is recommended that the high and low score per judging criteria category be discarded, and the remaining scores be multiplied by their K factors and added together to obtain the final score.

b. Each criteria will be judged from ten (10) to zero (0) in 0.1 increments, i.e., 8.7, 7.9, 9.8, etc.

c. If the pilot lands any time prior to 3 minutes 30 seconds (three and one-half minutes) the judges score is "prorated". Example: the pilot lands at the three (3) minute time. The judges will score the contestant as though he flew four minutes. The score room will tabulate the scores normally and the pilot will receive three-fourths (75%) of the judges score for his final score. If the pilot lands any time after three and one-half minutes there is no penalty. The judges will stop scoring when the timer announces "Time" at the four minute mark. Another Example: If the pilot lands at the two minute mark, he will receive 50% of the judges score.

d. Specific circumstances that will Disqualify (DQ) the competitor's flight.

d.1. If the plane crashes, it is a Disqualification (DQ).

d.2. If the plane goes behind the deadline, it is a DQ.

d.3. If the pilot performs dangerous or unsafe maneuvers or high energy maneuvers directed at the judges or spectators, it is a DQ. (As determined by a majority of the judges and/or the CD.)