

NZMAA FLYING RULES

Section 11: RC Scale Aerobatics

1. **RC SCALE AEROBATICS: OBJECTIVE**

To duplicate full-scale sport 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**

- 2.1 All NZMAA General Rules and CAA regulations covering the Radio Control flier his plane and equipment shall be applicable to this event.
- 2.2 Consideration of safety for 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 cause for immediate disqualification of that flight.

3. **OPEN EVENTS**

- 3.1 The events will accommodate aerobatic biplanes and monoplanes that are replicas of types which are known to be capable of aerobatic competition within the airframe known as the competition "box".
- 3.2 Manoeuvre sequences will be those used by the full scale International Aerobatic Club (I.A.C.) and adapted for the event by the International Miniature Aerobatic Club (I.M.A.C.) annually.

4. **MODEL AIRCRAFT SPECIFICATIONS**

- 4.1 Only one engine of the reciprocating internal combustion type or electric shall be use.
 - 4.1.1. Maximum flying weight with fuel 25 kg. (Note that models between 15 and 25kg require an NZMAA "Permit to Fly" from the Large Model and Sport Technical Committee.)
- 4.2 An effective silencer shall be used in accordance with NZMAA and club standards of noise reduction.
- 4.3 The Builder-of-the-model rule (BOM) shall not apply. Several contestants may fly the same aircraft as is frequently done in full-scale competitions. Scale Aerobatics is a measure of *piloting ability!* - utilising realistic RC miniature aircraft.

5. **BIPLANE SCALE BONUS**

- 5.1 A 2 % flight score bonus may be awarded to Biplane entries meeting the standards required of a scale aircraft.
- 5.2 The biplane bonus shall not apply in the Unlimited category.

6. SCALE REQUIREMENTS.

- 6.1 To prove that the model resembles a particular aircraft, some proof of scale may be 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 nor intended. The model shall be judged for likeness at a distance of approximately 3 metres.
- 6.4 If the contestant presents no proof of scale material with the model, and the contest director can determine that the aircraft is a replica of a full-size aerobatic aircraft, then the contestant will be allowed to enter the competition.
- 6.5 Scale shall be determined by the wingspan and variations should not exceed 10%. Fuselage width and height may be reduced up to 20%. Entries in the Basic category need not be Scale
- 6.6 A realistic pilot and instrument panel should be appropriately installed in all Scale Aerobatic aircraft.

7. ACHIEVEMENT AWARD PATCHES

- 7.1 Achievement award patches may be earned in each category by scoring five or better on each Manoeuvre in a Basic, Sportsman, Advanced, or Unlimited sequence.

8. MATERIALS AND WORKMANSHIP

- 8.1 Workmanship must be of satisfactory standards. Contest committees are empowered to refuse permission to fly or to disqualify any aircraft which in their opinion is not up to reasonable safe standards in materials, workmanship, radio installation, or condition as a result of damage.

9. COMPETITION CLASSES

- 9.1 The event shall be divided into three categories; in order of increasing difficulty, the categories are: **Basic, Sportsman, Advanced, Unlimited.**
- 9.2 Optional 3-Minute Freestyle sequences may also be offered as separate events.
- 9.3 Contest directors and or the sponsors of a sanctioned meeting shall determine which of the categories will be flown. Such information must accompany all advance notices pertaining in the contest. Competitors must also be advised prior to the start of the contest of any planned deviations from standard rules, or published sequences.

10. CONTEST CLASSIFICATION

- 10.1 A contestant may enter any one competition class at his own option. Advancement to the next higher class shall be mandatory after winning first place three times in any 24 month period. There shall be at least four entries making of official flights before first place victory is counted towards advancement.

11. OFFICIAL FLIGHTS.

- 11.1 Contestants shall have two attempts to achieve an official flight consisting of two complete sequences.
- 11.2 Landing between sequences is permitted for throttle and minor adjustments to the aircraft.
- 11.3 A re-start will be allowed in the event of a mechanical problem or flame-out as the pilot's second attempt to complete a flight. Pilots may request the re-start at the end of the round.
- 11.4 When a sequence is interrupted the pilot will be allowed to resume flying the sequence by re-flying the last judged manoeuvre and continue being scored from that point on with no penalty assessed. Interruptions for avoidance of other aircraft, radio interference or official command only.

12. NUMBER OF FLIGHTS

- 12.1 There shall be no limit on the number of flights (other than imposed by time available). Contest officials shall make every reasonable effort to insure that all contestants receive equal opportunity to fly.

13 AEROBATIC ZONE

- 13.1 All manoeuvres shall be flown in an area in front of the judges, 75 degrees on either side and no higher than 400 feet. The box maximum depth shall be 150 metres (500 feet). Minimum altitude, except when landing or taking off, shall be 20 feet.
- 13.2 The aircraft shall rock its wings back and forth prior to entering and just after leaving the aerobatic zone thus showing the judges the beginning and end of the sequence.

14 TIME LIMITS

- 14.1 Start engine and become airborne - two minutes
- 14.2 To enter the aerobatic zone - one minute.
- 14.3 No time limit while in the aerobatic zone. Between leaving the aerobatic zone and touchdown for landing two minutes unless required to hold upon command of appropriate official.

15. POINTS SYSTEM

- 15.1 All classes shall have the scheduled manoeuvres scored on a scale of ten (10) to zero (0).
- 15.2 Current K-factors may be used at the discretion of the Chief Judge.

16. DETERMINING THE WINNER

- 16.1 The highest scoring sequence of each 2-sequence flight before the same judges and weather conditions shall be counted.
- 16.2 When unknown sequences are flown, the best one of two attempts on a single flight shall be added to the known compulsory scores totalled with a K-factor of K-2 to establish the final standings in the contest. (Individual K-factors may be applied and only ONE Unknown sequence flown in major competitions.)

17. FLIGHT PATTERN

- 17.1 The contestant must fly his entire flight according to the established flight schedule for his particular class and in the sequence listed. Manoeuvres performed out of order will be scored zero (0).
- 17.2 Takeoff and landing are not to be considered judged manoeuvres. It is not necessary for the judges to see the aircraft take off or land.
- 17.3 No flybys are allowed during the acrobatic sequence. If a flyby or a break in the sequence occurs, any omitted manoeuvres and the next prescribed manoeuvre in the sequence will receive zero points as a penalty.
- 17.4 **Boundary Infringements.** Whenever 'THE COMPLETE AIRCRAFT' is observed to fly past any boundary or marker, a boundary infringement penalty will be noted by the Manoeuvre score being CIRCLED and a point penalty assessed when scores are tabulated.
- a. Penalty points assessed on each score sheet shall be: Basic - 2-Points; Sportsman - 4-points; Advanced - 8-points, - Unlimited - 10 points. (after k factoring).
 - b. Incorrectly flown manoeuvres and manoeuvres flown entirely out of the box shall be scored zero.
 - c. One point shall be subtracted for each approximate 15 degrees deviation.
- 17.4.1 Lines should be judged more critically than deviations in yaw and roll.

Note: One point is lost for going off line then one point for every 15 degrees off line.

17.5 3 minute Free Style. The 3-Minute Free is "Show Time" and a separate event. It is an unrestricted, individually created sequence in which "Anything SAFE Goes" It is graded on four criteria and should have separate awards when offered.

- a. ORIGINALITY- Creating new figure, novel combinations of old figures, utilisation of the aircraft, the element of surprise, and good use of the FULL acrobatic zone.
- b. VERSATILITY- Displaying a wide variety of manoeuvres.
- c. HARMONY & RHYTHM- Choreographic characteristics of sequence.
- D. EXECUTION- The quality of flying and the ability of the pilot to hold attention.

17.5.1 Judging the 3 minute Free Style. Four judges will evaluate the first contestant on each of the four criteria separately at approximately mid-way on a scale of 0.1 to 10.0 (To the nearest tenth of a point) 40 points possible (eg: "6" if Good). Each successive constant will then be scored relative to the first: better similar, or not as good. (eg: Better - 6.5 to 8; Similar - 5.8; Not as good - 4).

17.5.2 The four scores are totalled for each contestant to determine the winners. Large contests should provide awards for the highest scoring Basic, Sportsman, Advanced and Unlimited entries.

17.5.3 Two freestyle judges may be used instead of four with one judging Originality and Versatility and the other judging Harmony & Rhythm and Execution.

17.5.4 Multiply the Free Style scores by 10 (move the decimal over one) for recording the final scores of the 3-minute Free. eg: 28.5 becomes 285

17.6 Unknown Sequences. Separate Advanced and Unlimited sequences, consisting of 12 to 15 manoeuvres are designed for contestants to fly without prior practice. They should be reasonably flyable and without high K-factor complexity. (ie: No quarter rolls.)

- a. Distribute the Unknowns the day of the contest to allow pilots to mentally fly and visualise them.
- b. Flight order for the Unknowns should be established by drawing.

18. KNOWN COMPULSORY MANOEUVRE SEQUENCES

18.1 Same as IAC for each category or sequences similarly designed by the IMAC. In USA, sequences change annually and are printed in "MODEL AVIATION", along with updated rules changes which become official in USA upon publication. In NZ, updated schedules will be notified in the Scale Aerobatic Technical Committee Newsletter at least four weeks before an event. NZ Rule changes will be notified via "NZ MODEL FLIER'S WORLD".

SPORT AEROBATICS CD GUIDE

Introduction

RC Sport Aerobatics might also be known as Scale or Prototype Aerobatics since competitors fly the manoeuvres and sequences of full-scale aerobatics by Radio Control with scale aircraft which either have or could compete in full-scale aerobatics. The growth of Prototype Aerobatics, most widely known to modellers through the biannual Tournaments of Champions, has led to the recognition by the AMA of the International Miniature Aerobatic Club (IMAC) as the Special Interest Group for this activity. At the same time, the FAI representative of full-scale US acrobatic competition, the International Aerobatic Club, has committed to a close working relationship with the IMAC. This IAC - IMAC working relationship has had a significant role in upgrading the fidelity of RC Sport Aerobatics competition under IMAC guidelines.

The IAC Judging Standards and techniques have been adopted by IMAC and have become part of the rules for this used for judging IMAC contests and current-year IAC sequences for the Sportsman, Advanced and Unlimited categories are flown more often than not. The Aresti diagrams commonly used to portray manoeuvres and sequences in full-scale aerobatics are increasingly understood and used in RC Sport Aerobatics. Because the IAC sequences change annually sequences for the calendar year will be published by AMA as part of the Competition Newsletter each Spring. IMAC is dedicated to achieving the maximum possible prototype fidelity in RC Sport Aerobatics, and as additional full-scale practices and procedures are tested and proven they will be proposed as rule changes for this AMA competition category.

The NZ RC Aerobatics Technical Committee is a Special Interest Group (SIG) of the NZMAA. The SIG generally adopts the rules of the IMAC and will run contests to the rules published here. The sequences will be published by the SIG in their Newsletter usually in January each year. Sponsoring Sport Aerobatic Events can be made easier when some basic data is available as a guide is. The following information is compiled to help clubs and CD's plan contests.

Use of the example flight plans will prove adequate for most contests. Contestants should pay attention to the upwind downwind progression of a sequence when designing their own freestyle.

The number of events and categories in Sport Aerobatics may be varied according to anticipated attendance. Large regional contests can offer four Categories: Sportsman, Advanced, Unlimited, plus the 3 minute freestyle. A small club contest may simply offer one event, with the categories combined and with or without a 3 Minute freestyle (See scoring method).

Scoring

Normalised results will be used. The advantages being that each round can be judged by a different judges. All scores will be normalised between competitors for each round (2 sequences). To normalise the scores, give 100 points to the competitor with the highest score and a percentage of 1000 to each other competitor depending on their score.

Normalised score = (competitors score/winning score) x 1000

Eg. If competitor A's marks are 300, competitor B gets 200 and competitor C gets 150 then, after normalising, "A" gets 1000 points, "B" gets $(200/300) \times 1000 = 666.7$ points, and "C" gets $(150/300) \times 1000 = 500$ points.

For the event results add up normalised results for each round and normalise them with the added results of the other competitors. These results are also used for the Circuit results.

Classes.

- Basic: A category intended to enable interested newcomers to try the Scale Aerobatics type of contest. This category is non-championship (is not flown at a Nationals) and models need not be Scale. Generally flown to the Sportsman schedule with some of the more difficult manoeuvres deleted.
- Sportsman: Beginners and non-winners of past NZMAA Nationals FAI F3A aerobatics. Winners move up to Advanced.
- Advanced: Advanced fliers and experienced competitors.
- Unlimited: Master fliers and anyone not desiring to enter the other classes (voluntary at all times).

Events

- Open: All entries must be replicas of types which are known to be capable of "Aresti" competition within the "box" (Chipmunk, Skybolt etc.).
- 3-Minute Freestyle: A separate, unrestricted, individually created sequence of manoeuvres (anything *SAFE* goes).

Manoeuvre Sequences.

It is the Chief Judge's responsibility to be certain his judges know the correct line and track of each manoeuvre in every sequence. A pilots and judges meeting, followed by a demonstration flight is recommended. All zero's and low scores should be discussed prior to scoring the next sequence.

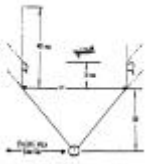
Judging.

The criteria by which we judge aerobatic manoeuvres is relative to full-scale realistic performance and speed. The actual line and track of the aircraft are what count, not the attitude which may be necessary to achieve it. Example: The yaw in knife-edge flight or nose high in inverted flight are acceptable attitudes.

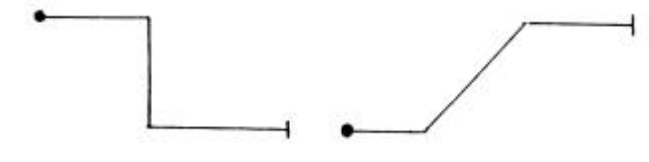
Each category will fly a complete round in succession. The Unlimited pilots should be called upon to judge. Sportsman can be used to record.

All lines are judged on the flight track of the aircraft. Spin recoveries must project vertical down-line prior to pull-out (A safety measure).

JUDGING STANDARDS AND TECHNIQUES



Family 1 - Lines and Lines Plus Angles.



Note: Family 1 figures are not to be used as competition manoeuvres.

Aresti System. It is appropriate that we begin our discussion of the Aresti System with this Family, as lines and angles are the foundation upon which all manoeuvres are flown. In discussing angles, we are primarily concerned with only three - 90, 60 degrees and 45 degrees. Most manoeuvres are flown in horizontal flight (upright or inverted) or on a 45 or 90 degree line. All lines are judged on the flight track of the aircraft. This means that in a 90-degree line up or down, the aircraft should be projecting an imaginary line in the sky of 90 degrees to the horizontal [compensating for any wind effect].

On a 45-degree line, the aircraft should be projecting an imaginary line in the sky of 45 degrees [compensating for any wind effect]. The same is true of horizontal lines, whether flown upright, inverted or knife-edge. When an aircraft is flown at normal cruise in horizontal flight, the fuselage would be parallel to the horizon. But if inverted [or in knife-edge] the nose may be several degrees above the horizon to sustain a horizontal track. Also, as the aircraft

is slowed down (as in the entry to a spin) the nose would rise above the horizon in either upright or inverted flight. The judge does not downgrade for this change of attitude. He is grading the horizontal line that the contestant is drawing by maintaining the same altitude. In grading a contestant on the performance of a figure on any prestated line, the perfect grade of 10 must be reduced by one full point for every 15 degrees deviation from the programmed line of flight. For example, a perfect hammerhead or stall turn, performed on a line of 70 degrees instead of 90 degrees to the horizon, can only receive a grade of 8.

The total length of a vertical or 45-degree line, either up or down, should not be considered in the grading of an individual manoeuvre. The only criterion to be used is whether there is an equal length of line prior to and after any figure performed on the line. The performance of the aircraft is not to be considered. Also, the transition from one plane of flight to another should be given a reasonable and constant radius. Higher point values are not to be given for square, high "G" corners.

Remember, especially with 45-degree lines, that you must make an allowance for the aircraft's position relative to your own. A true 45-degree line will appear steeper when flown closer to you or at either end of the box. Judging is of the true line flown. It should be assumed by a judge that a contestant is going to fly a perfect manoeuvre, so he should start with a grade of 10. As he watches the manoeuvre, he then begins to find fault with what he sees and starts downgrading as it progresses. This system is preferable to waiting until the manoeuvre is finished and trying to assign a grade on overall impression. The latter may cause judging to be erratic and inconsistent and may also confine grading to a range too narrow. However, as a final check, the figure score should be consistent with its overall quality. Again, the judge is assuming the manoeuvre is going to be a "10" until proven otherwise.

Remember that it is the judge's job to find fault. Be a "nit-picker". On the other hand, give a 10 if you see a perfect manoeuvre - but if you are really being critical, you won't see too many. Guard against confining your grade in a range too narrow. If you watch carefully and grade consistently, you will find yourself giving an occasional 2, 3, or 4 on some pretty sloppy manoeuvres that are not quite bad enough for a zero. You will also be giving an occasional 9 or 10 for the superlative manoeuvre with which you can find little or no fault.

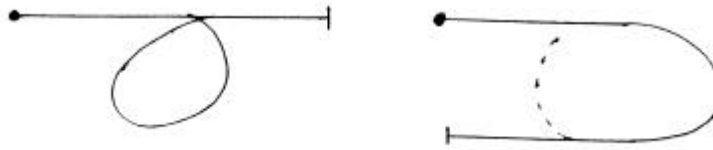
Take care not to grade on an overall impression of the flight. Be ready to drop down to a poor grade for a poor manoeuvre even if you have been scoring 8's or 9's on a flight. Conversely, don't get in a rut of lower scores. Be ready to break a string of 4's and 5's with a 9 if the manoeuvre warrants that score.

Note that all manoeuvres begin and end on definite lines. And these should be present in order to earn a good grade. Downgrade the contestant who rushes from one manoeuvre to another and does not project these lines properly. The absence of a distinct horizontal start and finish must result in the mark being reduced by 2 for each figure affected.

In discussing horizontal lines, the subject of "crabbing" or side-slipping" comes up. Good pilots will usually establish a few degrees of crab into any prevailing crosswind. Judges generally agree that this is acceptable if carried throughout the sequence and is preferable to making small corrections between manoeuvres, which tend to destroy the rhythm and harmony of a sequence.

Now that we have examined the foundation upon which all Aresti manoeuvres are built and have discussed grading in general, let's begin an evaluation of the individual figures.

Family 2 - Turns



All turns should be performed at a constant bank angle and a constant rate of turn. The minimum bank angle should be 60 degrees. Bank angle should be established first, the turn accomplished, and level flight re-established.

Altitude should remain the same throughout the manoeuvre. These same criteria apply whether the turn is upright or inverted. As a judge, you will usually see a constant bank angle, but frequently the rate of turn will vary. The manoeuvre must be downgraded for this. Other common faults are gaining or losing altitude while executing the turn. If all the proper elements of the turn are correct and there is any significant wind; with the proper application of power the turn should be finished at the same point over the ground as in a no-wind condition in a 360-degree turn.

Family 3 - Vertical Turns Not currently used.

Family 4 - Spins



All spins begin and end with a horizontal line. In order to spin, the aircraft must be stalled. The aircraft must project a horizontal line prior to the stall. When the aircraft stalls, the nose will fall through the horizon, and the wing should simultaneously drop in the direction of the spin. After the completion of the required number of turns, the aircraft should stop precisely on heading, and the 90-degree down line should be projected.

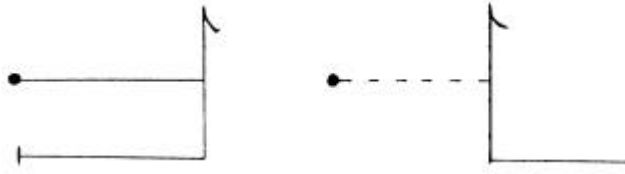
If the aircraft does not stall, it is apparent that it cannot spin. The grade on the manoeuvre would be a zero. You will occasionally see this wherein a contestant will aileron the aircraft around, and the spin will look like a barrel roll.

Some aircraft will spin with a nearly vertical attitude, and others will spin flatter, up to about 45 degrees. More or less value in grading is not given to either. However, the flat spin is a different figure, and here the attitude will be about 30 degrees or less.

The clean break and fully-stalled rotation are the main grading criteria along with the 90-degree downline after the rotation has stopped. Particularly watch to see if the rotation is finished on aileron. This should be downgraded by 1 point for each 15 degrees.

In positive spins from negative flight or negative spins from positive flight, a common error is to allow the speed during entry to get too high. This results in a vertical snap roll. For a given type of aircraft the rotation will be faster and steeper than for a spin. If you believe a snap roll has been performed, the grade should be zero.

Family 5 - Hammerhead or Stall Turns



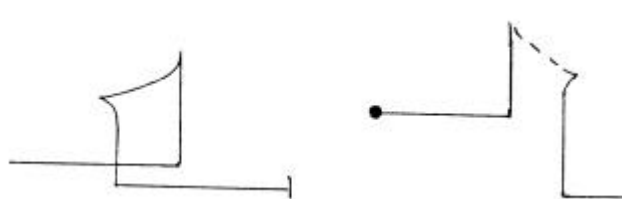
This family consists of two planes of flight starting in the horizontal, transitioning to vertical, and finishing in horizontal flight once again. The transitions should be at a constant radius and the aircraft track to the horizon is to be 90 degrees throughout the vertical portion. As the aircraft approaches zero air speed, it should pivot around its yaw axis, the nose and tail exchanging places while maintaining the same vertical plane. The wings must maintain their same plane of flight throughout the turnaround.

The aircraft then descends at 90 degrees to the horizon and makes a transition to horizontal flight with the same radius used in vertical entry.

If the wings should torque off 15 degrees during the turnaround, the maximum grade that can be earned is 8. Another common error is flying the aircraft around the top instead of pivoting on the vertical axis. This must result in a substantially lower grade, as the essential criterion for the figure is absent. Also look for one wing low or tucked under during the vertical portion up or down. Any of these things should downgrade the manoeuvre.

When stall turns are combined with rolls, the rolls should be in the exact centre of the vertical lines being drawn. If there is a roll going each way, up and down, they should occur at the same place in the vertical plane of flight, each being in the exact centre of its respective vertical line.

Family 6 - Tail Slides



All of the criteria of the stall turn apply to this manoeuvre up to the point at which the aircraft stops. At this point, the aircraft is to slide backwards a visible amount, about twice the length of the aircraft. The key here is visible amount. If there is no slide, the grade is zero.

The aircraft must definitely slide in a vertical plane and not with the nose inclined towards the horizon. A slide of the type must be downgraded by the formula of 1 point for every 15 degrees of inclination. Watch for the aircraft torquing off the correct plane of flight, and downgrade accordingly.

Family 7 - Loops



The loop, whether outside or inside, should be absolutely round, square, or whatever is called for. All loops should begin and end at the same altitude, and should be closed at the completion. This requires the contestant to compensate for the wind. The most common errors are to pinch the top, stretch the top or finish at a higher or lower altitude.

In square, triangular, six or eight-sided loops, each side must be of equal length. A frequently-seen error is the failure of the contestant to carry the horizontal line at the finish of the manoeuvre past the starting point of the initial pull up in his haste to get on to the next manoeuvre. Remember on a triangular loop and a six-sided loop you are looking at angles of 60 degrees, one of few instances where you will not be judging 45 or 90-degree lines.

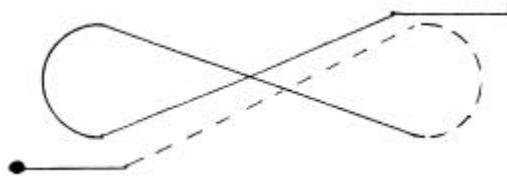
The judge is to take no account of the size of the loop caused by the performance of the aircraft.

Family 7.5 - Vertical S



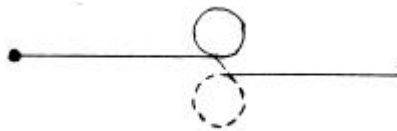
These are accomplished with half an inside loop and half an outside loop. Look for both loops to be the same size and perfectly semi-circular. The semi-circles should be aligned vertically, and no horizontal line is to be projected between the half loops.

Family 7.6 - Horizontal Eights



Note that this manoeuvre always begins and ends in horizontal flight. In judging, look for the tops and bottoms of the loops to be at the same height, respectively, and the two loops to be symmetrical. Check that the 45-degree lines between the two loops are exactly 45 degrees and of the same length. If there are rolls, they should be in the exact centre of the 45-degree line, and the 45-degree lines should intersect at the same point [relative to their total length] over the ground.

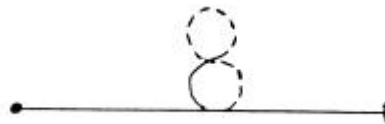
Family 7.7 - Vertical Eights



These manoeuvres are full inside or outside loops one above the other (not to be confused with the vertical eights composed of two vertical S's which are Family 7.8). All vertical eights may be combined with half rolls of various types.

They are to be graded on the same criteria as loops with the addition that the two loops should be of identical size and one directly above the other. Any roll should be performed in the horizontal tangent between the two loops with no horizontal line before or after the roll. If the loops are not closed at the same point or finish at a different altitude, the manoeuvre must be downgraded. Loop size is not scored; symmetry is.

Family 7.8 - Vertical Eight of Combined Vertical S's



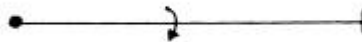
This manoeuvre may also be combined with various types of rolls, and when this is done the same criteria as for Family 7.7 apply. Even though the manoeuvre is performed differently, the judge is still looking for the same symmetry of loops and placement one above the other. Note that this manoeuvre should begin and end at the same altitude.

Family 8.1.1 - Slow Rolls



Slow rolls may be performed on horizontal, 45 or 90-degree lines, and they may be full, 3/4, 1/2, or 1/4 rotations. In all cases the same criteria apply. The rate of roll should be constant throughout the rolling portion, and the length of the line should be the same before and after the roll. The track of the aircraft during the rolling portion should continue to project the plane of flight as diagrammed. Remember that a deviation of track by only 15 degrees is cause for downgrading from a 10 to 9.

Family 8.1.2 - Horizontal Super Slow Roll



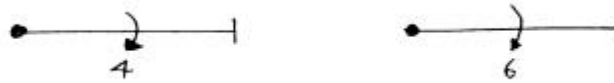
This manoeuvre must last at least 5 seconds in the case of the full roll and the appropriate fraction thereof for 3/4, 1/2, or 1/4 super slow rolls. All of the judging criteria of the regular slow roll apply, and in addition it must last the full allotted time or receive a zero.

Family 8.1.3.1 - Horizontal Inside Barrel Roll



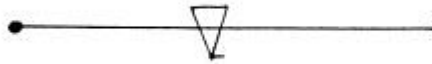
This manoeuvre is performed around an imaginary point on the horizon 20 degrees off the axis. The manoeuvre is flown with positive "G" throughout so the nose of the aircraft will describe a perfect circle around this point on the horizon. When viewed from the ground the aircraft appears to describe a corkscrew effect in the horizontal plane. The nose should not deviate more or less than 40 degrees from the pre-stated direction of flight on the axis. If the aircraft deviates either way from this, the manoeuvre must be downgraded by 1 point for each 15 degrees as prescribed in the rules for judging all Aresti figures.

Family 8.2 - Hesitation Roll



Judged on the same criteria as the slow roll, except that the roll rate may be faster and the aircraft hesitates 3, 4, 6, 8, or 16 times. The rate of roll should be the same throughout, and the manoeuvre should be centred on the line of flight. Pauses should be of equal duration with accurate degrees of rotation between points. Note that in the 3-point roll you are looking for 120 degrees of roll between each point.

Family 8.3.1 - Inside Snap or Flick Rolls



Snap rolls may be performed on the same lines as slow and hesitation rolls. They should be positioned in the centre of the pre-stated line of flight whether single or multiple.

In order for the aircraft to snap roll, it is necessary for the "G" load to be increased to the point where the wing will stall. Rudder is then applied to make the aircraft roll in the direction desired. The nose must definitely break from the line of flight indicating a stall has occurred, or the manoeuvre earns a zero.

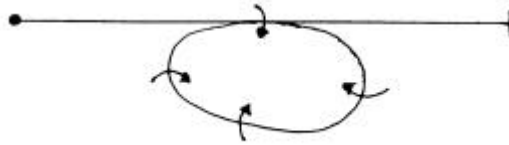
The judge is looking for a precise recovery on the same track as prior to the roll, with the wings exactly in the same plane of flight as before (or in the case of 1/4 and 3/4 snap rolls at 90 degrees). If this does not occur, the manoeuvre must be downgraded by the usual 1 point per 15 degrees of deviation.

Family 8.3.2 - Outside Snap Rolls



In this manoeuvre the same criteria stated for inside snap rolls are used. Note however, that the nose must break down from the line of flight prior to the wing stalling.

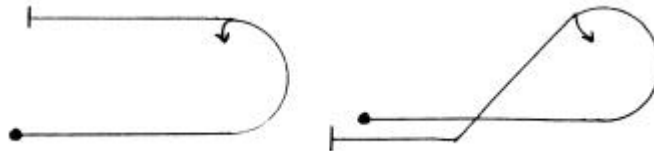
Family 8.4 - Rolling Turns or Rolling Circles



We now come to the compound manoeuvres with this Family. These are simple rolls combined with various horizontal turns.

The judging criteria for this complex manoeuvre is dictated by the number of rolls prescribed for the number of degrees of turn. With four rolls to the inside of a 360-degree turn starting from normal flight, the aircraft should be inverted at 45, 135, 225, and 315 degrees around the circle. The nose should be moving around the horizon at a constant rate, and the roll rate should not vary. There are six rules to apply, and some dictate specific reduction of grade as follows: 1 Smooth rate of roll; 2 No stop page of roll (2 points off for each); 3 Recognisable variation of turn rate (1 point off for each); 4 Finishing off track (1 point for each 15 degrees); 5 Even integration of rolls; and 6 Constant altitude throughout.

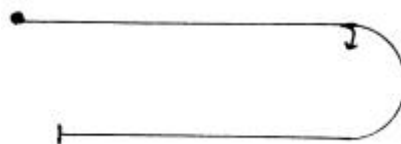
Family 9.1 - Half Loops and Half Rolls



In the first of these, the Immelmann, the complete half loop must be performed before the half roll is executed. There is no horizontal line before the roll. Technically, a line would create a half loop and then a half roll - two manoeuvres rather than one.

In the half Cuban Eight (9.1.0.2) a half roll follows 5/8 loop. In this manoeuvre, as the Immelmann, all factors relevant to loops apply to the loop portion, rolls to the roll portion. In this manoeuvre, the aircraft should project the 45-degree down line the same distance prior to the roll as after.

Family 9.2 - Half Rolls and Half Loops



Note that in this Family the roll precedes the loop - same criteria apply.

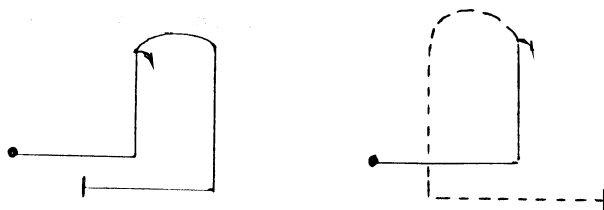
Family 9.2.0.2 - Half Rolls and Half Loops



This is the 45-degree Family and is sometimes called the reverse half Cuban Eight or fish hook, depending on whether the manoeuvre is done as a turnaround or the flight continues in the same direction.

Beginning in horizontal flight, there is a smooth transition to the 45 degree line, and the roll of the type selected is performed in the exact centre of the 45-degree line. Here, we have a 3/8 loop to perform with judging standards previously stated. Note that although the manoeuvre is drawn with a vertical down line, this line is not to be flown. Instead, the aircraft is to execute a continuous transition from the 45-degree plane around to the horizontal.

With the fish hook portion, the manoeuvre is identical until the aircraft reaches a vertical flight attitude at which time it changes from positive to negative (or vice versa) and again returns to horizontal flight. There is no vertical line.



Family 9.2.0.3 and 9.2.0.4

These are all vertical rolling manoeuvres with the same judging guidelines. The transition to the vertical from the horizontal should be smooth and at a constant radius. The vertical flight path should be projected and equal length before and after the roll. The half loop should be of constant radius and is of no specified radius as long as the radius chosen is constant. The manoeuvre must be downgraded where the contestant merely flops over the top and does not draw a semi circle. The vertical line in this case must be projected with a smooth transition to horizontal flight.

A Final Word

In conclusion, remember that you, as a judge, are expected to grade only against one standard - perfection. The performance of the aircraft of the difficulty in performing a manoeuvre (on the basis of your personal experience) in any given type of aircraft is not to be considered in formulating your grade.

Do not be afraid to find fault with a contestant's flying, regardless of his name or reputation. As a judge, this is your job.

**ANNEX A :
ARESTI SYMBOLS**

- A solid line indicates flight with positive G loading.
- A broken line denotes flight producing negative G loading.
- The beginning of a figure is indicated by a small circle.
- The end of a figure is indicated by a short line.
- An open triangle means positive G loading.
- A blackened triangle means negative G loading.

