ANNEX 5B

F3 R/C AEROBATIC POWER MODEL AIRCRAFT

MANOEUVRE EXECUTION GUIDE

5B.1. PURPOSE

The purpose of the Manoeuvre Execution Guide is to give accurate guidelines for the proper execution of aerobatic manoeuvres to both judges and competitors.

Note that this guide may not be all-inclusive.

5B.2. GENERAL

The flight path of a model aircraft is used to judge the shape of all manoeuvres, and manoeuvres must be entered and exited with straight and level upright or inverted flight of recognisable length. Centre manoeuvres start and finish on the same heading, while turn-around manoeuvres finish on a heading 180 degrees to entry. When appropriate, entry and exit of centre manoeuvres must be at the same altitude, unless specified otherwise. Positioning adjustments in altitude are allowed in turn-around manoeuvres.

5B.3. ACCURATE AND CONSISTENT JUDGING

The most important aspect of consistent judging is for each judge to establish his standard and then maintain that standard throughout the competition. It is advisable for the jury president, in conjunction with the contest director and the championship organiser to hold a conference prior to the start of the competition, in order to discuss judging and make the standards as uniform as possible. This is further augmented by some practice flights which all judges score simultaneously and privately. After these flights, the defects in each manoeuvre should be discussed by all judges and agreement reached about the severity of the defects. Once the contest is started, the individual judge must not alter his standard 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 manoeuvre performed.

A judge must not, under any circumstances, favour a competitor, or a national team, or a particular flying style, or brand of equipment, or propulsion method. Judges must only look at the lines described in the sky. Conversely, acts of negative bias towards a competitor, or a national team, or a flying style, or brand of equipment, or a propulsion method, must be viewed in a serious light, and corrective action may be necessary.

The performance of the model aircraft or its propulsion device, must not be allowed to influence a judge's mark.

5B.4. PRINCIPLES

The principles of judging the performance of a competitor in a R/C Aerobatic competition is based on the perfection with which the competitor's model aircraft executes the aerobatic manoeuvres as described in Annex 5A. The main principles used to judge the degree of perfection are:

1. Geometrical accuracy of the manoeuvre; (weighting approximately 50%).
2. Smoothness and gracefulness of the manoeuvre; (weighting approximately 25%).
3. Positioning of the manoeuvre within the manoeuvring zone; (weighting approximately. 12,5%).
4. Size of the manoeuvre; (weighting approximately 12,5%).
5. Proportion of the manoeuvre outside of the manoeuvring zone (in addition to the above).

5B.5. DOWNGRADING SYSTEM FOR JUDGING MANOEUVRES

In Annex 5A a description of each manoeuvre is given. With reference to above principles each manoeuvre must 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.

Each judge gives a mark for each manoeuvre during a flight. Assuming the highest mark 10 at the start of each manoeuvre, every defect is subject to downgrade of the mark in whole numbers. A high score should remain only if no substantial, severe or multiple defects are found.

5B.6. ATTITUDE AND FLIGHT PATH

The flight path of a model aircraft is the trajectory of its centre of gravity. The attitude is the direction of

the fuselage centre-line in relation to the flight path.

If not otherwise stated, all judging is based on flight path.

5B.7. WIND CORRECTION

All manoeuvres are required to be wind corrected in such a way that the shape of the manoeuvre, as described in Annex 5A, is preserved in the model aircraft's flight path. The exceptions to this criterion are in the snap-rolls, stall turns, and spins, where the model aircraft is in a stalled condition.

5B.8. 1. GEOMETRICAL ACCURACY OF THE MANOEUVRE

As a guide for downgrading deviations from the defined manoeuvre geometry, the manoeuvres are divided into their different components: lines, loops, rolls, snap-rolls, horizontal circles, line/loop/roll/horizontal circle combinations, stall turns, and spins.

5B.8.2. THE 1 POINT PER 15 DEGREE RULE

This basic rule provides a general guide for downgrading deviations from defined manoeuvre geometry. 1 point must be subtracted for each approximate 15 degrees deviation. In general, lines must be judged more critically than deviations in yaw or roll.

5B.8.3. LINES

All aerobatic manoeuvres are entered and exited by a horizontal line of recognisable length. When no horizontal line is flown between two manoeuvres, the just-completed manoeuvre must be downgraded by 1 point and the upcoming manoeuvre must be downgraded by 1 point. Horizontal flying between manoeuvres which is not considered part of the exit or entry line, must be observed, but not judged for quality.

The total length of a vertical or up/downline, as dictated by the performance of the model aircraft, is not a downgrading criterion.

All lines within a manoeuvre have a start and an end which define their length. They are preceded and followed by part loops. The length of a line should only be graded when a manoeuvre contains more than one line with a given relationship to each other ie as in a square loop. If there is a minor mis-relation, 1 point is subtracted, and more points are subtracted for greater deviations.

5B.8.4. LOOPS

A loop must have by definition, a constant radius, and must be performed in the vertical plane throughout. It is entered and exited by a well defined line which, for a complete loop, is horizontal. For a part-loop, however, such lines may be in any other plane of flight as required by the particular manoeuvre.

Loops and part-loops within one manoeuvre must have the same radius. Each occurrence of a slight difference in radius must downgrade the manoeuvre by 1 point, while more severe deviations may downgrade it by 2 or 3 points for each occurrence. The radius of the first loop or part-loop, determines the radii of subsequent loops or part-loops within one manoeuvre.

Every loop or part-loop must be performed without interruption to the circular flight path. Every visible segmentation must be downgraded by 1 point.

If the loop is not performed entirely in the vertical plane ie it drifts closer or further from the judges, minor drift must be downgraded by 1 point, while more severe drift must be downgraded by several points.

In three-, four-, six-, and eight-sided loops, The main criteria are that the loop must have the sides at the same lengths/correct angles for the defined number of times, and all part-loops must have the same radius.

5B.8.5. ROLLS

Rolls and part-rolls may be performed as individual manoeuvres, or as parts of other manoeuvres. The following applies to all continuous rolls and part-rolls as well as to consecutive continuous rolls and part-rolls:

a) They must be performed on a constant flight path.

b) The roll-rate must be constant. Small variations in roll-rate must be downgraded by 1 point, while more severe variations must receive a downgrade of 2 or more points. Slowing down (or speeding up) the roll-rate towards the end of a roll must be downgraded using the 1 point per 15 degree rule.

c) The start and stop of the rotation must be crisp and well-defined. If a start or stop is badly defined, 1 point is subtracted for each.

d) In all manoeuvres which have more than one continuous roll, the continuous rolls must have the same roll-rate. In all manoeuvres which have more than one part-roll, the part-rolls must have the same roll rate. Lines between consecutive part-rolls must be short and of equal length. Between consecutive

continuous rolls or part-rolls in opposite direction there must be no line. Where there are continuous rolls and part-rolls within one manoeuvre, the roll-rate for the part- rolls does not necessarily have to be the same as the roll-rate for the continuous rolls.

Particular attention has to be paid where the manoeuvre description requires continuous rolls or part- rolls to be performed in opposite directions. For a roll or part-roll performed in the wrong direction, a zero score must be given for the entire manoeuvre.

5B.8.6. SNAP-ROLLS

A snap-roll is a rapid auto-rotative roll where the model aircraft is in a stalled attitude, with a continuous high angle of attack.

Snap-rolls are judged in the same way as axial rolls as far as the constant flight path throughout the snap-roll, the start and stop of the rotation, and the roll direction is concerned.

At the start of a snap-roll, the fuselage attitude must show a definite stall-break and attitude separation from the flight path, before the rotation is started, since the model aircraft is supposed to be in a stalled condition throughout the snap-roll. If the stall-break does not occur and the model aircraft barrel-rolls around, the manoeuvre must be severely downgraded (more than 5 points). Similarly, axial rolls disguised as snap-rolls must be severely downgraded (more than 5 points).

Snap-rolls can be flown in both positive and negative attitudes. The attitude (positive or negative) is at the pilot's discretion. If the model aircraft returns to an unstalled condition during the snap-roll, the manoeuvre is downgraded using the 1 point per 15 degree rule.

5B.8.7. HORIZONTAL CIRCLES

Horizontal circles are performed in a horizontal plane and mostly used as centre manoeuvres. They may be positioned at a higher or lower altitude. Horizontal circles are mainly judged about the circular flight path, constant altitude of the circle, and by constant rates of roll, and integration of the continuous rolls or part-rolls with the circle, if applicable.

The circular flight path should be maintained throughout the manoeuvre and there must be no deviation in altitude. At low level it may be more difficult for judges to determine the roundness of the circle. The 150m distance requirement is waived for horizontal circles, and a downgrade should only be applied if the far side of the circle exceeds approximately 350m. Deviations from geometry should be downgraded as in loops and using the 1 point per 15 degree rule. Depending on the distance from the pilot at the entry, horizontal circles may be performed away from, or towards, the pilot and are at the pilot's discretion.

Other horizontal manoeuvres as combinations of horizontal circles or part-circles with lines etc have to be judged accordingly

5B.8.8. LINE/LOOP/ROLL/HORIZONTAL CIRCLE COMBINATIONS

These are very diversified, but all are combinations of lines, loops, part-loops, continuous rolls, part-rolls, snap-rolls, horizontal circles, and horizontal part-circles. The judging of all these components applies as described above.

Whenever a continuous roll, part-roll, snap roll, or a consecutive combination of these is placed on a line, the length of the line before and after the roll or the combination of consecutive rolls must be equal. 1 point is subtracted for a minor difference, and 2 points for a major difference. If there is a complete absence of a line before or after the roll, 3 points are subtracted.

Exceptions are all Immelman Turn and Split-S manoeuvres where rolls are always performed immediately before or after or part-loop, which means, the rolls always begin with the start of the lines and stop with the end of the lines. A visible line in-between the two components or rolls and not completely before or after the part-loop, must downgrade the manoeuvre.

Flight paths of continuous rolls or part-rolls that are integrated with loops or horizontal circles should be smooth, continuous, and of constant radius. Where an integrated roll is required, quick-rolling should be downgraded using the 1 point per 15 degree rule.

Particular attention has to be paid where the manoeuvre description requires a continuous roll or part-roll to be performed to the inside or the outside of a horizontal circle. For a continuous roll or part-roll performed in the wrong direction, a zero must be given for the manoeuvre.

5B.8.9. STALL-TURNS

The criteria in this manoeuvre are mainly about lines. The lines must have exactly vertical and horizontal flight paths.

The model aircraft must pivot around its centre of gravity (CG) in the yaw axis for the manoeuvre to receive a high score. If the model aircraft does not pivot on the CG, but within a radius of a half-wingspan, one point is subtracted. For a radius of pivot up to one wingspan, 2 to 3 points are subtracted and if the radius exceeds 1½ wingspans, the manoeuvre must be downgraded 4 to 5 points. A

radius of pivot of 2 wingspans or more is considered a wing-over and a zero must be given. If the model aircraft should "torque-off" during the stall turn, a downgrade must be applied using the 1 point per 15 degree rule. If the model aircraft flops forward or backward in a stall turn, a zero score must be given.

If the model aircraft shows a pendulum movement after the pivot, the manoeuvre is downgraded by 1 point. Similarly, if the model aircraft should "skid" before reaching the stall turn (early application of rudder), the manoeuvre is downgraded by 1 point. Drift of the model aircraft during the stalled condition must be ignored, provided the model aircraft does not drift outside the manoeuvring zone.

5B.8.10. **SPINS**

All spins are entered and exited with horizontal lines. In order to spin, the model aircraft must be stalled. The entry is flown in a horizontal flight path with the nose-up attitude increasing as the speed decreases. Drift of the model aircraft from the flight path at this point should not be downgraded, since it is in a near-stalled condition. However, severe yawing or weathercocking during the near-stalled condition, should be downgraded by 1 point per 15 degrees. A climbing flight path just prior to the spin must be downgraded, using the 1 point per 15 degree rule. The nose then drops as the model aircraft stalls. Simultaneously as the nose drops, the wing also drops in the direction of the spin. Drift during the rotation of the spin should not be downgraded since the model aircraft is in a stalled condition, provided the model aircraft does not drift outside the manoeuvring zone.

If the model aircraft does not stall or if the model aircraft is snap-rolled or spiral-dived into the spin, the manoeuvre is zeroed. If the model aircraft slides into the spin (is loath to spin), the manoeuvre must be downgraded by using the 1 point per 15 degree rule. Forcing the model aircraft to spin in the opposite direction as the initial rotation must be severely downgraded. Forcing the model aircraft to spin from a high angle of attack with down (or up) elevator, should be downgraded by 4 or 5 points. Judges must carefully observe the stalled attitude, which is not necessarily a complete stop, especially in no-wind conditions. This is no reason for downgrading.

After the defined number of turns, the stop of rotation is judged in the same manner as for a roll, downgraded 1 point per 15 degree deviation of heading. The spin rotation should stop parallel to the flight line. "Unloading", or stopping the spin rotation early and then applying only aileron to roll the model aircraft to the desired attitude, should be downgraded using the 1 point per 15 degree rule.

A vertical downward line of visible length must be held after the rotation stops. The pull- or push-out is judged like a part-loop and if followed by a part-roll, should be separated by a well-defined line of straight flight. Different models spin in different attitudes, and the attitude is not to be taken into consideration, as long as the model aircraft is stalled. Any reversals in direction must be immediate, and if the model aircraft returns to an unstalled condition during the spin, the manoeuvre is severely downgraded. The rate of rotation during a reversed spin may be slightly different, without a downgrade, but if the difference is significant, 1 point is subtracted.

5B.9 **SMOOTHNESS AND GRACEFULNESS OF THE MANOEUVRE**

Concerns the harmonic appearance of an entire manoeuvre. Ie maintaining a constant flight speed throughout the various manoeuvre components, like in climbing and descending sections contributes significantly to smoothness and gracefulness. Radii performed very tight or very loose, though being of equal size within one manoeuvre may be subject for downgrading Smoothness and Gracefulness.

5B.10. **POSITIONING OF THE MANOEUVRE WITHIN THE MANOEUVRING ZONE**

The entire flight must be within the manoeuvring zone to avoid being penalised.

A centre manoeuvre must be flown so that it is centred on the centre line indicated by the centre flag. If the manoeuvre is flown off-centre, it must be downgraded according to the misplacement. This may be in the range of 1 to 4 points subtracted. The centre of a centre manoeuvre is in the middle between its start and its end.

Flying so far out as to make evaluation of a manoeuvre difficult should be severely downgraded. The main criterion here is *visibility*. For a large, highly visible model aircraft, a line of flight approximately 175m in front of the pilot may be appropriate, while a smaller less visible model aircraft might have to be flown at say 140 to 150m. Manoeuvres performed on a line greater than approximately 175m in front of the pilot must be downgraded by at least 1 point.. Manoeuvres performed on a line greater than 200m in front of the pilot must be downgraded more severely (in the order of 2 to 3 points).

In general, turn-around manoeuvres are positioning manoeuvres. Therefore, entry and exit altitude need not be the same if the pilot wishes to make an altitude adjustment.

If any part of a manoeuvre is performed beyond the safety line, the manoeuvre will be zeroed. Repeated infringements of the safety line may result in the competitor being asked by the flight line director to terminate the flight, due to safety reasons.

5B.11. SIZE OF THE MANOEUVRE

The size of a manoeuvre is scored by its matching size relative to the size of the manoeuvring zone and relative to the size of the other manoeuvres performed throughout a schedule.

5B.12. PROPORTION OF THE MANOEUVRE OUTSIDE OF THE MANOEUVRING ZONE

Downgrades for flying a manoeuvre partially out of the zone should be in proportion to the degree of infraction, ie a small part of the manoeuvre (10%) flown past a 60 degree line would call for a downgrade of 1 point, while more of the manoeuvre (30%, 40%, 50% …) flown past a 60 degree line must be downgraded accordingly by 3, 4, 5… points. If an entire manoeuvre including entry and exit is flown out of the manoeuvring zone, it consequently must be zeroed. However, violations of a 60 degree line that occur near the 150 metre line (ie approximately over a 60 degree flag) should be seen less severely than violations along a line further out and more distant from the judges.

5B.13. EXAMPLES

An avalanche is entered in a slight climb, the flight path turns 15 degrees to one side after the snap and a wing is 15 degrees low during the exit. 10 – 1 – 1 – 1 = 7 points.

Consecutive four ¼ rolls are started late and end up slightly off-centre and there is no stop/line between the second ¼ roll and the third ¼ roll. 10 – 2 – 6 (1 point per 15 degrees) = 2 points.

Consecutive eight ⅛ rolls are started late and end up slightly off-centre, and there is no stop/line between the first ⅛ roll and the second ⅛ roll. 10 – 2 – 3 = 5 points.

An Immelmann turn is not well-rounded, the half roll is started before the model aircraft reaches the top of the loop, with the wing 15 degrees low and the flight path of the model aircraft 20 degrees off heading. 10 – 1 – 2 – 1 – 2 = 4 points.

A snap-roll on a 45 degree downline appears to be nothing more than an axial roll with a wiggle of the tail of the model aircraft. All other components are perfect. 10 – 6 = 4 points.

During a humpty-bump, a snap roll on a vertical downline appears to be a barrel roll, and the exit radius is noticeably smaller in radius than the other two part-loops. 10 – 6 – 1 = 3 points.

A square loop with half rolls has the first leg climbing 100 degrees. The model aircraft gallops in elevation across the top, stops the vertical downward half roll 15 degrees too early, is corrected, and the last half roll ends up 10 degrees to one side of the centre-line. 10 – 1 – 2 – 1 – 1 = 5 points.

On a top hat with ¼ rolls, the model aircraft is accidentally rolled in the wrong direction and the horizontal flight is performed upright instead of inverted. 10 – 10 = 0 points.

In the middle of a double Immelmann, which may be manoeuvre number 12, a competitor experiences an engine cut and the manoeuvre is not completed. 10 – 10 = 0 points. The rest of the manoeuvres are also awarded zero points.

An otherwise flawless two-turn spin is about 45 degrees off-centre. This must be considered as a severe misplacement. 10 – 4 = 6 points.

During a stall turn in dead-calm conditions, the flight path of the model aircraft is exactly vertical, but the model aircraft is “skidded” 15% in the upline to ensure a turn. The model aircraft shows a pendulum movement after the stall turn, and the half roll in the downline is performed directly before the part-loop exit. 10 – 1 – 1 – 3 = 5 points.

A loop with an integrated roll on top has the roll performed rapidly with no attempt by the pilot to integrate the roll with the top 90 degree quadrant of the loop. 10 – 6 = 4 points.

A half reverse Cuban eight is started too late, and the pilot squeezes the manoeuvre together by flying a 60 degree upline and making no line after the half roll. The manoeuvre still gets about halfway (50%) out of the zone. 10 – 1 – 3 – 5 (misplacement, going out of the zone) = 1 point.

During an inverted spin entered flawlessly, the model aircraft unstalls and makes the final 90 degree of rotation as a vertical axial roll. 10 – 6 = 4 points.

A pilot flies flawlessly consecutive eight ⅛ rolls. 10 – 0 = 10 points. You will not see too many of these in a competition but a manoeuvre should be awarded a 10 if there are no detectable flaws that would otherwise downgrade it to a 9.

A pilot performs a near-perfect split-S, and the only flaw is a very slight, barely visible low wing on exit. 10 – 0 = 10 points. In some cases, an error may be so slight that a judge may want to consider giving a score of 10, rather than wait for the perfect manoeuvre to arrive.

A pilot performs a manoeuvre other than that stated on the score sheet. 10 – 10 = 0 points.

After this incident, the pilot performs the rest of the manoeuvres out of sequence, and no manoeuvres correspond to the manoeuvres stated on the score sheet, in the order in which they are listed. All manoeuvres affected in this way score 0 points.

During a figure M, the model aircraft disappears from view behind a low cloud, or in the sun, which is directly in the background, so that only one stall turn is visible. Every judge scores N/O. The competitor will be awarded a reflight with the entire schedule being judged, but only the mark for the affected manoeuvre used to complete the tabulation.

During an avalanche, a judge fails to notice the snap-roll at the top of the manoeuvre. Score = N/O. The score tabulators will enter the numerical average of the other judges' scores, rounded to the nearest whole number.

After the last flying manoeuvre in a preliminary schedule, an official calls "time". The competitor lands his aircraft after expiry of the time limit. No penalty.