5.1.13. **Schedule of Manoeuvres**

For 2004-2005, Schedule P-05 will be flown in the preliminaries. Schedule F-05 will be flown in the semi-finals, as well as in the finals, alternating with unknown schedules.

For 2006-2007, Schedule P-07 will be flown in the preliminaries. Schedule F-07 will be flown in the semi-finals, as well as in the finals, alternating with unknown schedules.

PRELIMINARY SCHEDULE P-05	K-Factor
1. Take-off sequence	1
2. Reverse Cuban 8, 4/8pt. roll and 2/2pt. roll, exit inverted	4
3. Stall turn, 2/4pt. roll up, negative snap-roll down	3
4. Reversed four-point roll	4
5. Half square loop, full roll up, exit inverted	2
6. Inverted triangle loop with ½ rolls, exit inverted	3
7. Two turn inverted spin	2
8. Loop with full roll on top	4
9. Half clover, 2/4pt. roll up, ½ roll down, exit inverted	3
10. 45 degrees up with 4-point roll, exit inverted	4
11. Reverse humpty bump, pull-push-push, 2/4pt. roll down ½ roll up (or 3/4pt. roll down, ¼ roll up)	3
12. Reverse double Immelmann, full roll first, 2/4pt. roll second, exit inverted	4
13. Half of a reverse Cuban 8, with ½ rolls	3
14. Square loop with ½ rolls in vertical legs, and 2/4pt. rolls in horizontal legs	5
15. Half reverse Cuban 8, full roll, exit inverted	2
16. 4/8pt. roll, with slow roll opposite	4
17. Figure 9, positive snap roll up, exit inverted.	3
18. Vertical eight, top first, integrated ½ roll on centre	3
19. Split S with full roll, exit inverted	2
20. Four-point roll from inverted, exit inverted	4
21. Half square outside loop with 2/4pt. roll up, exit inverted	2
22. Two 2-turn inverted spins, opposite, ½ roll exit	4
23. Landing sequence	1
	70

PRELIMINARY SCHEDULE P-07	K-Factor
1. Take-off sequence	1
2. Half clover, 4pt. roll up, 2/4pt.roll down	4
3. Half square loop on corner, ½ rolls, exit inverted	2
4. Reverse Cuban 8 from top, 4/8pt. roll and 2/4pt. roll in uplines, exit inverted	4
5. Half reverse Cuban 8 from top, 2/2pt. roll	3
6. 45 degrees down, with 1 ½ positive snap-roll, exit inverted	4
7. Push-push-push humpty bump, with ½ roll up, exit inverted (or ¼ roll up and ¼ roll down)	3
8. Eight-point roll from inverted, exit inverted	4
9. Stall turn, ½ roll up, 2/2pt. roll down	3
10. Loop, with 4-pt. roll on top	4

11. Immelmann turn 1
12. Square loop on corner, from top, with ½ rolls 5
13. Figure 6, with ½ roll down 2
14. Hourglass, mid-entry, top first, with 2/4pt. roll down, exit inverted 4
15. Half vertical 8, top first 2
16. Reverse knife-edge, exit inverted 5
17. Half square outside loop, 2/4pt. roll up 2
18. 2 ½ turn inverted spin 4
19. Half horizontal hourglass, ½ roll up first, 2/2p. roll opposite second 3
20. Horizontal 8 from top, with half rolls integrated 3
21. Half outside loop with full roll, exit inverted 2
22. Six-sided loop, 2/4pt. roll on top 4
23. Landing sequence 1

70

SEMI- FINALS, AND FINALS SCHEDULE F-05 K-Factor

1. Take-off sequence 1
2. Rolling loop 5
3. Half square loop on corner, 2/4pt. rolls, exit inverted 3
4. Reverse humpty bump with positive snap-roll down, full roll up, exit inverted 4
5. Figure 6 with ½ roll down, exit inverted 3
6. Inverted hourglass, mid entry, top first, 2/4pt. roll down 4
7. 2 ½ turn positive spin 3
8. Reverse knife-edge, exit inverted 5
9. Stall turn, 2/8pt. roll up, ¾pt. roll down 3
10. Square horizontal 8 5
11. Half roll, half outside loop, with full roll 3
12. Reverse avalanche, 1 ½ negative snap-roll, exit inverted 5
13. Reverse humpty bump, 2/8pt. roll down, ¼ roll up
    (or 2/4pt. roll down, ½ roll up) 3
14. Reverse golf ball from top, with ½ rolls 4
15. Half square outside loop, positive snap-roll down, exit inverted 3
16. Reverse 4-point roll, from inverted, exit inverted 4
17. Rolling half outside loop, full roll. 3
18. 45 degrees down, 2/4pt. roll and negative snap-roll opposite, ½ roll exit 4
19. Landing sequence 1

66

SEMI-FINALS, AND FINALS SCHEDULE F-07 K-Factor

1. Take-off sequence 1
2. Pull-push-push humpty bump, 4/8pt. roll up, pos. snap-roll down, exit inverted 5
3. Half of a reverse Cuban 8, ½ roll and 2/4pt. roll in uplines 3
4. Reverse double avalanche, negative snap roll first, positive snap-roll second 5
5. Half square outside loop, 2/2pt. roll opposite, exit inverted 3
6. Rolling figure S, with opposite half rolls integrated, exit inverted 5

7. Negative snap-roll split S 3
8. Slow roll from knife-edge, exit inverted 5
9. Stall turn, 4/8pt. roll up, full roll down 3
10. Rolling circle, with 2 rolls reversed 5
11. Pull-push-pull humpty bump, ½ roll down (or ¼ rolls up and down) 3
12. Spinning half loop, 2 ½ negative spins, exit inverted 4
13. Half square loop on corner, with ½ rolls, exit inverted 2
14. Reverse cobra roll, with 2/4pt. rolls 4
15. Rolling half loop, exit inverted 3
16. Four-point roll from inverted, exit inverted 4
17. Top hat with 3/4pt. roll up, ¾ roll down, exit inverted 3
18. 45 degrees up, 1 ½ negative snap roll 4
19. Landing sequence 1

66

The description of the manoeuvres, judging notes, and Aresti diagrams are given in Annex 5A. The Judges' Guide is at Annex 5B.

ANNEX 5A

DESCRIPTION OF MANOEUVRES FOR R.C. AEROBATICS

5A.1.13. The shape of all manoeuvres is judged on the flight path of a model aircraft, and manoeuvres must start and finish in straight and level upright or inverted flight. Centre manoeuvres must start and finish on the same heading, while turn-around manoeuvres must 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.

All manoeuvres which have more than one loop or parts of loops must have the loops and parts of loops the same diameter and in the case of consecutive loops, in the same place. Similarly, all manoeuvres which have more than one continuous roll must have the same roll rate. All manoeuvres which have more than one point roll, must have the same roll rate, and the points must be of equal duration. Where there is a combination of continuous rolls and point rolls within a manoeuvre, the roll rate for the point rolls does not necessarily have to be the same as the roll rate for the continuous rolls. All consecutive rolls (continuous and/or point rolls) on a horizontal line must be at the same altitude and heading.

All manoeuvres with rolls, part rolls, point rolls, or snap-rolls, or combinations of same, must have lines of equal length before and after the rolls or combinations, except when specified otherwise. Barrels rolls and axial rolls instead of specified snap-rolls must be scored zero. Spiral dives instead of specified spins must be scored zero. Snap-roll entries to spins must be scored zero. Wing-overs instead of stall turns must be scored zero.

Any violation of the above will be reason for downgrading, in addition to the downgrades for deviations from the manoeuvre descriptions and the judging notes in Annex 5A, the Judges Guide (Annex 5B) and any official judge training material. Note that these lists are not all-inclusive.

PRELIMINARY SCHEDULE P-05

P-05.01 **Take-off sequence:** Place the model aircraft on the runway, and take off. Soon after reaching a safe height, turn 90 degrees toward the line defined by the upwind and downwind markers. When approximately over this line, turn 270 degrees in the opposite direction for a downwind trim pass with the model aircraft upright. When approaching the downwind marker, perform a 180 degree turn, reversal, or other turn-around manoeuvre of the competitor's choice.

Judging notes:

- Take-off sequence not followed, zero points.
- Model aircraft passes behind the judges line (zero line), zero points.
- Model aircraft is flown very far past the left-hand and/or right-hand marker flags, zero points.
- Only two scores, a zero or a 10, may be awarded for the take-off sequence.

P-05.02 **Reverse Cuban eight, 4/8pt. roll first, 2/2pt. roll second, exit inverted:** Pull to a 45 degree upline, execute four points of an eight-point roll, followed by a three-fourths inside loop and a two-point roll on the second 45 degree line. Push through 5/8 of an outside loop to exit inverted.

P-05.03 **Stall turn, 2/4pt. roll up, negative snap-roll down:** Push vertical and perform two points of a four-point roll followed by a stall turn. On the downline perform a negative snap-roll, then pull to level flight.

Judging notes:

- Snap-roll must be negative.

P-05.04 **Reversed four-point roll:** On a horizontal line perform two points of a four-point roll, followed by two points of a four-point roll in the opposite direction.

P-05.05 **Half square loop, full roll up, exit inverted:** Pull vertical and perform a full roll, pull to exit inverted.

P-05.06 **Inverted triangle loop, with half rolls, exit inverted:** Pull through 135 degrees to a 45 degree downline and perform a half roll. Push through 90 degrees to a 45 degree upline, perform a half roll, and pull to exit inverted.

P-05.07 **Two turn inverted spin:** Perform two consecutive inverted (negative) spins, then pull to level flight.

Judging notes:

- Snap-roll entry, zero points.
- Forced entry, downgrade.

P-05.08 **Loop with full roll on top:** Pull up and complete an inside loop. In the top 90 degree quadrant of the loop perform a full roll, integrated with the loop.

P-05.09 **Half clover, 2/4pt- roll up, half roll down, exit inverted:** Pull to a vertical upline and perform two points of a four-point roll. Push into ¾ outside loop, fly inverted, push into a second ¾ outside loop, followed by a half roll on the downline. Push to exit inverted.

Judging notes:

- Upline and downline must coincide.

P-05.10 **45 degrees up with 4pt. roll, exit inverted:** Push to a 45 degree upline and perform a four-point roll. Pull to exit inverted.

P-05.11 **Reverse humpty bump, pull-push-push, with options:** Pull to a vertical downline and perform two points of a four-point roll (or alternatively three points of a four point roll). Push through a half outside loop to a vertical upline and perform a half roll (or alternatively a quarter roll). Push to recover upright.

P-05.12 **Reverse double immelmann, full roll first, 2/4pt. roll second, exit inverted:** Push to a half outside loop, followed immediately by a full roll, fly inverted, then push to a half outside loop, followed immediately by two points of a four-point roll to exit inverted.

Judging notes:

- The straight inverted flight is equal to the diameter of the half outside loops.

P-05.13 **Half of a reverse Cuban eight, with half rolls:** Push to a 45 degree downline and perform a half roll, followed by ¾ of an inside loop. On the second 45 degree downline, perform a half roll, then pull to recover upright.

P-05.14 **Square loop, with half rolls and 2/4pt. rolls:** Pull to a vertical upline and complete a square loop. In each of the vertical legs, perform a half roll, and in the horizontal legs two points of a four-point roll.

P-05.15 **Half reverse Cuban eight, with full roll, exit inverted:** Pull to a 45 degree upline and perform a full roll. Push through 5/8 of an outside loop to exit inverted.

P-05.16 **Four points of an 8pt. roll, slow roll opposite:** On a horizontal line, perform four points of an eight-point roll from inverted, followed immediately by a slow roll in the opposite direction.

P-05.17 **Figure 9, positive snap-roll up, exit inverted:** Pull to a vertical upline, perform a full positive snap-roll, then push to ¾ of an outside loop to exit inverted.

P-05.18 **Vertical eight, with half roll integrated with the loops:** Push to complete a full outside loop, then perform a half roll, followed by a full outside loop directly under the first outside loop, to recover upright. The half loop must be integrated with the last 1/8 quadrant of the first outside loop, and the first 1/8th quadrant of the second outside loop.

P-05.19 **Split S, with full roll, exit inverted:** Perform a full aileron roll, followed immediately by a half outside loop, to exit inverted.

Judging notes:

- The half outside loop is immediately after the roll.

P-05.20 **Four-point roll from inverted, exit inverted:** From level inverted flight perform a four-point roll, to recover in level inverted flight.

P-05.21 **Half square outside loop with 2/4pt. roll up, exit inverted:** From level inverted flight push to a vertical upline and perform two points of a four-point roll, then pull to exit inverted.

P-05.22 **Two two-turn inverted spins, opposite from inverted, half roll exit:** From inverted, perform a two-turn inverted spin then immediately perform a two-turn inverted spin in the opposite direction. Hold a vertical downline, then push to level inverted flight followed by a half roll to recover upright.

Judging notes:

- Snap-roll entry, zero points.
- Forced entry, downgrade.
- The spin reversal is immediate.
- The exit half roll is part of the manoeuvre.

P-01.23 **Landing sequence:** At reduced power, execute a 180 degree level or descending turn within the aerobatic zone to a downwind heading. Fly a downwind leg, with the model aircraft upright. When approximately over the downwind marker, turn 180 degrees toward the runway, and fly a descending approach to the runway, touching down in the landing zone. The landing sequence is complete when the model aircraft has either rolled 10 meters or comes to rest, if within 10m.

Judging notes:

- Model aircraft does not follow landing sequence, zero points.
- Turns which are not either level or descending will be cause for awarding a zero score for the landing.
- If any landing gear leg retracts on landing, zero points.
- If the model aircraft lands anywhere outside the landing zone before the landing is completed, zero points. The landing zone is designated by a circle of 50m radius or lines across a standard runway spaced 100 metres apart where the runway is at least 10m wide.
- Only two scores, a zero or a ten, may be awarded for the landing sequence

PRELIMINARY SCHEDULE P-07

P-07.01 **Take-off sequence.** See P-05.01.

P-07.02 **Half clover, with 4pt. roll up and 2/4pt. roll down.** Pull to a vertical upline and perform two points of a four-point roll. Push into ¾ outside loop, fly inverted, push into a second ¾ outside loop, followed by a half roll on the downline. Pull to recover in level flight.

Judging notes:

- Upline and downline must coincide.

P-07.03 **Half square loop on corner, with half rolls, exit inverted:** Pull to a 45 degree upline and perform a half roll. Push through 90 degrees to a 45 degree upline and perform a second half roll, then pull to a level inverted exit.

P-07.04 **Reverse Cuban eight from top, 4/8pt. roll and 2/4pt. rolls in uplines, exit inverted:** From inverted, pull to complete 5/8 of an inside loop, then perform four points of an eight-point roll on the 45 degree upline. Pull through a ¾ inside loop and on the second 45 degree upline, perform two points of a four-point roll, then pull to exit inverted.

P-07.05 **Half reverse Cuban eight, from top, with 2/2pt. roll:** From inverted, pull to a 45 degree downline and perform two points of a two-point roll. Then push through a 5/8 outside loop to recover in level flight.

P-07.06 **45 degrees down with 1 ½ positive snap rolls, exit inverted:** Push to a 45 degree downline, and perform one and one half positive snap rolls. Push 45 degrees to exit inverted.

Judging notes:

- Snap rolls must be positive.

P-07.07 **Push-push-push humpty bump with half roll or ¼ roll options, exit inverted:** Push to a vertical upline and perform a half roll (or alternatively a quarter roll), then push through a half outside loop to a vertical downline (and perform a second quarter roll) and push to exit inverted.

P-07.08 **Eight-point roll from inverted, exit inverted:** From inverted on a horizontal line, perform an eight-point roll, to exit inverted.

P-07.09 **Stall turn, half roll up, 2/2pt. roll down:** Push to a vertical upline and perform a half roll, followed by a stall turn. On the downline perform a two points of a two-point roll and pull to recover upright..

P-07.10 **Loop with 4-point roll on top:** Pull up to complete a loop. In the top 90 degree quadrant of the loop, perform a four-point roll, integrated with the loop.

P-07.11 **Immelmann turn:** Pull to complete a half inside loop, followed immediately by a half roll to exit upright.

Judging notes:

- The half roll must be immediately after the half loop.

P-07.12 **Square loop on corner from top, with half rolls:** Push to a 45 degree downline to complete a full square loop on corner. In each of the sides, perform a half roll.

P-07.13 **Figure 6 with half roll:** Push to a vertical downline and perform a half roll, followed by ¾ of an outside loop to recover upright.

P-07.14 **Hourglass, mid-entry, with 2/4pt. roll down, exit inverted:** Pull to a 45 degree upline, pull 135 degrees to horizontal inverted, pull 135 degrees to a 45 degree downline and perform two points of a four-point roll, pull 135 degrees to horizontal, pull 135 degrees to a 45 degree upline, then pull 45 degrees to exit inverted on the same level as that of entry.

P-07.15 **Half vertical eight:** Push to complete a full outside loop, followed by a half inside loop directly below the outside loop to recover upright.

P-07.16 **Reverse knife-edge, exit inverted:** On a horizontal line, perform a quarter roll to knife-edge and fly a straight line. Roll 180 degrees in the opposite direction and fly a second line in knife-edge flight, then perform a quarter roll in the same direction to exit inverted.

Judging notes:

- The knife-edge segments are of equal length and duration and must be long enough to demonstrate controlled, sustained knife-edge flight.

P-07.17 **Half square outside loop, 2/4pt. roll up:** Push to a vertical upline and perform two points of a four-point roll, them pull to exit inverted.

P-07.18 **2 ½ turns inverted spin:** Perform two and a half consecutive inverted (negative) spins, then pull to level flight.

Judging notes:

- Snap entry, zero points.
- Forced entry, downgrade.

P-07.19 **Half horizontal hourglass, half roll and 2/2pt. rolls opposite in uplines:** Pull to a 45 degree upline and perform a half roll. Pull 135 degrees to a vertical downline, pull 135 degrees to a 45 degree upline and perform two points of a two-point roll in opposite direction, then push to recover upright.

P-07.20 **Horizontal eight from top, with half rolls:** Push to complete ¾ of an outside loop, perform a half roll, integrated with the last 1/8 quadrant of the first loop and the first 1/8 quadrant of the following loop, then push to complete a full outside loop directly behind the first outside loop, perform a half roll, integrated with the last 1/8 quadrant of the loop and the first 1/8 quadrant of the following part-loop, and push to recover upright.

Judging notes:

- The two outside loops are round with the half rolls integrated with the loops.

P-07.21 **Half outside loop with full roll, exit inverted:** Push to complete a half outside loop, followed immediately by a full roll, to exit inverted.

Judging notes:

- The full roll must be immediately after the half outside loop.

P-07.22 **Six-sided loop, with 2/4pt. roll on top:** Push to a 60 degree upline and complete a six-sided loop. In the top leg, perform two points of a four-point roll.

P-07.23 **Landing sequence**: See P-05.23.

FINALS SCHEDULE F-05

F-05.01 **Take-off sequence:** See P-05.01.

F-05.02 **Rolling loop with one roll:** Pull to complete a loop, with a full roll integrated with the entire loop.

F-05.03 **Half square loop on corner with 2/4pt. rolls, exit inverted:** Pull to a 45 degree upline and perform two points of a four-point roll. Push through 90 degrees to a 45 degree upline and perform two points of a four-point roll, then pull to exit inverted..

F-05.04 **Reverse humpty bump with positive snap-roll down and full roll up, exit inverted:** Before centre, pull to a vertical downline and perform a positive snap-roll, followed by a half outside loop to a vertical upline. Then perform a full roll and push to exit inverted.

Judging notes:

- Snap-roll must be positive.

F-05.05 **Figure 6 with half roll, exit inverted:** Pull to a vertical downline and perform a half roll, followed by ¾ of an inside loop to exit inverted.

F-05.06 **Inverted hourglass, mid-entry, with 2/4pt. roll down:** Push to a 45 degree upline, push 135 degrees to horizontal, push 135 degrees to a 45 degree downline and perform two points of a four-point roll, push 135 degrees to inverted horizontal, push 135 degrees to a 45 degree upline, then push 45 degrees to recover upright on the same level as that of entry.

F-05.07 **2 ½ turns positive spin:** Perform two and a half consecutive positive spins, then pull to level flight.

Judging Notes:

- Snap roll entry, zero points.
- Forced entry, downgrade.

F-05.08 **Reverse knife-edge, exit inverted:** On a horizontal line, perform a quarter roll to knife-edge and fly a straight line. Roll 180 degrees in the opposite direction and fly a second line in knife-edge flight, then perform a quarter roll in the same direction to exit inverted.

Judging notes:

- The knife-edge segments are of equal length and duration and must be long enough to demonstrate controlled, sustained knife-edge flight.

F-05.09 **Stall turn, 2/8pt. roll up, 3/4pt. roll down:** From inverted push to a vertical upline and execute two points of an eight-point roll, followed by a stall turn. On the downline, perform three points of a four-point roll and pull to recover upright.

F-05.10 **Square horizontal eight:** Pull up after centre and complete a square inside loop. Directly behind the inside loop, complete a square outside loop, and pull to recover upright.

F-05.11 **Half roll, half outside loop, full roll:** Perform a half roll to inverted, then push to complete a half outside loop, followed immediately by a full roll, to exit upright.

Judging notes:

- The half roll and full roll are immediately before and after the half outside loop.

F-05.12 **Reverse avalanche with 1 ½ negative snap rolls, exit inverted:** Push to a half outside loop with one and a half negative snap rolls at the bottom, then pull through a half loop to exit inverted.

Judging notes:

- Snap rolls must be negative.

F-05.13 **Reverse humpty bump with options, pull-push-push:** Pull to a vertical downline, perform two points of an eight-point roll (or alternatively two points of a four-point roll), then push through a half outside loop to a vertical upline, perform a quarter roll (or alternatively a half roll), then push to recover upright.

F-05.14 **Reverse golf ball from top, with half rolls:** Push to a 45 degree downline, perform a half roll, pull through ¾ of an inside loop to a 45 degree upline, perform a second half roll and push to recover upright..

F-05.15 **Half square outside loop, with positive snap-roll down, exit inverted:** Push to a vertical downline and perform a positive snap-roll, then push to exit inverted.

Judging notes:

- Snap-roll must be positive.

F-05.16 **Reverse 4-pt. roll, inverted to inverted:** On a horizontal line from inverted perform three points of a four-point roll in one direction, followed by three points of a four-point roll in the opposite direction, to exit inverted.

F-05.17 Rolling half outside loop with full roll: Push to complete a half outside loop, with a full roll integrated with the half loop.

F-05.18 45 degree down, with 2/4pt. roll and negative snap-roll opposite, half roll exit: Push to a 45 degree downline and perform two points of a four-point roll, followed immediately by a negative snap-roll in the opposite direction. Push to inverted, and perform a half roll to recover upright.

Judges notes:

- Snap roll is immediately after 2/4pt. roll
- Snap roll must be in the opposite direction to the 2/4pt. roll.
- Snap roll must be negative.
- Exit half roll is part of the manoeuvre.

F-05.19 Landing sequence: See P-05.23.

FINALS SCHEDULE F-07

F-07.01 Take-off sequence: See P-05.01.

F-07.02 Pull-push-push humpty bump, 4/8pt. roll up, positive snap-roll down, exit inverted: Pull to a vertical upline and execute four points of an eight-point roll. Push through a half outside loop to a vertical downline and perform a positive snap-roll, then push to exit inverted.

Judging notes:

- Snap-roll must be positive.

F-07.03 Half of a reverse Cuban eight, half roll and 2/4pt. rolls in uplines: Push to a 45 degree upline and perform a half roll. Push through ¾ of an outside loop to a 45 degree upline and perform two points of a four-point roll, then push to recover upright.

F-07.04 Reverse double avalanche: Push to complete an outside loop. At the bottom perform a negative snap-roll, and at the top a positive snap-roll.

Judging notes:

- Snap rolls must be negative and positive respectively.

F-07.05 Half square outside loop, 2/2pt. roll opposite, exit inverted: Push to a vertical downline and perform two points of a two-point roll in opposite directions. Push to exit inverted.

Judging notes:

- The reversal of the 2-pt. rolls must be immediate.

F-07.06 Rolling figure S, with opposite half rolls, exit inverted: Push to complete a half outside loop, followed immediately by a second half outside loop directly above the first to exit inverted. In each half outside loop, perform a half roll (opposite direction) that is integrated with the half loop.

Judging notes:

- Half loops must be round.
- Half rolls must be continuous and integrated with the half loops.
- Half rolls must be in opposite directions.

F-07.07 Negative snap-roll, half loop: From inverted, perform a negative snap-roll, followed immediately by a half inside loop, to recover upright

Judging notes:

- Snap-roll must be negative.
- Half loop is immediately after snap-roll.

F-07.08 Slow roll from knife-edge, exit inverted: On a horizontal line perform a quarter roll to knife-edge, then perform a slow roll in the opposite direction to a knife-edge position, followed by another quarter roll in the

opposite direction to the slow roll, to exit inverted.

Judging notes:

- Knife-edge positions need to be demonstrated only briefly.

F-07.09 **Stall turn, 4/8pt. roll up, full roll down:** Push to a vertical upline and perform four points of an eight-point roll, followed by a stall turn to a vertical downline, perform a full roll down and pull to recover upright.

F-07.10 **Rolling circle, two rolls reversed:** Perform a rolling circle away from the runway, with two rolls in opposite directions. The first roll is to the outside and the second to the inside of the circle to recover upright, at the same point as entry.

Judging notes:

- Roll rate must be constant
- Roll reversal must be immediate.
- Circle must be of constant radius and wind corrected.
- Manoeuvre must be downgraded if the circle is too large and too far out.

F-07.11 **Pull-push-pull humpty bump, with roll options:** Pull to a vertical upline (and as an option, perform a quarter roll), push through a half outside loop to a vertical downline, perform a half roll (or alternatively a quarter roll) and pull to recover upright.

F-07.12 **Spinning half loop, 2 ½ negative spins, exit inverted:** Pull into a half loop, gradually reducing power. Perform two and a half consecutive inverted (negative) spins, then push to exit inverted.

Judging notes:

- Snap-roll entry, zero points.
- Forced entry, downgrade.

F-07.13 **Half square loop on corner, with half rolls, exit inverted:** Push to a 45 degree upline and perform a half roll. Pull through 90 degrees to a 45 degree upline and perform a second half roll, then push to recover upright.

F-07.14 **Reverse cobra roll with 2/4pt. rolls:** Push to a 45 degree downline and perform two points of a four-point roll, then push through 90 degrees to a 45 degree upline, followed by two points of a four-point roll. Push to recover upright.

F-07.15 **Rolling half loop, exit inverted:** Push to complete a half outside loop, with a full roll integrated with the half loop, to exit inverted.

F-07.16 **Four-point roll from inverted, exit inverted:** From level inverted flight perform a four-point roll, to recover in level inverted flight.

F-07.17 **Top hat with 3/4pt. roll up and ¾ roll down, exit inverted:** Push to a vertical upline and perform three points of a four-point roll, pull to level inverted flight, pull to a vertical downline and perform a three-quarter roll, then push to exit inverted.

Judging notes:

- Horizontal cross-box leg must be inverted
- Inverted cross-box horizontal leg needs to be only very brief.

F-07.18 **45 degree up with 1 ½ negative snap-roll:** From inverted push to a 45 degree upline, perform one and a half negative snap-roll, then push to recover upright.

Judging notes:

- Snap rolls must be negative.
- Exit altitude is at a higher flight level.

F-07.19 **Landing sequence:** See P-05.23.

ANNEX 5B

F3A R.C. AEROBATICS JUDGES' GUIDE

5B.1. **Purpose:** The purpose of the FAI F3A Judges' Guide is to furnish an accurate description of the major classes of aerobatic manoeuvres and their judging criteria as reference for use in developing a uniformly high, accurate, and consistent standard of judging.

5B.2. **Principles:** The principles of judging the performance of a competitor in a R/C Aerobatic competition is based on the perfection with which the model aircraft executes the aerobatic manoeuvres as described in Annex 5A. The main principles used to judge the degree of perfection are:

1. Precision of the manoeuvre.
2. Smoothness and gracefulness of the manoeuvre.
3. Positioning or display of the manoeuvre.
4. Size of the manoeuvre, relative to the manoeuvring area and other manoeuvres in the flight.

The above requirements are listed in order of importance. However, all of them must be met for a manoeuvre to receive a high score.

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 followed by 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.

5B.4. CRITERIA FOR JUDGING MANOEUVRES

In Annex 5A, a description of each manoeuvre is given, with judging notes with some manoeuvres. 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.
4. The positioning of the manœuvre.
5. The size of the manœuvre, relative to the manoeuvring area and relative to other manoeuvres being flown.

A high score should be given only if no major defects are found and the manoeuvre is well positioned. When in doubt, give the lower score.

5B.4.1. 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.4.2. THE 1 POINT/15 DEGREE RULE

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

5B.4.3. GRADING CRITERIA FOR THE INDIVIDUAL MANOEUVRES

These criteria are furnished to provide the judge with a guide for downgrading deviations from the defined manoeuvre geometry. The manoeuvres are divided into their different components; lines, loops, rolls, stall-turns, snap-rolls, spins and loop/roll combinations.

5B.4.3.1 LINES

All aerobatic manoeuvres are started and ended by a horizontal line. When no 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.

The total length of a vertical or climbing line, as dictated by the performance of the model aircraft, is not a grading criterion. The performance of the model aircraft must not be allowed to influence a judge's mark.

All lines within a manoeuvre have a beginning 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 several lines with a given relationship, as in a square loop. If there is a minor mis-relation, 1 point is subtracted, and more points are subtracted for greater defects.

Whenever a type of roll is placed on a line, the length of the line before and after the roll must be equal. One point is subtracted for a reasonable difference, and two points for a greater difference. If there is a complete absence of a line before or after the roll, 3 points are subtracted.

5B.4.3.2. LOOPS

A loop must have, by definition, a constant radius, and must be flown in the vertical plane throughout. It starts and ends 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 being flown.

The 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 differences may downgrade it by 2 or 3 points for each occurrence.

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

If the loop is not flown entirely in the vertical plane, i.e. 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, higher marks must not be awarded for flying tight, high G corners. The main criteria is that the loop must have the sides at the correct angles for the defined number of times, and all part-loops must have the same radius.

5B.4.3.3. ROLLS

Rolls may be flown as individual manoeuvres, or as parts of other manoeuvres. The following criteria apply to all rolls:

a) The rate of roll must be constant. Small variations in roll-rate must be downgraded by 1 point, while more severe variations must receive heavier downgrades. Slowing down the roll rate towards the end of a roll must be downgraded using the 1 point/15 degree rule.

b) The roll must have a crisp and well-defined start and stop. If a start or stop is badly defined, 1 point is subtracted for each.

c) All rolls flown on lines between part-loops must be placed on the middle of that line. For downgrading, see 4.3.1.

d) Point-rolls must have the same roll rate, and the points must be of equal duration on each point. One point is subtracted for slight variations, while more severe mis-timing is further downgraded. If one or more point is not visible, or there are more than the required number of points, the manoeuvre is severely downgraded by 5 or more points.

5B.4.3.4. 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, 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 1/2 wingspan, one point is

subtracted. For a radius of pivot up to one wingspan, 2 points are subtracted, and if the radius exceeds 1 ½ wingspan, the manoeuvre is severely downgraded. A radius of pivot of 2 wingspans or more is considered a wing-over and a zero score must be awarded. If the model aircraft should "torque-off" during the stall turn, a downgrade must be applied using the 1-point/15 degree rule. If the model aircraft flops forward or backward in a stall turn, a zero score must be awarded.

If the model aircraft shows a pendulum movement after the pivot, the manoeuvre is downgraded by one point. Drift of the model aircraft during the stalled condition must be ignored, provided the model aircraft does not drift outside the aerobatic zone.

The entry and exit must consist of part-loops with constant and equal radius.

Any types of rolls must be placed on the middle of the lines. The length of the vertical lines is not a judging criteria.

5B.4.3.5. **SNAP-ROLLS**

A snap-roll (or rudder roll) is a rapid autorotative roll where the model aircraft is in a stalled attitude.

Snap-rolls have the same judging criteria as axial rolls as far as start and stop of the rotation, and constant flight path through the manoeuvre is concerned.

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

Snap-rolls can be flown both positive and negative, and the same criteria apply. If the model aircraft returns to an unstalled condition during the snap-roll, the manoeuvre is severely downgraded.

5B.4.3.6. **SPINS**

All spins begin and end 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 is cause for downgrading. A climbing flight path just prior to the spin must be downgraded, using the 1-point/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 aerobatic zone.

If the model aircraft does not stall or if the model aircraft is snap-rolled into the spin, the manoeuvre is zeroed. If the model aircraft slides into the spin (is loathe 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.

After the defined number of turns, the stop of rotation is judged in the same manner as for a roll, i.e. one point downgrade for each 15 degree deviation of heading.

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. Remember that different models spin in different attitudes, and that 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.

5B.4.3.7. **LOOP/ROLL COMBINATIONS**

These combinations are used extensively in centre manoeuvres turn-around manoeuvres. They are very diversified, but all are combinations of loops, part-loops, rolls, point-rolls, part rolls, snap-rolls and lines. All judging criteria for these apply.

There are, however, some judging criteria which should be explained further. In the Immelmann turn and split S manoeuvres and variations, the half roll, snap-roll, point-roll, or full roll should be performed immediately after or before the half loop as required by the particular manoeuvre. A visible line in between the two components must downgrade the manoeuvre by 2 points.

On half Cuban eights and half reverse Cuban eights, the roll or point-roll should be placed on the middle of the line. The radii of the part-loops must all be the same.

In humpty-bumps, the radius of the part-loop on the top (or bottom) and the exit part-loop must be constant, and be the same as that of the entry part-loop. Falling forward (or tight radius) must be downgraded.

5B.4.4. **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 grading criteria are in the stall turns, and spins, where the model aircraft is in a stalled condition.

5B.4.5. **POSITIONING**

The entire flight must be within the aerobatic zone to avoid being penalised. A centre manoeuvre must be flown with its centre 90 degrees in front of the judges line. 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.

If an entire manoeuvre including entry and exit is flown out of the aerobatic zone, it must be zeroed. Downgrades for flying a manoeuvre partially out of the zone should be in proportion to the degree of infraction, i.e. a small part of the manoeuvre (10%) flown past the 60 degree line would call for a minor downgrade (10%), perhaps one point, while more of the manoeuvre (say 30% or 40%) flown past the 60 degree line must be downgraded more severely (30% or 40%), say three or more points. Also, violations of the 60 degree line that occur near the 150 metre line (i.e. approximately over the 60 degree flags) should be downgraded much less severely than violations along a line further out and more distant from the judges.

Vertical height should not exceed 60 degrees and downgrades for flying a manoeuvre partially out of the zone should be in proportion to the degree of infraction as stated above.

Flying so far out as to make evaluation of a manoeuvre difficult should be severely downgraded. The main criteria 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 competitor must be downgraded under any circumstances as even the keenest eye begins to lose perspective at this distance. Manoeuvres performed on a line greater than 200m in front of the competitor must be downgraded severely.

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.

5B.4.6. **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.

A 4-point roll is started late and ends up slightly off-centre and the third point is not visible. 10 – 1 – 6 = 3 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. 10 – 10 = 0 points.

On the downwind leg of a landing sequence, a knife-edge pass is performed. This must be considered as “hot-dogging”. 10 – 10 = 0 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.

During the take-off sequence, the model aircraft runs off the runway, is retrieved by the helper and a successful take-off is performed. 10 – 10 = 0 points. Only one attempt at a manoeuvre is allowed and a second attempt at taking-off must be scored zero.

The competitor starts a flight by taking-off from left to right, completes the flight and discovers that the wind has changed, and lands from right to left. 10 – 10 = 0 points. This instance would indicate that the landing sequence was not followed. In some cases the contest director may call for a landing from the other direction if

there were a strong change in wind direction, and safety would be compromised with a down-wind landing. In such a case, the landing would be scored a 10.

In the middle of a double Immelmann, which is 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, including the landing sequence.

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 a roll on top has the roll performed rapidly with no attempt by the competitor to integrate to roll with the top 90 degree quadrant of the loop. 10 – 3 = 7 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 competitor flies a flawless 8-point roll. 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 competitor 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 competitor performs a manoeuvre other than that stated on the score sheet. 10 – 10 = 0 points.

After this incident, the competitor 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, so that only one stall turn is visible. Score = N/O. The competitor will probably be awarded a reflight of the manoeuvre affected.

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.