

## ANNEX 5F

### F3N MANOEUVRE DESCRIPTIONS AND DIAGRAMS

#### 5F.1 F3N SET MANOEUVRE DESCRIPTIONS

- (a) The list of Set Manoeuvres contains 30 manoeuvres (listed below) and ten optional manoeuvres. The optional manoeuvres must be selected by the organiser at least 6 months prior to the competition from a list that is available from the F3 Helicopter Subcommittee Chairman. This list will be revised by the F3 Helicopter Subcommittee on a yearly basis and will be approved by the CIAM Bureau.
- (b) The competitor or his caller must announce the name and start and finish of each manoeuvre. All aerobatic manoeuvres start and end with a straight and level flight of 10 metres minimum length parallel to the judges' line. All manoeuvres from stationary flight start and end with a hovering of at least 1 second with the MA parallel or vertical to the flight line. All manoeuvres (considering also entry and exit) should be performed symmetrical to the centre line. The drawings in paragraph 5.11.12 illustrate the manoeuvres, in case of a dispute the following text takes precedence over the drawings. All manoeuvres can also be flown in opposite direction to that shown in the drawings.

Number	Description	K-Factor
1.1.	<p><b>Double Immelmann</b></p> <p>MA performs a half inside loop immediately followed by a half roll to upright flight. After a straight flight of about 20 meters MA performs a half outside loop, again immediately followed by a half roll to upright flight.</p>	<b>K=4.0</b>
1.2	<p><b>Double roll backwards</b></p> <p>MA enters in upright backward flight and performs two consecutive axial rolls.</p>	<b>K=4.5</b>
1.3	<p><b>4-point roll</b></p> <p>MA enters in upright forward flight and then performs 4 quarter rolls, separated each by a recognizable straight segment of the same duration.</p>	<b>K=4.5</b>
1.4	<p><b>Outside loop with half rolls</b></p> <p>MA performs a half roll to inverted flight, followed by a recognizable straight segment and then enters an outside loop (upward). After the loop, MA flies another recognizable straight segment, followed by a half roll to upright flight.</p>	<b>K=5.0</b>
1.5	<p><b>Inverted horizontal eight</b></p> <p>MA enters in inverted forward flight parallel to the judges' line, performs a 90°-turn to a straight flight above the centre line and then performs a horizontal eight, consisting of two 360° circles.</p> <p>The manoeuvre is not intended as a hover manoeuvre. In case of low flying speed and banking angle less than 45deg, severe downgrade will apply.</p>	<b>K=6.0</b>
1.6	<p><b>Backward knife edge pirouette</b></p> <p>MA enters in upright backward flight, transitions to a slight ascent (max 15°) and performs a quarter roll. After a recognizable straight segment MA performs a 360°-pirouette, followed by another straight segment and a quarter roll in opposite direction to the first to upright backward flight.</p>	<b>K=5.5</b>
1.7	<p><b>Four pushed half flips</b></p> <p>MA hovers in upright position, then performs four half pushed flips (forward) each separated by a hovering of 2 seconds. MA maintains its position during the manoeuvre.</p>	<b>K=5.5</b>
1.8	<p><b>Tic-toc (Metronome)</b></p> <p>MA hovers and then is rotated (Nose up) about 135°. It then starts rotating alternately about the lateral axis by about 90° forward or backward. Both 45° positions have to be reached at least three times. The tail rotor stays almost in the same position during the manoeuvre.</p>	<b>K=6.0</b>
1.9	<p><b>360°-turn with roll</b></p> <p>MA enters in upright forward flight in the center of the window and then after a straight and level flight section performs a quarter (inside) loop to a vertical climb. Just before the stall, MA performs a 360°-pirouette to a vertical (backward) dive, followed by another quarter (inside) loop to upright flight and an axial backward roll centered on the main judge's line.</p>	<b>K=6.0</b>

Note 1: The 1/4 input and output loop must be the same size.

Note 2: The exit must be at the same height as the entrance.

Note 3: Axial backward roll, must not have a straight line after 1/4 of loop and must be centered on the centreline of the window.

- 1.10 Standing 8** **K=8.0**  
 MA enters in forward upright flight parallel to judge line. After passing centerline, MA performs half inside loop, followed by half outside loop. MA is now at the top of the standing 8 on the centerline, and performs fast half pirouette. MA now performs half outside backwards loop, followed by half inside backwards loop. MA is now back to starting point on centerline, and exits in backwards upright flight. All loop segments must have same radius.
- 1.11 Spike** **K=7.0**  
 MA enters in upright forward flight. MA performs a 2-point half roll, followed by minimum 10m inverted flight. MA then performs  $\frac{1}{4}$  outside loop and ascends vertically. MA then descends vertically and performs  $\frac{1}{4}$  inside backwards loop with same radius as before, followed by minimum 10m upright backwards flight. MA then performs a 2-point half roll, and exits in backward inverted flight on the same line as the manoeuvre was started.
- 1.12 Inverted backwards horizontal eight** **K=7.0**  
 MA enters in inverted backward flight parallel to the judges' line, performs a 90°-turn to a straight flight above the centre line and then performs a horizontal eight, consisting of two 360° circles with the tail always pointing in flight direction.  
 The manoeuvre is not intended as a hover manoeuvre. In case of low flying speed and banking angle less than 45°, a severe downgrade will apply.
- 1.13 Rolling circle** **K=7.5**  
 MA performs a horizontal circle while it performs consecutive axial rolls. MA speed, rolling rate and the radius of the circle should be constant.
- 1.14 4 rainbows with half rolls** **K=7.5**  
 MA performs a rainbow (a semicircle with the lateral axis always vertical to the flight path) to a recognizable stop, then a stationary half roll to another stop. Then it enters another rainbow to a stop on the position of the start of the manoeuvre, followed by another half roll and continues like that, until four rainbows and four half rolls are completed.
- 1.15 Funnel** **K=7.5**  
 MA enters in inverted flight and performs a quarter pirouette. MA then performs three superimposed circles in lateral inverted flight with the rotor disk tilt at least 45 degree from a horizontal plane. The diameter of the circles should be at least 10 meters.
- 1.16 Tumbling Circuit** **K=8.0**  
 MA enters in backwards upright flight parallel to judge line. Before passing centerline MA performs  $\frac{1}{4}$  backward inside loop, which stops on the centerline. MA then completes a horizontal circle while doing sequence of half forward outside loops and half backward inside loops. Circle must include a minimum 4 of these sequences distributed equally. When passing centerline again, MA performs  $\frac{1}{4}$  forward outside loop, and exits in forward inverted flight on same line as manoeuvre was started.
- 1.17 Triple pirouetting flip** **K=7.5**  
 MA hovers on centreline and then starts pirouetting. At the same time or after one pirouette the MA starts to flip three times while it continues to perform pirouettes continuously. There should be at least one pirouette during each 360° flip (2 pirouettes are shown only as an example in the drawing). MA finishes by stopping in the same hover position and orientation as the starting point. Pirouettes and rotations should have a constant rate.
- 1.18 Cuban eight backwards** **K=8.0**  
 MA enters in upright backward flight and performs a 5/8 inside loop to a 45° downline. The MA performs a half roll centred on the downline, followed by a  $\frac{3}{4}$  inside loop and another half roll centred in the 45°downline. MA then finishes the first partial loop to upright backward flight. The tail of the MA should always point in the direction of flight.

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- 1.19 Pirouetting loop** **K=8.0**  
 MA enters in upright flight and starts performing pirouettes when reaching the centreline. The MA then performs an inside loop while constantly performing pirouettes about the yaw axis. During the one loop there must be at least 2, but not more than 6 pirouettes. The pirouettes should be distributed equally through the loop and stop on centreline before exiting.
- 1.20 Backward rolling circle** **K=9.0**  
 MA enters in upright backward flight and performs a horizontal circle while it performs consecutive axial rolls. MA speed, rolling rate and the radius of the circle should be constant. The tail of the MA should always point in the direction of flight. Rolling should start and stop on centreline. MA exits in backward upright flight.
- 1.21 Waltz** **K=8.5**  
 MA enters in inverted flight and on centreline immediately performs a quarter pirouette, tail rotates to circle centre and enters a funnel. After a quarter funnel MA performs a complete smaller funnel (max. half diameter of the first) then continues with another quarter larger funnel, followed again by a complete smaller funnel etc. After the larger funnel is completed there is again a complete smaller funnel, followed immediately on centreline by another quarter pirouette to the exit in inverted flight. The diameter of the large funnel should be at least 20 meters.
- 1.22 Double 4-point Tic-toc** **K=8.0**  
 MA hovers tail in on centreline and is then rotated nose up by pulled flip to approx. 135°. It then starts rotating alternately about the lateral axis for about 45° in each direction. Both 45°-positions have to be reached one time for one tic-toc. The MA then rotates by 90° on a clock face. It performs another tic-toc in this position, then again performs another 90° rotation and so on, until it has performed two complete rotations of a clock face while executing tic-tocs. The MA should describe a circular shape during the manoeuvre. The 90° rotations can be performed either when the model reaches one of the two end positions, or integrated in the movement back, before the next tic-toc is performed.
- 1.23 Pirouetting funnel** **K=8.5**  
 MA enters in inverted flight and then starts pirouetting whereas it performs three superimposed circles in lateral inverted flight with the rotor disk tilt at least 45 degree from a horizontal plane. The diameter of the circles should be at least 10 meters and there should be at least three pirouettes during each circle. MA exits in inverted flight.
- 1.24 Four point tic-toc reversal** **K=9.0**  
 MA hovers on centreline tail in and is then rotated nose up by pulled flip to 135°. It then starts rotating alternately about the lateral axis for about 45° in each direction. Both 45°-positions have to be reached one time for one tic-toc. The MA then rotates by 90° clockwise on a clock face. It performs another tictoc in this position, then again performs another 90° rotation and so on, until it has performed one complete rotation of a clock face while executing tic-tocs. The MA now immediately begins a full rotation in the opposite direction, following the same tic toc steps. The MA should describe a circular shape during the manoeuvre.  
 The 90° rotations can be performed either when the model reaches one of the two end positions, or integrated in the movement back, before the next tic-toc is performed.
- 1.25 Pirouetting globe** **K=9.0**  
 MA enters in upright flight and then performs four pirouetting loops. During each loop, the flight path is changed in a way, that the next loop is rotated about 45° (seen from above) until a complete globe has been described. The MA exits the manoeuvre at the same altitude but in opposite direction to the beginning. During each loop, the MA must perform at least two pirouettes. The pirouettes should be distributed equally through the loop.
- 1.26 Duus Iglo** **K=9.0**  
 Viewed from above, the manoeuvre shows an X. The centre point of the X is on the centreline. MA enters in 1 of the 4 outer points in the X in upright hovering and boom pointing to centre of the X. Model then performs half pulled rainbow, while also doing an integrated half pirouette. Top of rainbow must be at the centre of the X. MA then makes a sharp quarter aileron roll, and completes second half of the rainbow while making another integrated half pirouette until model hovers inverted shortly. The boom still points to centre of the X, but now in another of the 4 outer points. *cont/...*

Same sequence is then repeated 3 more times, until MA is back at the starting point. Hovering will be inverted after the first and third legs.

- 1.27 Rolling Circle Tail Reversal** **K=9.5**  
 MA enters in forward upright flight parallel to judge line. Immediately after passing centreline, MA starts a horizontal rolling circle. After each quarter of the circle, MA performs a half elevator flip. After each half flip the roll input direction must be changed. After a complete circle and the four half flips, MA exits in forward upright flight. Speed and height of MA should be constant during complete manoeuvre.
- 1.28 Funnel with half rolls** **K=9.5**  
 MA enters in inverted flight and performs a quarter pirouette. MA then performs three superimposed circles in lateral inverted flight with the rotor disk tilt at least 45 degree from a horizontal plane. After each half funnel except the last the MA performs a half roll centred on the centreline. After three funnels and five half rolls the MA exits in upright flight. The diameter of the circles should be at least 10 metres.
- 1.29 Pirorainbow X reversal** **K=11.0**  
 MA hovers over the centre line with an angle of 45°, then enters the manoeuvre with a rainbow, a not stationary flip that follows an arched flight path of at least 10 meters length. During the rainbow the MA performs one pirouette in each direction, with the reverse on the top of the rainbow. Then another rainbow (with pirouette reversal) leads back to the starting point. MA then continues with these rainbows rotating in 90° steps CW or CCW, until the four outer points of an X (viewed from above) are reached and MA hovers where it started the manoeuvre. MA does not perform any part of the pirouettes, when hovering in the centre. During the stops at the four outer points, rotor disk must be horizontal but there should be no hovering.
- 1.30 Vertical Tic Toc Eight** **K=10.5**  
 Model enters in upright forward flight and performs a quarter roll to knife edge on centreline, MA then performs a half tic-toc loop. On the top of the loop MA performs a half pirouette, and then continues up with another half tic-toc loop while keeping the tail in the flight direction. On top of this second circle MA performs a half roll. It completes the upper tic-toc loop with the tail in the flight direction. It then performs another half pirouette and completes the lower tic-toc loop with the nose in the flight direction. Model exists in upright forward flight. During the manoeuvre the longitudinal axis of the model always follows the flight path.

*The manoeuvre drawings appear on the next page.*