4.2. Description of Mandatory Maneuvers

Following is a list of the mandatory maneuvers that must be performed in the RC Sport Scale and Giant Scale events.

4.2.1. - Takeoff

The model should remain still or near still (according to whether the prototype had brakes) on the runway with the engine running after release by contestant or a helper or after a taxi maneuver. **The propeller will not stop before the takeoff run commences.** Takeoff should be into the wind and should begin with a straight ground run followed by a gentle liftoff with a climb angle consistent with that of the prototype. **Aircraft with conventional (tailwheel) gear might swing as the tail rises. Such swing must be corrected promptly with no loss of points.** Takeoff is completed when the model is approximately 10 feet from the ground. For maximum points, the model should use any scale operation that was required by the prototype to perform its normal takeoff. **Retractable gear, if equipped, commences as soon as positive rate of climb is established.**

Errors:

- Pilot or helper holds model after advancing the throttle to takeoff power.
- Electric powered propeller stops before takeoff run commences.
- Model swings on takeoff run (a slight swing should not be the cause of loss of points on light aircraft types with conventional (tail wheel) gear if it is corrected promptly).
- Model becomes airborne too soon.
- Takeoff run is too long.
- Model jumps off ground.
- Model climbs too steeply after takeoff.
- Model drops a wing badly during takeoff (should not be confused with aileron correction for crosswind).
- In the interest of safety, a takeoff may be aborted and restarted with a seven (7) point or 70% of maximum score on the first retry (and 70% for each subsequent retry) rather than given an automatic zero (0). For example, the maximum score that could be given would be seven (7) points after the first abort and first retry, the second retry after another abort is five (5) points (70% of 7), the third retry is 3.5 points (70% of 5), etc. The contestant is still on the clock for each retry.

4.2.2. - Figure Eight

This maneuver demonstrates pilot control of the aircraft. The model approaches in straight and level flight on a line parallel to the spectators' flightline, then a 90-degree turn is made in a direction away from and perpendicular from the spectators to the judges, followed by a 360-degree turn in the opposite direction, followed by a 270-degree turn in the first direction, completing the maneuver directly over the center of the landing circle centered on the judges, on the original approach line and at the same altitude as entry. The intersection (midpoint) of the maneuver shall be on a line that is at a right angle to the direction of entry, and passes through the center of the landing circle, centered on the judges, and at the entry altitude.

Errors:
- Entry not made parallel with spectator line.
- Rate of turn not constant in any half circle.
- Circles not same size.
- Model does not maintain constant altitude.

©FAI 2019
• Model does not complete 270-degree turn at point where first 90-degree turn was started.
• Finish not on the same heading or altitude as entry.
• Model does not begin and end in level flight.

4.2.3. - Fly-Past
The model shall fly straight along a path parallel to the runway that is over the far edge, the edge away from the spectators, at an altitude of between 10 and 20 feet. The model shall be flown at the fly-past altitude for at least five (5) seconds. The midpoint of the maneuver should be opposite the judges. If a very wide runway is used, such as may be the case at an airport or military air base, the CD may specify a path other than the far edge of the runway (e.g., center line) over which the maneuver shall be flown.

Errors:
• Straight and level flight at a constant altitude is not maintained during the minimum time required for the maneuver.
• **Note: Wing bank angle for crosswind correction should not be downgraded.** Note: Allowance should be made for slower types of light aircraft which should not be downgraded for slight corrections in gusty wind conditions.
• Altitude is not between 10 and 20 feet.
• The maneuver is offset to the right or left of the judges.

4.2.4. – Landing
The landing maneuver begins either when the model commences to flare at the end of a traffic pattern or, if no traffic pattern is performed, when the model is
at altitude of about 10 feet. There shall be no requirement to touch down in a marked circle, but for maximum points, the model should land approximately opposite the judges. An aircraft with conventional gear (i.e., with tail wheel) may make a three-point landing or may touch the main wheels first and gently lower the tail wheel as the speed decreases. An aircraft with a tricycle gear should land on the main gear first and gently lower the nose wheel during the roll out. Due to the non-scale shortness of many landing strips used for contests, it is not always possible for the model to come to a complete stop before it runs out of prepared strip. In all cases, the landing maneuver is complete before the end of the prepared surface. Nose-overs caused by entry into unprepared ground are to be disregarded; quality and control of the landing forming the judging criteria. For this waiver to be effected, the model must make initial contact in the first half of the prepared strip.

The contestant or his helper may call emergency landing when a true emergency occurs during flight. A score will be awarded on the survivability of the aircraft and pilot. A perfect emergency landing can earn a score of ten (10). If the model lands on its back, zero (0) points will be awarded.

Errors:

- Model does not flare or does not flare smoothly (gallops in pitch axis).
- Model bounces at touchdown.
- Model noticeably drops a wing during landing.
- Model touches a wingtip on the runway.
- Tricycle gear model does not touch its main wheels first.
- Model runs erratically after touchdown.
- Model collapses a gear leg on landing.
- Note: If a model runs uncontrollably over the foul line after the touchdown a zero (0) landing score should be given.

### 4.2.5. - Realism in Flight

The realism score shall be awarded in proportion to how well the model simulates the complete flight, stability, takeoff, landing, and taxiing characteristics of the prototype aircraft. The model should also be judged for its realistic attitude in flight, smoothness of control in yaw, pitch and roll axes, and for use of throttle in aerobatic maneuvers. The model should be flown at speeds that best simulate prototypical maneuvers and overall flight. The model should not be flown excessively fast where it may result in unrealistic high bank angle attitudes and high g loads for typical turns, or excessively slow that results in unrealistic flat or shallow angle turns. The model should not show signs of instability that may be characterized by an erratic flight path. Any model of an aircraft with retractable gear that executes the complete flight presentation with its wheels down shall be downgraded for realism. It is the competitor’s option to choose any flight maneuver as long as the prototype aircraft was capable of performing those maneuvers. Full flight performance capabilities need not be performed. No downgrade will be given for choice of maneuvers.

Errors:
- Model does not fly in a realistic manner.
- Attitude in flight is unrealistic.
- Model does not fly smoothly.
- Engine(s) not throttled back in maneuvers that would normally require less than full power.
- Models of aircraft that featured retractable landing gear are flown with their wheels down.

4.3. Description of Optional Maneuvers - **KEEP**

Following is a list of commonly seen flight maneuvers which, together with the itemized Scale Operations in section 4.1, should be given first consideration for the selection of the options in the flight path demonstration. A contestant is not, however, limited to the maneuvers in this list and may select any maneuver of his own choosing. A contestant may also deviate from the descriptions of the maneuvers in the following list if the prototype aircraft performed the maneuver in a different manner. In either of these cases, the contestant should be prepared, if asked, to supply appropriate documentation to the Contest Director or the CD’s designee that shows how the full-scale aircraft performed the maneuver. Additional fly-past maneuvers, such as a “fast fly-past” or “slow fly-past,” are discouraged because of their similarity to the mandatory fly-past (4.2.4) unless the speed, either very fast or very slow, was a remarkable feature of the prototype aircraft and the contestant wishes to demonstrate that it is also a feature of the model.

4.3.1. - Taxi

The model shall taxi in accordance with the sketch below to the starting point for the takeoff.
a. Models with two-wheel landing gear and tail skid or un-steerable tail wheel, or other gear configurations not allowing steering will taxi forward into the wind a distance of at least 50 feet, slow down to a near stop or stop, and then become airborne in a realistic manner.

b. Models with two-wheel landing gear and steerable tail wheel will taxi forward into the wind, or downwind if the contestant prefers, a distance of at least 50 feet, using “S” turn visibility taxiing procedure, slow down to a near stop or stop (depending on whether or not the prototype was equipped with brakes) and then become airborne in a realistic manner.

c. Models with steerable tricycle landing gear will taxi downwind at least 50 feet, stop, turn at least 120 degrees into the wind and become airborne in a realistic manner. After landing, the model shall perform a taxi maneuver as follows:

d. After landing, model shall perform a taxi maneuver as follows:
1. After landing, model will slow to a near stop or stop and then taxi forward in a realistic manner for a distance of at least 50 feet (see 4.3.1 (a)).
2. After landing, model shall return in a realistic manner to the starting area and stop (see 4.3.1 (b and c)).

Errors:
- Model does not stand still unassisted before commencing to taxi.
- **Electric propeller stops anytime during taxi.**
- Model does not follow the prescribed course.
• Model does not halt before taking off if prototype had brakes.
• Model taxis too fast. Model does not taxi in the manner of the prototype

4.3.2. - **Straight Flight Out (see diagram below)**

If this maneuver is chosen as an option, a Procedure Turn (4.3.3) and a Straight Flight Back (4.3.4) must follow it. The model must be brought exactly over the center of the runway and/or center of the landing circle and flown in an absolutely straight path parallel to the flight line for a distance of approximately 300 feet before starting the Procedure Turn (distance does not have to be accurate; pilot will determine completion of 300 feet).

**Errors:**

• Model does not fly over center of runway and/or landing circle.
• Plane deviates to the left or right.
• Does not hold a constant altitude.
• Gallops in elevation.
• **Note:** Wing bank angle for crosswind correction should not be downgraded.

4.3.3. - **Procedure Turn (see diagram above)**

After the straight flight, the model must turn exactly 90 degrees to the left or right, whichever will take the plane away from the spectator line (direction to be specified by the CD), then exactly 270 degrees to the right (or left) and cross over the point where the first turn commenced. **All turns and completion at same altitude as entry**

**Errors:**

• Left turn not 90 degrees.
• Right turn not 270 degrees.
• Changes in altitude during turns.
• Turns not smooth and circular.
• Does not head back over exact outgoing path.

Note: If a contestant wishes to perform this maneuver without preceding it with a Straight Flight Out, it should commence as the model, heading on a line parallel to the runway, begins the 90 degrees turn at a point immediately opposite the judges or over the center of the landing circle (if used)

4.3.4. - Straight Flight Back (see diagram above)
If this maneuver is chosen as an option, a Straight Flight Out and a Procedure Turn (4.3.2 and 4.3.3) must precede it. The model should fly back toward the circle along the same line and altitude as the outgoing path and pass exactly over the circle. If no circle is used the maneuver should terminate when the model passes in front of the judges on a path over the center of the runway.

Errors:
• Turns or wiggles during straight flight.
• Change in altitude.
• Gallops in pitch, yaw or roll.
• Flight not along original path.
• Does not pass over the circle (or center of runway immediately in front of judges).
• Note: Wing bank angle for crosswind correction should not be downgraded.

4.3.5. - Inside Loop
From straight flight, the model pulls up into a smooth round loop and resumes straight and level flight on the same heading and altitude as the entry. The throttle should be cut back at the top of the loop and opened when normal flight is resumed. The aircraft has to stay in one plane and the wings remain perpendicular to the flight path. A light aircraft type would be expected to execute a shallow dive at full throttle in order to pick up speed before commencing the loop. Lower powered aircraft may not be capable of round loops. Competitor should alert judges to egg shaped loop.
Errors:

- Wings are not level throughout the maneuver.
- Loop is not round or is executed endwise.
- Throttle is not cut back at the top of the loop and opened when normal flight is resumed.
- Model of light aircraft type does not execute shallow dive to pick up speed before commencing the loop.
- **Model does not remain in one plane or wings do not stay perpendicular to flight path.**

### 4.3.6. - Outside Loop

Starting in level flight, the model noses down to perform a smooth round outside loop which is completed when the model regains its starting altitude and exits in level flight on the same heading as the entry. The throttle should be closed at the beginning of the maneuver and should be opened after completion of the first half of the loop when the model is inverted and is at a point closest to the ground.
Errors:
- Maneuver does not begin and end in level flight.
- Exit altitude is not the same as entry altitude.
- Model does not begin and end on the same heading.
- Loop is not round.
- Wings do not remain level during maneuver.
- Throttle not closed during first half of maneuver.

4.3.7. - Immelmann Turn
From a straight and level flight, the model performs the first half of a loop and when inverted performs a half roll and resumes straight and level flight on the opposite heading.  

The aircraft has to stay in one plane and the wings remain perpendicular to the flight path.  Light aircraft types would be expected to commence the maneuver by executing a shallow dive at full throttle in order to pick up the necessary speed.
Errors:
- Wings are not level during half loop.
- Model does not resume straight and level flight on the correct heading.
- Model does not remain in one plane or wings do not stay perpendicular to flight path. Both ¼ portions of loop are not the same size.
- ½ Loop not completed before roll.
- Inverted line after ½ loop before roll.

4.3.8. - Stall / Hammerhead Turn

The model does not actually stall during this maneuver. Start and Finish are aligned with the judges, which should give proper viewing placement for the judges. The model starts in level flight, performs a ¼ loop to vertical, noses up to the near vertical attitude, at which point the throttle is closed once the vertical line is established. And when the airspeed bleeds off, but before stall (model stops on vertical climb) the model yaws through 180 degrees, then dives and finally recovers straight and level flight on a heading in the opposite direction to the entry at the same altitude. The contestant should specify whether the turn shall be to the left or right.
4.3.9. - Wingover

Model starts in level flight and noses up to a near-vertical attitude at which time it is flown through a 180 degrees arc using rudder to end up on a near vertical dive. Throttle should be closed at this point and the model pulls out of the dive at the same altitude as the entry and on a parallel path, but on a 180 degrees opposite heading. This maneuver will vary depending on the performance level of the aircraft. The model approaches straight and level, parallel to the flight line. The maneuver starts when crossing the judge’s position. The model then pulls up into a smooth climbing turn, using rudder, away from the judges. The bank angle at the peak of the turn (90 deg.
to the entry track) should be between 45 and 60 deg. for a non-aerobatic aircraft. An aerobatic aircraft should be at 60 to 90 deg. The height gain should be appropriate for the aircraft modeled. The turn continues while descending to the entry-level altitude. Throttle should be reduced through the descent. The maneuver completes with the exit path at the same altitude and parallel to the entry, finishing opposite the judges position.

Errors:
- Model not level at start.
- Model rolls left or right during pull up.
- Model tucks under a wing during 180 degrees turn.
- Throttle not closed during dive. Return path not parallel to entry.
- Recovery not at same altitude as entry.
- Model does not fly straight and level to complete the maneuver.

4.3.10. - Split-S (Reversal)
From a straight flight, the model performs a half roll and when inverted, with wings level. When opposite the judges performs the second half of a loop, ending opposite the judges, and resumes straight and level flight on a heading opposite that of the entry. The throttle should be closed at the inverted position at the start of the second half of a loop and opened when normal flight is resumed.
Errors:

- Model changes heading during half roll.
- **Wings not level when inverted.**
- Wings are not level during half loop.
- **Half loop is not round.**
- Half loop not centered on judges.
- Half loop too tight or too fast.
- Throttle is not used **properly.**
- Model does not exit from maneuver on the exact opposite heading to entry.
- Maneuver flight plane is not parallel with the flight line.

4.3.11. - Roll

There are four types of rolls; Aileron, Slow, Barrel, and Snap. The contestant should nominate what type of roll he will perform, i.e., Axial, Slow, Barrel, Snap or Hesitation.

4.3.11A – Aileron Axial

The aileron roll is not normally flown in full-scale aerobatic competition. The rudder and elevator remain neutral through the maneuver. From straight and level flight, the model rolls at a constant rate through one (1) complete rotation.
and resumes straight and level flight on the same heading. The roll is centered so that it is inverted and level when adjacent to the judges. Light aircraft types would be expected to execute a shallow dive at full throttle before the maneuver. The contestant should nominate what type of roll he will perform, i.e., Axial, Slow, Barrel, Snap or Hesitation do not have the power to perform an aileron roll and maintain flight track.

Errors:
- Rate of roll is not constant.
- Exit altitude not the same as at entry.
- Style of roll not typical to prototype.
- Inverted portion of roll not centered on judges’ position.
- Entry and exit at different altitude.
- Entry and exit at different speeds.
- Entry and exit tracks and line of roll not parallel with judges’ line.
- Does not resume straight and level flight on same track as entry.
- Style of roll not as nominated.
- Inappropriate use of throttle.
- Too far away/too close/too high/too low.

4.3.11B – Slow Roll
The slow roll is similar to the axial roll; however, rudder and elevator are used to maintain the track and altitude. Light aircraft types would be expected to execute a shallow dive at full throttle before the maneuver. From straight and level flight, the model rolls at a constant rate through one (1) complete rotation, resumes straight, and level flight on the same heading and altitude as at the start. Generally, military and lightly powered aircraft will pull up about 20° at the start of the roll so the maneuver track will have a slight “hump” in the track. Because the roll rate is slow, the length of the maneuver will be longer than for an axial roll. The center point will still have the wings level in an inverted position adjacent the judges.

Errors:

- Rate of roll is not constant.
- Exit altitude not the same as at entry.
- Style of roll not typical to prototype.
- Inverted portion of roll not centered on judges’ position.
- Entry and exit at different altitude.
- Entry and exit at different speeds.
- Entry and exit tracks and line of roll not parallel with judges’ line.
- Does not resume straight and level flight on same track as entry.
- Style of roll not as nominated.
- Inappropriate use of throttle.
- Too far away/too close/too high/too low.

4.3.11B-1 – Hesitation roll

The Hesitation Roll is a variation of the Slow Roll including momentary stops at various angles of bank. The roll usually has up to eight hesitation points. A 2-
point roll has a hesitation at the inverted position. A 3-point roll hesitates at 120° and a 4-point roll hesitates each 90°. In all cases, the inverted portion is placed

Errors:
- Rate of roll is not constant.
- Exit altitude not the same as at entry.
- Style of roll not typical to prototype.
- Inverted portion of roll not centered on judges’ position.
- Entry and exit at different altitude.
- Entry and exit at different speeds.
- Entry and exit tracks and line of roll not parallel with judges’ line.
- Does not resume straight and level flight on same track as entry.
- Style of roll not as nominated.
- Inappropriate use of throttle.
- Too far away/too close/too high/too low.

4.3.14. 4.3.11C – Barrel Roll

There are three (3) types of barrel roll: Air Force, Navy, and civil aviation type. Since this maneuver is most likely to be performed by a model of a civilian aircraft, only the civil aviation barrel roll is described. The model should begin with a shallow dive to pick up speed, the nose should then pull up and the model begins what appears to be a climbing turn. Continued application of ailerons in the turn will roll the model which, when inverted, may be as much as 90 degrees off its original heading. No down elevator is applied in the inverted position so the nose will fall as both turn and roll continue till the model returns to the upright position at the same altitude and on the same heading as the entry. The barrel roll orbit should be big and fat like a beer barrel.

Described is the civil aviation barrel roll. The barrel roll is a maneuver where the aircraft makes a complete rotation along both the pitch and roll axis, forming a helical roll around a straight flightpath. This beautiful maneuver is not normally flown in full-scale aerobatic competition. To execute, the aircraft starts in straight and level flight the plane starts a brief climb. As the nose passes through the horizon aileron is introduced. As the aircraft rolls, it continues to pitch up. When the airplane has rolled 90° with the wings vertical the nose will be 45° from the entry path. As the aircraft continues to roll inverted, the wings will be level and the nose is 90° off the original flightpath. While the roll continues, when the wings are again vertical, the nose will come back to 45° from the entry flightpath. The aircraft should roll to level flight and be on the same flightpath and altitude as when the maneuver started.
Errors:
- Rate of roll is not constant.
- Exit altitude not the same as at entry.
- Style of roll not typical to prototype.
- Inverted portion of roll not centered on judges’ position.
- Entry and exit at different altitude.
- Entry and exit at different speeds.
- Entry and exit tracks not parallel with judges’ line.
- Does not resume straight and level flight on same track as entry.
- Style of roll not as nominated.
- Inappropriate use of throttle.
- Too far away/too close/too high/too low.

4.3.12. 4.3.11D - Snap Roll–Inside

A snap roll is normally flown on a straight line. The model begins in level flight and as the nose is pulled up to the point where the wing will stall, rudder is applied to roll the model in the desired direction. The nose of the model should break the line of flight in a direction towards the pilot’s cockpit, indicating that a stall has occurred. While most models will roll faster in a snap roll than in an aileron-induced roll, roll rate should not be a factor in judging. The roll should stop precisely when the model is again upright and the maneuver should be completed in straight and level flight. Snap rolls may be performed vertically or on a 45 degree climbing or diving flight path, but such maneuvers should always begin and end in straight and level flight.

Errors:
- Model does not begin and end in straight and level flight.
• Wing does not stall during roll.
• Roll is not terminated precisely after 360-degree rotation.
• Model does not exit from the maneuver on the same heading as the entry.

4.3.12 4.3.11E - Snap Roll–Outside
This maneuver should be performed in a similar manner to the inside snap roll except that, as the break occurs, the nose of the model moves away from the direction of the pilot’s cockpit indicating that a stall was induced by the application of down elevator control.

Errors:
• Model does not begin and end in straight and level flight.
• Wing does not stall during roll.
• Roll is not terminated precisely after 360-degree rotation.
• Model does not exit from the maneuver on the same heading as the entry.

4.3.12 4.3.15. - One (1) Lap Pylon or Speed Run Demonstration
Models performing this maneuver must be model of pylon racers or long distance race aircraft. Models of aircraft which raced over a closed course (pylon racers) shall perform one (1) lap of a simulated equilateral triangular racecourse. Each leg should be 5 seconds long. One (1) leg of this shall be parallel to the runway. Models of long distance race aircraft may make a single high speed pass parallel to the runway (at a distance consistent with safety considerations).
Errors:

- Apex of triangular course not centered on judges.
- Model does not fly straight and level during the designated straight legs of the maneuver.
- Model does not make a pass parallel to the runway.
- Models of pylon racers do not perform turns in the manner of race aircraft (model yaws noticeably when banked, model gains or loses excessive altitude in turns).
- Legs of course not straight.
- Legs of course too short or too long. Triangle angles not 60°.
- Entry / Exit paths not parallel to flight line.
- No compensation for wind.

4.3.13 4.3.16. - Spin

The number of turns to be performed shall be noted on the judges’ score sheets. The contestant may choose any whole number. The entry shall be from straight and level flight parallel to the runway. Power shall be reduced and the model should remain on heading in a slightly nose high attitude until it stalls and commences to spin. The model should auto-rotate through the prescribed number of turns and recover on the same heading at a lower altitude. The rate at which the model rotates in the spin will depend on its size and type but judges should be alert to observe models that are performing a spiral dive rather than a true spin.
Errors:
- Entry not from level flight parallel to runway.
- Does not perform the prescribed number of turns.
- If the number of turns performed is greater or less than the prescribed number by more than one (1) complete turn, a zero (0) score should be given.
- Does not recover on same heading as entry.
- Wings not level during recovery.
- A spiral dive rather than a true spin shall be scored zero (0).

4.3.144.3.17—Cuban Eight
The model starts in straight and level flight, parallel to the flight line. After passing the judges the model pulls up into an inside loop and after completing half the 5/8 of the loop, heads inverted downwards at 45 degrees, does a half roll followed by another half 5/8 inside loop to the inverted downwards 45 degrees heading, does another half roll and pulls out into straight flight at the same altitude as then entry and on the same heading.

A light aircraft type light powered aircraft would be expected to execute a shallow dive at full throttle in order to pick up speed before commencing the maneuver. Throttle should be closed at the top of each loop and reopened during each descent.

Errors:
- Maneuver is not performed in a constant vertical plane or is executed endwise.
- Loops are of unequal diameter.
- Half rolls are not executed at the correct point in the maneuver.
- Half rolls are not executed at judge’s center.
- Down lines are not equal lengths.
- Improper use of throttle during maneuver.
- Model does not exit from the maneuver at the same height as entry.
- Entire maneuver not centered on judges.
4.3.15. - ½ Cuban Eight

This maneuver is a shortened version of the Cuban Eight. The model starts in straight and level flight, parallel to the flight line. After passing the judges the model pulls up into an inside loop. After performing 5/8 of the loop, the inverted model establishes a downward 45° line. At judges center a half roll is performed to upright. The descent line continues and the model, recovers at the same altitude as entry on a reverse track from entry. A light powered aircraft would be expected to execute a shallow dive at full throttle in order to pick up speed before commencing the maneuver. Throttle should be closed at the top of each loop and reopened during each descent.

Errors:

- Maneuver not performed in a constant vertical plane.
- Loop is not round.
- Half roll not executed at judges center.
- Down lines are not equal lengths.
- Model does not exit from the maneuver at the same height as entry.
- Improper use of throttle during maneuver.
• Entire maneuver not centered on judges.

4.3.16 – Reverse Cuban Eight
The maneuver starts in straight, level flight parallel to the flight line. Before reaching judges center the model enters a 45° upward line. When reaching judge’s center, perform a half roll to inverted and the up line is continued. When reaching the end of the up line, perform a 3/4 inside loop and then establish another 45° upward line. Perform another half roll to inverted when reaching judges center and continue the up line. Perform a 5/8 inside loop when reaching the end of the up line. Complete the loop at the same altitude and track as the entry in straight and level flight. A light powered aircraft would be expected to execute a shallow dive at full throttle in order to pick up speed before commencing the maneuver. Throttle should be closed at the top of each loop and reopened during each descent.

Errors:
• Maneuver not performed in a constant vertical plane or is executed endwise.
• Loops are of unequal diameter.
• Half rolls are not executed at judge’s center.
• Down lines are not equal lengths.
• Model does not exit from the maneuver at the same height as entry.
4.3.17 – \( \frac{1}{2} \) Reverse Cuban Eight

This maneuver is a shortened version of the Reverse Cuban Eight. The maneuver starts in straight, level flight parallel to the flight line. Before reaching judges center the model enters a 45° upward line. When reaching judge’s center, perform a half roll to inverted and the up line is continued. When reaching the end of the up line, perform a 3/4 inside loop. Complete the loop at the same altitude and opposite parallel track as the entry in straight and level flight. A light powered aircraft would be expected to execute a shallow dive at full throttle in order to pick up speed before commencing the maneuver. Throttle should be closed at the top of each loop and reopened during each descent.

Errors:

- Improper use of throttle during maneuver.
- Entire maneuver not centered on judges.

- Maneuver not performed in a constant vertical plane.
- Loop is not round.
- Half roll not executed at judges center.
• Down lines are not equal lengths.
• Model does not exit from the maneuver at the same height as entry.
• Improper use of throttle during maneuver.
• Entire maneuver not centered on judges.

4.3.18. - Touch-and-Go
This maneuver shall count as two (2) options. After a smooth and gradual
descent on a straight-line path into the wind, the model aircraft then lands and
takes off again into the wind without coming to a halt. Crosswind correction is
applied as required. The main wheels must roll on the ground for a minimum of
15 ft. Flaps will be used if applicable. Conventional gear models with a tail wheel
or skid do not have to touch the tail wheel or skid. Models with a nose gear
should touch all gear onto the ground.

Errors:
• Approach during landing is too steep.
• Violent changes in pitch, yew or roll during approach or climb out.
• Model bounces on landing.
• Model fails to stay on ground for 15 ft. changes in heading during the
takeoff run, verses landing approach.
• Both main wheels must roll on the ground for 15 ft.

4.3.19. - Overshoot
The model makes a landing approach at low throttle to below 10 feet altitude
without touching down, followed by a climb out at full throttle to resume level
flight. Model should commence by flying a final crosswind leg followed by a turn onto a normal landing approach at low throttle, using flaps if applicable, until it reaches a point over the center of the runway at a point immediately opposite the judges at a height of 10 feet or less. At this point full throttle is applied, and the model climbs straight ahead to resume level flight.

**Errors:**
- Model does not commence maneuver with the correct landing approach.
- Model must be descending until full throttle is applied, and particular attention should be paid to the timing and altitude when throttle is opened.
- Model does not use flaps (if applicable).
- Model does not climb away smoothly.
- Landing gear is not retracted on climb out (if applicable)

**4.3.20. - Slips**
There are two types of slips: Forward and Slide. There is also a slipping turn but this is not generally performed as a competition maneuver. While the two types of slips are similar, in that they both use crossed controls, their uses and results are different. Use a Forward Slip to maintain the ground track while increasing the descent rate without increasing airspeed. The Side Slip results in a sideways track change in a no wind condition. Use it to counteract a crosswind blowing you off the runway centerline or to adjust misalignment of track. The pilot must specify if the Slip is for alignment or cross wind correction.
4.3.20A. Forward Slip

Remember that this maneuver maintains track while the longitudinal aircraft axis is at a minimum 15° angle to the track. Perform the maneuver by lowering a wing while simultaneously applying opposite rudder. The lowered wing should be into whatever crosswind is present. The descent should be steeper than normal but without an increase in airspeed. Maneuver continues to below 10 ft. of altitude, terminating at the judges’ position with a transition to normal flight attitude and overshoot with normal climb out.
Errors:

- Flight track not parallel to flight line.
- Aircraft heading is not at least 15° angle to track.
- Descent is not steeper than normal.
- Airspeed is too high.
- Slip does not end at Judges’ position.
- Model does not transition to normal climb.
- Whole maneuver not centered on judges.

4.3.20B. - Side Slip

This maneuver allows easy correction of misaligned flight track. The heading of the aircraft does not change, but a sideways track results. Perform the maneuver by lowering a wing in the desired track correction while simultaneously applying opposite rudder. The model should visibly move sideways for 5 ft. to 10 ft. Simultaneously remove cross control and resume normal coordinated flight when the aircraft reaches the desired alignment. The Side Slip maneuver also allows correction for crosswind (side wind) influence. The heading of the aircraft does not change. The track does not change because the slide slip counteracts the side push from the wind. The descent might not be steeper than normal. Perform the maneuver by lowering a wing into the wind while simultaneously applying opposite rudder. The wing is lowered enough to compensate for the side push of the wind. The rudder amount is that needed to maintain the heading of the aircraft. The resultant track is a maintained runway centerline. The maneuver continues to below 10 ft. of altitude, terminating at the judges’ position with a transition to normal flight attitude and overshoot with normal crosswind climb out.
4.3.21. - Flight in a Triangular Circuit

Errors:
- Pilot does not specify purpose of slip.
- Track does not visibly change for alignment correction slip.
- Track does not maintain parallel to runway for cross wind approach.
- Aircraft is not stable during slip.
- Slip does not end at Judges’ position.
- Model does not transition to normal climb for alignment correction or with normal crosswind climb out for cross wind approach.
- Whole maneuver not centered on judges.
This maneuver may only be selected for non-aerobatic aircraft. The model approaches upwind (parallel to the flight line) in a straight and level flight to a point above the center of the circle (if used) or opposite the judges, and turns away from the flight line (say left) through 60 degrees and flies straight and level for approximately 300 feet, turns left through 120 degrees and flies a further 300 feet, again turns left through 120 degrees and flies a further 300 feet to a position over the circle center (the starting point) which completes an equilateral triangle. The model then leaves the maneuver through a final left turn through 60 degrees and resumes straight and level flight on the same heading as the entry. Note that the direction of the turn will be reversed for wind in the opposite direction.

Errors:
- Maneuver is not commenced and terminated at the correct point.
- Model changes altitude during maneuver.
- Legs are noticeably too long or too short.
- Legs are not straight.
- Correction for wind drift is not properly made.
- Rate of turn at corners is not constant.

4.3.22. - Flight in a Rectangular Circuit

This maneuver may only be selected for non-aerobatic aircraft. The model approaches upwind in a straight and level flight to a point above the center of the circle (if used) or opposite the judges, and continues for approximately 150 feet 10 seconds at which point it turns away from the flight line (say left) through 90 degrees, flies straight and level for approximately 300 feet 20 seconds, turns left through 90 degrees, flies a further 150 feet 15 seconds, turns left through 90 degrees and flies back towards the flight line for a further 300
feet 20 seconds to end the maneuver over the circle center (the starting point). A further left turn, which must be made to avoid flying over the flight line, is not assessed as a part of the maneuver. Note that the direction of the turns will be reversed for wind in the opposite direction.

Errors:
- Maneuver is not commenced and terminated at the correct point.
- Model changes altitude during maneuver.
- Legs are noticeably too long or too short.
- Legs are not straight.
- Correction for wind drift is incorrect.
- Rate of turn at corners is not constant.

### 4.3.23. - Flight in a Straight Line with One Engine Throttled
This option is, of course, for multiengine models only. The model approaches into the wind in straight and level flight at a constant altitude with one (1) engine throttled for a minimum distance of 300 feet, after which the throttled engine is opened up and the model resumes normal flight. **Crosswind correction may be applied without loss of points, but track must be straight.**
Errors:
- Model does not maintain straight flight.
- Model is unstable. Models lose undue altitude.
- Altitude not maintained.
- No wind compensation.
- Engine is not opened up again after demonstration.

4.3.24. - Standard Traffic Pattern Approach to Landing

The rectangular traffic pattern consists of 5 legs; Upwind, Crosswind, Downwind, Base, & Final. The model goes directly into the landing from this maneuver. The model begins on an upwind heading directly over the centerline of the runway. After passing in front of the judges it should continue, straight and level. For approximately 100 – 200 feet before making a 90-degree turn away from the flight line onto the first crosswind leg. Aircraft bank angles should be between 30° and 45° maximum for all turns. A second 90-degree turn begins a downwind leg with the model flying a constant altitude and again passing in front of the judges. A third 90-degree turn toward the flight line begins the second crosswind base leg during which the model may begin its descent. A fourth 90-degree turn into the wind, final approach leg, should line the model up with the runway centerline, and straight descending flights should continue to the point of touchdown. The maneuver is considered completed when the model begins to flare prior to landing.
Errors:

- Any change in altitude during the first upwind, crosswind and downwind legs.
- Deviation from a straight and level path on any leg.
- Excessive use of the throttle during the final approach.
- Note: Where applicable, wheels should be lowered on the downwind leg and flaps on the second crosswind base leg.

4.3.25. – Overhead Approach to Landing

While open to all aircraft the overhead approach is generally used by military aircraft as the purpose of the approach is safe, higher speed, efficient recovery of multiple aircraft. Start the approach at the Initial Point on centerline of the runway, flying at a low cruise setting. Fly at constant altitude to the Break point, where a 180° turn is started. On turn completion, a straight leg is flown for 5 – 10 seconds, where a descending 180° turn commences. At turn completion, fly straight, while descending to landing. Maneuver completes at flair for landing. Crosswind correction is applied as appropriate.
Errors:

- Initial leg not correct length.
- Initial leg not straight or at constant altitude.
- Break turn not at constant altitude.
- Downwind leg not at constant altitude.
- Downwind leg is not straight.
- Turns not round.
- Turns not at constant bank angle.
- Descending leg is not straight.

4.3.256 - Spot Landing

If the main gear of the model makes its first contact with the ground within a 100-foot diameter circle, the judges shall award points equal to those awarded for the landing. All judges must agree on whether or not the model did touch down within the circle.

4.3.267 - Slow Speed Inspection Pass

This maneuver includes the described transition periods on a common heading and elevation to enter and exit slow flight. The model shall transition smoothly into and out of a high lift and high drag aerodynamic configuration using the applicable features of the aircraft. As a minimum, this maneuver must include the use of fully deployed flaps as the model is progressively brought to its slow flyby speed. This will be along a straight and level path parallel and over the far edge of the runway from the spectators (or as otherwise specified by the CD), at an elevation of between 20 and 40 feet for a minimum of five (5) seconds. This
slow midpoint period of the maneuver should be opposite the judges. The model’s flying speed during the Slow Speed Inspection Pass should be remarkably slower than the mandatory fly-past*, to the extent that the apparent stall speed has been effectively reduced by use of flaps and other applicable features. The model will often require some low level power to “drag” it through this high drag period. The model will then slowly transition out of this high lift and high drag profile while speed is again increased. This transition should not include immediate lifting of flaps prior to increasing speed, which could otherwise stall the model. Immediate flap retraction may be a direct indication to the judges that the model was not sufficiently slowed to optimally demonstrate the Slow Speed Inspection Pass. This high drag slow maneuver performed along a near level path requires skill in power management, judgment of model speed verses stall, and coordination of all applicable scale operations to transition accordingly.

*When electing this maneuver it must immediately follow the mandatory Fly-Past.

Errors:
- A smooth, straight and level flight at a constant altitude is not provided to transition into, during, and out of the Slow Speed Inspection Pass.
- It is not stable or on the same heading.
- Note: Allowances shall be made for corrections in gusty wind conditions.
- Altitude is not between 20 and 40 feet.
- The maneuver is offset to the left or right of the judges.
- The 5-second slow speed portion is not remarkably slower than the mandatory Fly-Past.
• All applicable high lift or high drag features such as flaps and retracts were not deployed.
• If flaps were not deployed, the maneuver will score a zero.

4.3.278. - Chandelle

This maneuver is **not an aerobatic maneuver, but a performance maneuver.** It is an exaggerated a specialized climbing turn in which the airplane changes direction through 180 degrees and gains as much altitude as possible. It is available to all aircraft. The model may begin with a shallow dive to pick up speed, the nose should then pull up and the model begins a climbing turn proceeding away from the flight line. The maximum climb and bank occur at approximately the midpoint during the change in direction. The maximum bank angle may only be 45 to 60 degrees for non-aerobatic aircraft and up to 90 degrees for fully aerobatic aircraft. Entry speed should be sufficient to prevent visible slipping or skidding and maintain the same turn rate throughout the maneuver. The degree of bank angle and rate of climb are constantly changing as the speed continues to decline through the maneuver. As the 180 degree point is reached in the turn where the aircraft is traveling in the opposite direction from which it entered, the wings are brought level for the maneuver completion. At this time, the aircraft would be flying at reduced speed compared to entry. The aircraft flies straight and level from maneuver start for 2 – 3 seconds for established entry. Start a Climbing turn by simultaneously add available power, smoothly rolling into a 30° Bank and starting to add pitch up. Maintain the bank angle and continue to increase pitch, reaching the maximum pitch at 90°. From 90° thru 180°, maintain the pitch angle while smoothly and slowly decreasing bank angle, reaching wings level at 180° with airspeed just above stall. Maintain level flight at airspeed for 2 – seconds, and then transition to normal flight. The entire turn is a constant rate turn, achieved because of rudder use with the decreasing bank angle.
Errors:

- The same turn rate is not maintained.
- The model slips or skids.
- The model does not provide a notable climb rate.
- **The model is not near stall speed at maneuver completion.**
- The model does not finish with wings level on a heading opposite to that entered.

4.3.289. - Any Other Flight Maneuver

A contestant may perform any flight maneuver of his own choice provided that it is within the capabilities of the prototype aircraft. Such a maneuver **must** be cleared by the Contest Director prior to flight time and, if necessary, a short description of the maneuver may be requested by the CD for use by the flight judges. **The contestant should describe the maneuver, as described to the CD, to the judges before the flight round starts to ensure judges understanding.**

4.3.29.30 - 360 Degree Descending Circle at a constant low throttle setting
Commencing from straight and level flight, the model aircraft performs a gentle 360-degree descending circle in a direction away from the judges at a constant low throttle setting. The maneuver terminates at a height between 10 and 20 feet resuming straight and level flight on the same path.

**Errors:**
- Rate of descent not constant.
- Descent too steep.
- Throttle not constant or low enough.
- Circle misshapen.
- No significant loss of height.
- Descent not to a level of 10 or 20 feet.
- Circle not centered on judges’ position
- Entry and exit paths not parallel with judges line.
- Too far away or too close.

**4.3.30.31 - Lazy Eight**
The model aircraft approaches in straight and level flight on a line parallel with the judges’ line. After passing the judges’ position, a smooth climbing turn is
started away from the judges. At the apex of the turn, the bank should be at least 60 degrees. The nose of the model aircraft then lowers and the bank comes off at the same rate as it went on. The turn is continued beyond 180 degrees to cross in front of the judges with wings level before intercepting and turning on to the reciprocal of the original approach track. This completes half of the figure, which is then repeated in the opposite direction to give the full symmetrical maneuver about the judges’ position. Intercepting the original approach track parallel with the judges’ line completes the maneuver. A low powered aircraft would be expected to execute a shallow dive at full throttle in order to pick up speed before starting the maneuver. This maneuver is essentially two wingovers in opposite directions and should be capable of being flown by most aircraft. As with the Chandelle, the Lazy 8 maneuver is not an aerobatic maneuver but a performance maneuver. Therefore, it is available to all aircraft. It gets its’ name because the nose of the plane is following a figure 8 on its side on the horizon, the plan view of the maneuver is not a figure 8. The lazy 8 is a maneuver designed to develop perfect coordination of controls through a wide range of airspeeds and altitudes. It is the only standard flight training maneuver during which at no time do the forces on the controls remain constant. A lazy 8 consists of two 180° turns, in opposite directions, while making a climb and a descent in a symmetrical pattern during each of the turns. At no time throughout the lazy 8 is the airplane flown straight and level; instead, it is rolled directly from one bank to the other with the wings level only at the moment the turn is reversed at the completion of each 180° change in heading. Three reference points per loop are used to ensure symmetrical loops in the maneuver, on at 45°, one at 90°, and one at 315°. The maneuver starts in straight, level flight parallel with the flight line at 20 – 40ft altitude. Start a gradual climbing turn toward the 45° reference point when reaching the judges position. Control the climbing turn so that the aircraft reaches maximum pitch attitude, approximately 15°, and approximately 15° bank angle at the 45° reference point. The turn rate will naturally attempt to increase as the airspeed decreases, so start with a slow rate of roll so that you do not reach the 45° reference before maximum pitch is reached. The climbing turn continues to the 90° reference point. At the 90° point, the airspeed is at minimum, maximum altitude has been reached, pitch attitude is level, and bank angle is between 30° & 45° for non-aerobatic aircraft or between 45° & 60° for aerobatic aircraft. The turn continues as a descending turn to the 135° reference point while slowly decreasing bank angle. At the 135° point, the aircraft is at maximum down pitch, approximately 15°, and approximately 15° bank angle with increasing airspeed. The descending turn continues to the 180° reference point. At this point, the aircraft is in level flight, at entry airspeed, at entry altitude, and parallel to the entry flight path. Immediately start the second 180° climbing turn by flying it like the first. The aircraft finishes the maneuver flying in level flight, at entry airspeed, at entry altitude, parallel, and in the same direction as the entry flight path.
Errors:

- Entry and exit paths not parallel with judges’ line.
- Insufficient climb achieved. Insufficient bank achieved.
- Climb and descent angles not equal throughout maneuver.
- Arcs misshapen.
- Maneuver not symmetrical about judges’ position.
- Start and finish positions not as indicated.
- Overall size of maneuver not realistic for prototype.
- Model aircraft flight path not smooth and steady.
- Too far away/too close/too high/too low.

4.3.312. - Derry Turn

This is a high-speed performance maneuver limited to high performance aircraft. The model approaches at a high speed in straight and level flight on a parallel line with the judges’ line. The model then makes a steep bank (in excess of 60 degrees) one-quarter-circle turn in a direction away from the judges without losing height. When centered in front of the judges, and perpendicular to the entry line, the model makes a half roll inverted in the same rolling direction as the entry, again directly followed by a steep one-quarter-circle turn in the opposite direction, and then flies off straight and level on a line parallel with that of the entry maneuver. The entire maneuver is flown at the same altitude.
Errors:
- Entry not parallel with judges’ line.
- Maneuver not centered in front of judges.
- The rolling maneuver in front of judges not axial on a line directly away from judges.
- The roll in center is not in the same roll direction as the entry to the maneuver. Any hesitation between the end of the first quarter turn, the roll and/or the start of the second turn.
- Exit not parallel with entry.
- Significant height Altitude difference during maneuver.
- The maneuver misshapen (as seen as part of a figure eight).
- Maneuver is too low or too high to be easily judged.

RADIO CONTROL FLIGHT JUDGING GUIDE—SOARING SECTION
For event 517.

1. Mandatory Manuevers:
1.1. Three Hundred Sixty Degree Thermal Turns
Beginning from any attitude or altitude, with the entire maneuver visible to all flight judges, the model shall perform two (2) consecutive 360-degree turns, either to the right or to the left. Turn direction shall be pilot’s choice. Pilot should attempt to keep both circles concentric. Upon completion of the second turn, model shall resume its original heading.
Errors:

- Model does not complete two (2) full 360-degree turns.
- Model flies past the 360-degree point of the second turn.
- Model dives or stalls.
- Model does not keep two (2) circles reasonably concentric. (Note that slight downwind drift is permissible without downgrade, though both circles should be the same size in diameter.)
- Model does not leave the second turn on the same heading at which it entered the first turn.

Slight loss or gain in altitude during the maneuver shall not be cause for downgrade. This is to allow for flight through lift or sink conditions.

1.2. Landing

Final approach shall be a part of the landing task. Maneuver shall begin when the model has completed its turn onto final approach, as announced by the contestant, and shall be considered to be complete when model comes to rest. Model shall maintain an “on course” attitude toward the landing area until touchdown. Upon touchdown, model shall slide or roll forward to a gradual stop. It is suggested that the actual landing and the final approach be scored on an equal basis by the judges (i.e., a “perfect approach and an upside down landing earning five (5) total points. Approach—five (5) + landing—five (5) total points for landing maneuver.)

Errors:

- Model dives, stalls, or severely changes attitude during final approach.
• Model bounces or stops abruptly on touchdown.
• Model drops a wing too soon after touchdown without appropriate rollout.
• After dropping a wing, model ground loops.
• Model turns upside down.
• Model shedding parts during this maneuver shall be cause for a zero (0) total landing score.

1.3. Realism in Flight
The realism score shall be awarded in proportion to how well the model simulates the complete flight stability, airspeed, landing, and rollout characteristics of the prototype aircraft. The model should also be judged for its attitude in flight and smoothness of control in yaw, pitch, and roll axis. The model should not show signs of instability which may be characterized by an erratic flight path. Any model of an aircraft with retractable gear that executes the complete flight presentation with its wheel(s) down shall be downgraded for realism.
Upon completion of a flight, judges should discuss its realism to attempt to arrive at a unanimously agreed upon score.

Errors:
• Model does not fly at scale-like speed.
• Attitude in flight is unrealistic.
• Model does not fly smoothly.
• Models of aircraft that featured retractable landing gear are flown with their wheel(s) down or do not show wheel(s) extended during landing maneuver.

2. Optional Flight Maneuvers
For event 517.

2.1. Climb to Release
From hand tow, winch, or hi-start launch, the model will directly ascend to release altitude and fly smoothly off the towline.

Errors:
• Model weaves from side to side on tow.
• Model’s nose dips or rises in a sudden or erratic manner.
• Model “zooms” excessively upon release.
• Winch pulsing causes model to “stutter” on tow.

2.2. Optional Maneuvers
Any maneuver described in the RC Scale Flight Judging Guide or Any Other Flight Maneuver (4.3.27.) may be selected in the contestant’s flight plan provided that such maneuvers are within the capabilities of the prototype aircraft. (Examples of optional maneuvers available to aerobatic sailplanes could be Inside Loop, Immelmann Turn, etc., and for non-aerobatic types, Straight Flight Out, Procedure Turn, Straight Flight Back, Flight in a Rectangular Circuit, etc., though neither type shall be restricted to only these specific maneuvers)

2.3.
In all flight judging, the following shall be taken into consideration:
2.3.1. Downwind drift of non-powered aircraft due to wind conditions during maneuvers.

2.3.2. Slight gain or loss of altitude in lift or sink conditions during maneuvers.