Multi Rotor Line of Sight Training and Proficiency Test Guide

Revised 13/03/2018

Index:

1 - INTRODUCTION

Due to the unprecedented and ever increasing popularity of the multirotor models, it has become necessary that they be incorporate into flying at SAMAA Registered flying fields.

In the interest of the hobby and safety, it is essential that:

- An adequate standard be achieved before a beginner be allowed to hover and fly on his own without a qualified instructor in attendance.
- Further challenges must be set to ensure and entice the model pilot to improve his flying skills.

With these two main objectives in mind this booklet's main functions are:

1. To outline some of the basics of multirotor flying.
2. To define many of the terms used or applied to the hobby.
3. To help ensure that the pupil pilot is given a grounding in the SAMAA, FLYFPVSA and club safety rules and the etiquette applicable to the flying field.
4. That he be taught to fly in an acceptable and structured sequence with milestone targets.
5. To ensure that at the end of this learning or teaching period, he will have achieved a level of competence —solo exemption that will allow him to fly safely, without a club instructor in attendance when other members, spectators or people are present.
6. To define the test manoeuvres which he must perform in front of the judges to be awarded his solo proficiency rating.
7. To define further tests which allow him the opportunity, if he so wishes, to progress on and achieve higher levels of proficiency.
8. To define the requirements needed to:
    - Fly at air shows and demonstrations
    - Become an Instructor.

This document will set down the guidelines for the checking of equipment and the stages suggested for a multirotor pilot to learn to fly and at a later stage improve, advance and as his competence increases, obtain higher merit qualifications.

For the average pupil pilot it is necessary to give the very basic explanation of how a multirotor flies and the controls involved in producing motion.

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Multirotor is a heavier-than-air craft that derives its lift from driving multiple rotors or propellers revolving on a vertical axis. Multirotors can rise and descend vertically, hover and move forward and backwards, or sideways.

Rotors/propellers are usually driven by electric brushless DC motors mounted at the extremities of the frame. The aircraft is controlled in pitch, roll and yaw by varying the speed on individual motors which are managed by a flight controller that includes gyroscopes and accelerometers. Pilot inputs are supplied to the flight controller from the radio control receiver. Instructions from the receiver are interpreted by the flight controller and the applicable motor speed adjusted to match the pilot input commands. The flight controller can also be used to stabilise and self level the aircraft.

Additional devices can be added to the flight controller to increase the aircraft capability such as a GPS receiver for position hold or automated flight, barometer or sonar for altitude control, etc

2 - DEFINITIONS

Pupil Pilot - A Pupil Pilot is a member who is learning to fly a multirotor. He will have SAMAA membership but has not as yet obtained his Solo proficiency. HE SHALL ALWAYS BE ACCOMPANIED BY AN EXPERIENCED SAMAA REGISTERED AND QUALIFIED CLUB INSTRUCTOR.

Pilot - A member who is in charge of a multirotor, who can fly and has achieved the minimum qualifications of Solo. When he switches on his radio transmitter he becomes a Pilot.

SAMAA - South African Model Aircraft Association. It is the Coordinating and Controlling Body for Aero modelling in South Africa. All SAMAA Rules and Regulations are to be incorporated in and enforced at SAMAA registered clubs.

FAI - Federation Aeronautique Internationale. The international sporting body for all competitive aviation activities.

LOS – Line of sight. In direct view of the pilot without the assistance of any mechanical or electronic devices with the exception of glasses or contact menses.

Member - A fully paid up member of FlyFPVSA and SAMAA.

Pilot Box/Pilot Area - The designated area from which pilots fly their multirotor aircraft.

Pit Area - The area between the club house and the Pilot boxes on the runway nearest to the club house.

Run Up Area - An area off to the side of the taxiways where engines can be checked without interfering with aircraft and multirotors in the pit area or the Pilots flying.

Transmitter - A purpose made, commercially manufactured unit which shall have been designated and manufactured to work within the tolerances of the frequency band without interfering with the adjacent frequency bands. It is used to control our multirotors.

Buddy Box - Two transmitters connected together via a cable, whereby the Instructor has the master transmitter and can assume control of the multirotor as required. This system avoids the traditional method of grabbing the transmitter from the pupil when a mistake is made.

Hovering - is when the model has lifted off the ground and is controlled to remain stationary above the take off point. This is regarded as the first milestone in multirotor flying.

Tail In - this is the usual position used when first starting to fly, it is the safe position, with the tail towards the pilot.

Nose In – This is when the aircraft is flying or hovering with the nose of the aircraft towards the pilot.

Ground Effect - when you are hovering (usually at a height less that propeller diameter) the model will be difficult to keep stationary due to the downwash from the propellers, climbing a little higher out of the ground effect makes things become smoother.

Orientation - At some stage you will find that you are unsure of the models attitude and direction. This is disorientation, it has nothing to do with eyesight, but rather with the fact that you are unable to relate the information you see to the actions needed to recover control. Fortunately with practice and experience this problem will eventually disappear.

Simulator - The simulator is a computer program which allows you to fly a model on your home PC using your transmitter as the control without the risk of crashing and destroying your real model.

Rules and Regulations - SAMAA Manual of Operations, FLYFPVSA Rules and Safety Regulations, the Club Rules and Regulations. Club By-Laws (which have been specifically written to accommodate any club or external restrictions or requirements).

Multirotor Model - A model aircraft which flies by the use of three or more independent propellers, linked by radio control and an electronic flight controller so as to allow the pilot to fly the model remotely , where and as he wants, using a hand held transmitter.

MULTIROTOR AIRCRAFT TYPES

Multirotors come in numerous variations, sizes and formats, not all of which will be suitable for the multirotor tests. Some of the many multirotor models available are listed below;

Tricopter **-** As the name suggests these have 3 motors, typically spaced in a Y-shape, with the rear single motor being mounted on a servo controlled pivot for yaw control.

Quadcopter **-** These are the most common type of multirotor model using four fixed motors. They can be in either a plus or X configuration. Quadcopters will have two motors spinning clockwise and two counter clockwise.

Hexacopter **-** With six motors, these can either have the motors spaced out evenly in a circle or doubled up in a Y-format. These will have three motors spinning clockwise and three counter clockwise, when set up as a Y-shape there will be one motor of each direction on each arm. This configurations offers some redundancy in the event of a motor failure.

Octacopter **-** As with the hexacopter these can be set up with all motors in a circle or with double motors on each arm in a cross or X configuration similar to quadcopters. As with hexacopters these offer more resistance to motor failures. These will have four motors spinning clockwise and four counter clockwise. When set up as a quad-rotor format there will be one motor of each direction on each arm.

Variable Pitch Multirotors **-** These can be any format from above, but are most typically quadcopters. A single motor drives four variable pitch propellers individually controlled by collective pitch servos similar to helicopter rotors. This variable pitch approach allows for negative pitch be configured and sustained inverted or negative G flight to be achieved.

Reverse Direction Multirotors **–** A development in brushless speed controllers that allows for sustained inverted flight with the motor direction reverse for sustained inverted or negative G flight.

3 - TEACHING A PUPIL PILOT TO FLY

This section has been introduced to set down some guidelines to Club Instructors.
It is intended to outline the things that a pilot should know, and its objective is to assist the Instructor.

The duties of the Club Instructor are four fold:

3.1 CHECKOUT THE PUPIL/BEGINNER'S MULTIROTOR

Every multirotor should be checked out for correct motor and equipment installation and for correct radio and flight controller setup.
It is suggested that the pre-flight checklist in Section 5 be used for this purpose.

3.2 FIELD ETIQUETTE AND SAFETY RULES

Most clubs have not prepared classes to cover this aspect of the hobby and therefore it is up to the Instructor to run through the Club Constitution book and documentation covering:

1. – Club Rules and Flying Procedures;
2. – Safety Rules, Safety Code and Procedures; and
3. – Bye-Laws and Special Regulations.
4. – SAMAA and FLYFPVSA Rules.

3.3. GENERAL INSTRUCTION

The Instructors' third duty covers a fairly large scope and the Instructor must do his best to cover the subjects listed below.
To date, no course has been prepared, so it is up to the Instructor to do his best to give the pupil a grounding in the following:

3.3.1 Theory of Flight

1. Basics multirotor flight principals
2. The 3 axis (yaw, pitch, roll).
3. Flight controls.
4. Flight modes
5. Ground effect.

3.3.2 Radio Functions

1. Basic control philosophy.
2. Actions and functions of Tx.
3. Actions and functions of Rx.
4. Checks, range, batteries, etc.
5. Gyro and accelerometer (fc) functions.
6. Battery and airframe maintenance and charging.
7. Receiver failsafe settings.

3.3.3 Frequency Control

1. Control frequencies (2.4GHz)
2. VTx frequencies and frequency control.
3. ICASA frequency regulations.

3.3.4 Pre-Flight Checks

1. Airframe condition and security
2. Radio in correct flight mode
3. Control checks.
4. Lift-off discipline.
5. Allocated flying area, procedures and clearance, permission from other Pilots flying.
6. Club local flying and safety rules.

3.3.5 Flying

1. Power management for height.
2. Acquisition of stick practise.
3. Simple hover and correction during manoeuvres.
4. Power up and take-off procedures.
5. Landing and disarming procedures.
6. Hover Proficiency
7. Disorientation
8. Normal turns and manoeuvres.
9. Approach and landing pattern.
10. Accurate positioning of multirotor in the sky.
11. Basic aerobatics.
12. Identification of pupil‘s weakness, revision and practise to improve.
13. Solo Proficiency Test.
14. Follow up and correction of any issues arising after solo test.

3.4. FLIGHT TRAINING

NO PUPIL PILOT MAY FLY HIS MULTIROTOR OR MULTIROTOR MODEL FROM THE FLIGHTLINE UNLESS ATTENDED BY AN AUTHORISED CLUB MEMBER.

3.4.1 Pre Flight Checks

Refer Section 4

3.4.2 Flight Checks

1. FC trim, PID tuning, rates and expos.
2. Vibration and drift.
3. After test-flight adjust FC as required and check for all equipment security (refer section 4).
4. Re-check in flight, re-adjust if necessary

3.4.3 Teach the pupil to fly

Each instructor has their own individual approach to teaching a pupil, but the basics throughout the world show that in most cases the Instructor is an observer who adds moral support and ensures that the required corrective action is taken. The use of computer simulators and buddy box training is strongly recommended. The suggested sequence of skills training is as follows:

- Tail in hover.
- Tail in squares and circle.
- Tail in Figure 8.
- Side on hover (both sides)
- Forward flight.
- Circuits
- Figure eight.
- Nose in hover
- Advanced circuits.

4 - PRE-FLIGHT CHECKLISTS

This checklist is a general checklist and should be used in part or in whole by all pilots to check out their Multirotor models before the first flight of the day.

This pre-flight checklist is to be used in whole by all pilots who are doing their proficiency tests.
It is a prerequisite that any new, untried or repaired Multirotor model be properly checked before its first flight. The check-lists which follow are brief but reasonably comprehensive.
If in the views of the instructor, the multirotor model is not airworthy or is unsuitable for a pupil the instructor must explain the reasons and the pupil must correct the problems before flights can be attempted.

CHECK LIST:

4.1 Structure and Mechanics:

1. Check frame for cracks and general condition.
2. Check structure for loose items.
3. Check propellers for nicks, cracks, bends and security.
4. Check motors for debris or bent shafts.
5. Frame parts secure.
6. Check CG.
7. Check motor alignment.

4.2 Radio and equipment Installation:

1. Check that suitable ESC's are installed.
2. Check battery for suitable capacity, condition and secure installation.
3. Check that no wires are loose.
4. Batteries Charged.
5. GPS installation correct and secure if fitted.
6. Transmitter battery charged.
7. Check receiver position and protection.
8. Check antennae properly mounted and protected.
9. Camera and VTx secure and connected correctly.
10. Flight controller correctly installed and secured and properly orientated.

4.3 Multirotor Model Setup:

1. Check correct model selected on transmitter.
2. Check all trims to neutral.
3. Check propellers for correct direction.
4. Check retracts tight if fitted.
5. Check the free movement of radio gimbals.
6. Check failsafe
7. Check battery Alarm connected if fitted.
8. Check Video working, correct channels selected on both VTx and VRx.

5 - MULTIROTOR PROFICIENCIES

The proficiencies have been split into four types; Solo, Advanced, Instructor and Demonstration Proficiencies. An advanced proficiency is required for a pilot to be eligible to motivate an instructors or demonstration proficiency.
The primary purpose of solo proficiency testing is to confirm the pilot has adequate control over his aircraft to maintain safe flight under varying conditions and to ensure he has sufficient knowledge of the rules and regulations to safely operate his aircraft.
Proficiency tests must be judged by two Instructor Rated judges who were not the pupil's primary instructors

5.1 The Model
The test can be performed with virtually any suitable multirotor type and must be able to fly the manoeuvres required by the test.
The Judges do not have the authority to alter the required manoeuvres to suit a model. If, in the judge's opinion, the model is unsuitable for the test, then it should be explained to the pilot that the model available is unsuitable for the test. The supply of the model to do the test is the responsibility of the pilot and it is pilot's ability that is being testing, not the model.

All multi-rotor proficiency tests must to be done without GPS, altitude hold or any other form of automated flight assistance.

Pilots should be prepared to explain the capabilities of the system they are using and show that it does not take over control from the pilot and that automated flight will not be achieved during the test.

5.2 THE PROFICIENCY TEST
The Proficiency test is made up of three sections, all sections are equally important and a lack of knowledge in any one section will require a retest. The sections are;

5.2.1 Oral Test
The pilot must answer a minimum of eight questions on Safety matters from the SAMAA and FLYFPVSA Safety Codes and local flying rules. Please note that a minimum of 8 questions are compulsory, and that any pilot not knowing the answers to these questions will automatically fail.
A pilot who has done a flying test which was found to be only just acceptable and who lacks knowledge on the questions, should be asked more than eight questions and if the judges are still not satisfied that the pilot has actually read the safety codes, you should not hesitate to fail him.
The proficiency scheme is a test of both flying ability and knowledge

5.2.2 Pre-flight Inspection
The pilot is to go through his prefight checks as if the test was his first flight of the day.
Points the judges should look for are that the pilot has a steady and regular ground routine and is in full control of what he is doing whilst preparing the multirotor aircraft for flight.
Electric powered models must be carried out from the pits area to a safe point before the flight battery is connected and the model MUST be considered live as soon as the flight battery is plugged in. Great care should be taken at this point and any help given to the pilot should be in the interests of safety.
A poor performance in this section is not direct grounds for failing the candidate but must certainly be part of a cumulative fail if other aspects of his performance is below the standard required.

5.2.3 Flight Test
There is no requirement for the fixed positioning of manoeuvres relative to the wind direction in the Multirotor test.
The pilot must ensure that the model stays at a reasonably constant height and heading and moves at a constant speed through the manoeuvres as required. All deviations from steady and well controlled flight should be noted as they will form part of your examiner's judgement of the test flight. Good use of the controls to maintain a constant height throughout the test is something both the judges and the pilot must watch carefully.

All take-offs and landings should be smooth, without undue oscillations, and lifts and descents should be straight and controlled with the model a comfortable and safe distance in front of the pilot. In any stationary hovering the model should remain steady and should not oscillate unduly.
Movement of the model from one point to another whilst in the hover should be done at a steady walking pace.
The standard brief hover time should be about three to five seconds. The judge should discuss this with the pilot before the test clearly stating that he wants to see a positive stop with the hover long enough to show that the model is well controlled and steady with little wandering or oscillation. Stopwatch accuracy is not required.
The pilot should also be aware that the onus is on him to commence with the next manoeuvre. However, the pilot may ask the Instructor to indicate when he is satisfied that previous manoeuvre has been completed, to help him to decide when to move on. This is quite permissible if requested by the pilot.

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5.3 REQUIREMENTS FOR THE "SOLO" PROFICIENCY TEST

The Solo Proficiency Test consists of an oral test, a pre-flight inspection and a basic flying test.
This qualification fulfils the minimum requirement of the SAMAA Insurance to fly a model multirotor at a Club field without an instructor present.
Solo proficiency does not authorize the pilot to fly his multirotor model from the Club field runway, when general flying is in progress.
The first two test items, Oral (general and safety) and Pre-flight, will require some homework from the pilot, the third item, the flying test needs to be flown twice during the proficiency test.
Failing the oral section constitutes failing the test.
Each manoeuvre is marked out of 10.
The pass mark is an average of 50 %, with no less than 3 out of 10 for any individual manoeuvre.
The Judges pass/fail decision is final and not open to discussion.
If a pilot fails the test, he may be re-tested once on the same day, if time allows.
The Solo Proficiency Test will be arranged and conducted in a formal manner, with at least one Advanced Multirotor proficiency rated member and one multirotor Instructor, the duly completed and signed test papers must be forwarded to SAMAA and the FlyFPVSA committee.

5.4 REQUIREMENTS FOR THE "ADVANCED" PROFICIENCY TEST

All requirements for the Solo test apply.
The test must be judged by at least two Multirotor Instructor rated members.
The multirotor model must have been assembled and set up and trimmed by the pilot, before the test.
The pass mark is an average of 60 %, with no less than 4 for any individual manoeuvre.
The Judges pass/fail decision is final and not open to discussion.
If a pilot fails the test, he may be re-tested once on that day, if time allows
The Advanced Proficiency Test will be arranged and conducted in a formal manner, with a minimum of two Multirotor Instructors present and the duly signed test papers must be forwarded to SAMAA and the FlyFPVSA committee.
The Advanced Proficiency qualifies a pilot to become a Club Instructor, and teach members to fly.
Advanced pilots may participate in demonstration events provided the event is organised and managed by a Demonstration rated member.
The teaching of pupils to fly a multirotor model, when requested is essential to the future of the group.

5.5 REQUIREMENTS FOR A DISPLAY PILOT

A Display Pilot Rating is attainable. This will only be awarded to Instructor rated Pilots who wish to fly regularly at Public displays and demonstrations. Any Pilot who wishes to fly at public displays regularly must hold a minimum of an Instructor Proficiency rating, and have received the rating of Display pilot from the FLYFPVSA committee
Ensure that SAMAA permission is obtained for any pilot to fly at any Display or Flying Event at a non-SAMAA registered site to validate the Insurance cover.
A pilot holding an Advanced Proficiency level is permitted to fly at a display but the event must be under the management of a Demonstration Proficient person.

5.6 REQUIREMENTS FOR A MULTIROTOR INSTRUCTOR

As an instructor the level of competence you should expect of a pilot before awarding a solo is that in your opinion the pilot is capable and competent to be allowed to fly on unsupervised.

5.6.1 Club Instructor - A person, who in a Club's views, is qualified to assist a beginner to learn to fly and who has passed a Multirotor Advanced Proficiency Test.
Note this is an accreditation awarded by the club to an advanced proficiency pilot.

5.6.2 Multirotor Instructor - A Pilot who has satisfactorily obtained his Multirotor Advanced Proficiency and who has demonstrated to the FLYFPVSA Committee that he has a thorough understanding of building and setting up a multirotor model, and has an interest in training a pupil to fly a multirotor model, may apply to the FLYFPVSA committee to be appointed as a Multirotor Instructor. This application must be in writing, giving his modelling and judging experience.
The applicant should meet the following criteria to be considered by the FLYFPVSA committee.

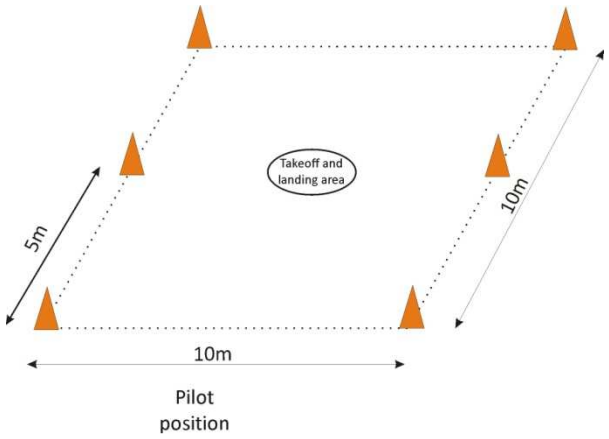
a.) He shall be a fully paid up member of FLYFPVSA and SAMAA and be in good standing with regards to payments.
b.) He shall have a minimum of one years' exposure to multirotor or other RC model flying.
(Fixed wing or helicopter proficiencies will strongly advantage the application)
c.) He should have knowledge of how to set up multirotor flight controller systems, and have an understanding of multirotor requirements
d.) Should have knowledge on how to setup BUDDY BOX systems.
e.) He shall be mature and unbiased.
f.) He shall be respected in the flying fraternity.
g.) He must be willing to train a pupil to fly a multirotor model.

The pilot's Application shall be submitted for approval to the FLYFPVSA Committee and ratification by SAMAA when required.
It is at the FLYFPVSA committee's discretion as to how many Instructors are required in an area or province based on the number of active members and pilots in that area or province.

6 – PROFICIENCY FLIGHT TEST MANOUVERS

6.1 FLIGHT TEST AREA

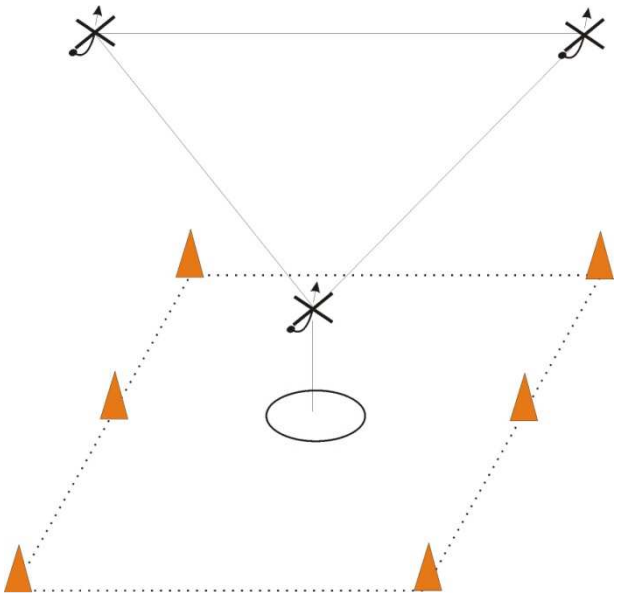
The flight test area should be 10 x 10m square demarcated by 6 cones or flags to act as reference points for the completion of manoeuvres. The cones or flags must be placed at the four corners of the flight area as well as the centres of the left and right hand sides of the square. A landing and takeoff area must be demarcated at the centre of the flight area.
The pilot must be positioned a minimum of 2 meters outside the flight area at the centre of the box.



6.2 FLIGHT TEST MANOUVERS

6.2.1 Tail in vertical triangle

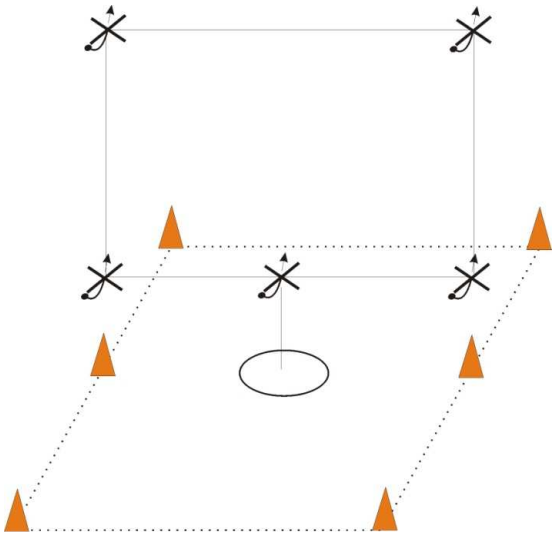
Model takes off from the central landing area, rises vertically to eye level, pauses, rises 2m in altitude in a straight line diagonally to the edge of the box in either direction with constant speed, heading and rate of climb, pauses, hovers sideways with a constant altitude, speed and heading to the opposite side of the flight box, pauses, descends 2m in altitude in a straight line diagonally with constant speed, heading and rate of decent back to the centre of the box pauses, descends vertically, and lands on the central landing area.
Downgrading Guide: Takeoff, Horizontal hovering lines (max 2), Diagonal hovering lines (max 2), Stops (max 5), Landing, Constant altitude, Constant heading, Constant speed, Positioning.



6.2.2 Tail in vertical rectangle

Model takes off from the central landing area and rises vertically to eye level, pauses, maintaining a constant altitude, heading, and speed, hovers sideways either direction, to the edge of the box, pauses, rises vertically 2m, pauses, hovers sideways over the central landing area to the opposite side of the box, pauses, descends vertically 2m, pauses, hovers back to central landing area, pauses, and descends vertically to land on the central landing area.

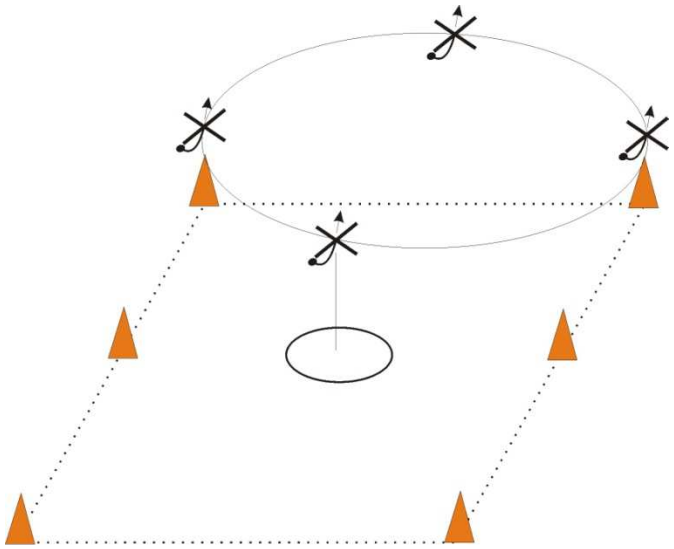
Downgrading Guide: Pilot position, Takeoff, Horizontal lines (max 3), Vertical lines (max 2), Stops (max 6), Landing, Constant altitude, Constant heading, Constant speed, Positioning



6.2.3 Constant heading circle

Model takes off from the central landing area and rises vertically to eye level, pauses, maintaining constant altitude, heading, and speed, completes a circle to the right or left. The circle passes over the two (2) corner flags opposite the pilot ending over the central landing area, pauses, descends vertically, and lands on the central landing area.

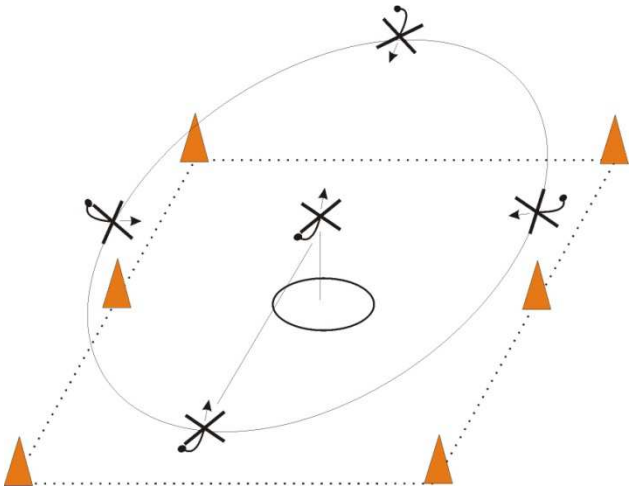
Downgrading Guide: Pilot position, Takeoff, Circle not round, Stops (max 2), Landing, Constant altitude, Constant heading, Constant speed, Positioning.



6.2.4 Nose in circle

Model takes off from the central landing area and rises vertically to eye level, pauses, hovers backward in a straight line, at a constant altitude, heading, and speed to edge of box, pauses, hovers either direction with nose pointing at the central landing area in a 5m radius circle passing over the centre of each side of the box, pauses, hovers forward in a straight line to the central landing area, pauses, descends vertically to central landing area.

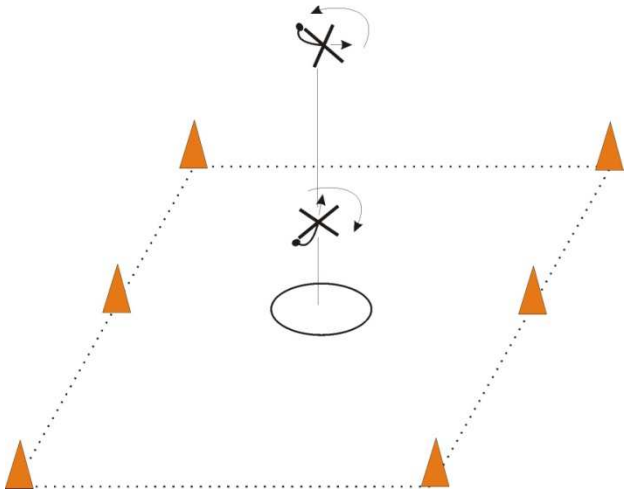
Downgrading Guide: Pilot position, Takeoff, Horizontal lines (max 2), Stops (max 4), Circle is not round, Constant altitude, Constant heading, Constant speed, Landing, Positioning.



6.2.5 Spike with 90 degree pirouettes

Model takes off from the central landing area and rises vertically to eye level, pauses, rotates 90 degrees in either direction, pauses, climbs vertically 2m, pauses, rotates 90 degrees in the opposite direction, pauses, descends vertically 2m, pauses, descends vertically to central landing area.

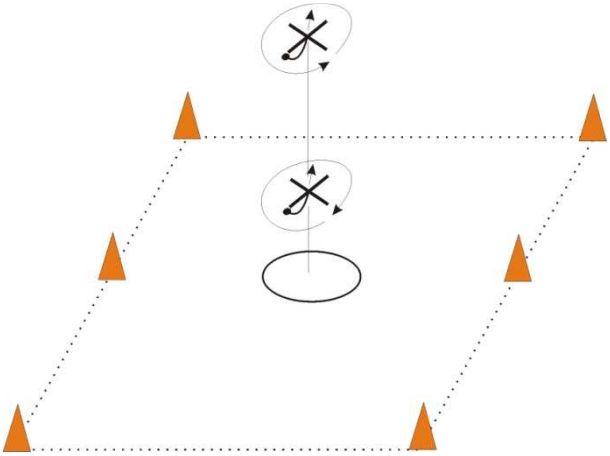
Downgrading Guide: Pilot position, Takeoff, Rotations not 90 degrees (max 2), Vertical lines (max 2), Rotation not 90 degrees (max 1 per rotation), Stops (max 6), Landing, Constant altitude, Constant heading, Constant speed, Positioning.



6.2.6 Spike with 360 degree pirouettes

Model takes off from the central landing area and rises vertically to eye level, pauses, rotates 360 degrees in either direction, pauses, climbs vertically 2m, pauses, rotates 360 degrees in the opposite direction, pauses, descends vertically 2m, pauses, descends vertically to central landing area.

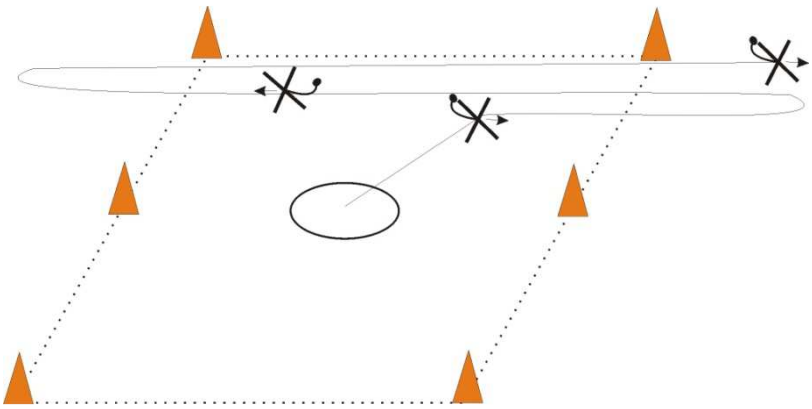
Downgrading Guide: Pilot position, Takeoff, Rotations not 360 degrees (max 2), Vertical lines (max 2), Rotation not 90 degrees (max 1 per rotation), Stops (max 6), Landing, Constant altitude, Constant heading, Constant speed, Positioning.



6.2.7 Straight and level flight with own turns

The model takes off from the central landing area and climbs away, gaining speed and altitude in the direction of the circuit pattern, either left or right. At a distance greater than 10m the multirotor is turned and flown straight and level past the pilot. At a distance of greater than 10m on the other side the pilot performs a turn and the multirotor is again flown straight and lever past the pilot in the opposite direction and same altitude. The turn is at the pilot's discretion and may be a level turn, a stall turn or type of 180 degree turn.

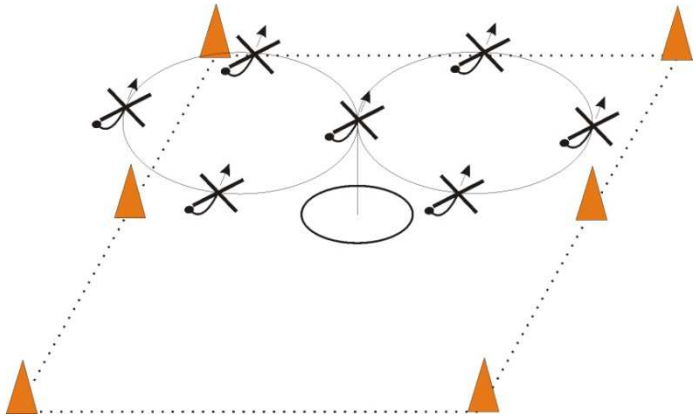
Downgrade Guide: Pilot position, speed control, height control, directional control, control and smoothness of turn.



6.2.8 Figure 8 with constant heading

Model takes off from the central landing area and rises vertically to eye level, pauses, begins a forward hovering circle, maintaining a constant altitude, heading, and speed, in either direction. The circle passes over the two (2) corner flags on one side of the box and back to the central landing area, continues and makes another circle in the opposite direction to the central landing area, pauses, descends vertically to the central landing area.

Downgrading Guide: Pilot position, Takeoff , Circles not round (max 2), Stops (max 2), Landing, Constant attitude, Constant heading, Constant speed, Positioning.

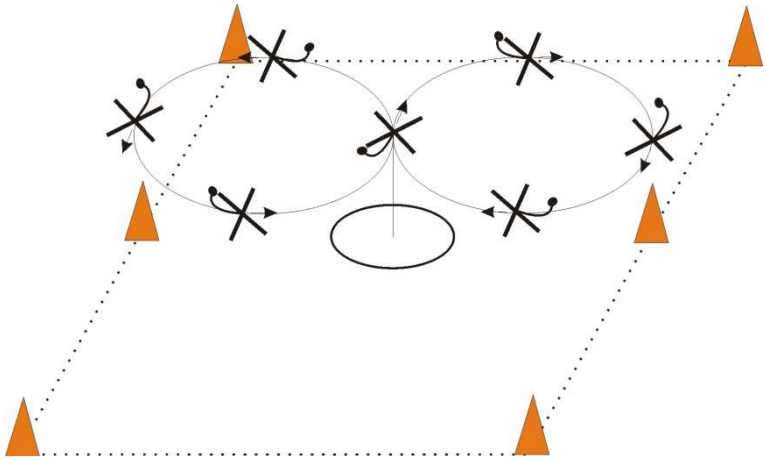


6.2.9 Figure 8 with heading change

Model takes off from the central landing area and rises vertically to eye level, pauses, begins a forward hovering circle, maintaining a constant altitude and speed, in either direction. The circle passes over the two (2) corner flags on one side of the box and back to the central landing area, continues and makes another circle in the opposite direction to the central landing area, pauses, descends vertically to the central landing area.

The turns must be banked turns making use of both roll and yaw and should be coordinated correctly.

Downgrade Guide: Pilot position, height control, speed control, smoothness of turns, straight legs.

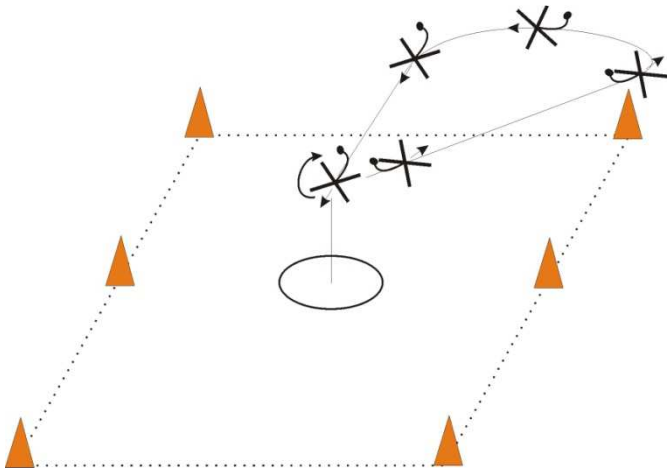


6.2.10 Teardrop

Model takes off from the central landing area and rises vertically to eye level, pauses, turns 45 degrees (left or right), pauses and then begins level forward flight. When the model passes over the box corener flag it begins a turn toward the centre of the box, returning to straight and level flight at the centre of the box and flying nose in toward the central landing are. The models stops and hovers over the landing area and then performs a 190 deg pirouette, pauses and then lands on the central landing pad.

The turn must be a banked turn making use of both roll and yaw and should be coordinated correctly.

Downgrade Guide: Pilot position, height control, speed control, smoothness of turn, straight legs.



6.2.11 Emergency decent

An emergency decent may be called at any time during any manoeuvre at the instructor's discretion to simulate a flight area encroachment, either ground or air, to judge the pupil's ability to react to emergency situations and the appropriate corrective actions to be taken to avoid an unsafe situation.

Once the emergency has been called and the pupil has dealt with the situation appropriately the manoeuvre must be re-flown and scored.

7 – FLIGHT TEST SCORE SHEETS

Completed test score sheets must be forwarded to the FlyFPVSA committee who will then forward them to SAMAA for accreditation to the pilot's SAMAA membership.

Multirotor LOS Proficiency Test
Solo

	Flight 1	
Manoeuvre	**Judge 1**	**Judge2**
1 – Oral Test		
2 – Pre-flight Checklist		
3 – Tail in vertical triangle		
4 – Constant heading circle		
5 – Tail in vertical rectangle		
6 – Spike with 90 degree pirouette		
7 – Straight and level flight with own turns		
8 – Emergency decent (called at any time)		
Score Sub Totals		
Score for each flight		
Percentage		

Pilot Name:	Club Name:
Pilot's Address:	Date:
	Tel No (W)::
	Tel No (C):
Pilot Signature:	SAMAA No:
Judge 1 Name:	Signature:
Judge 2 Name:	Signature:
Club Chairman:	Signature:

Items 1 and two are either a pass or fail.
A minimum score of 3 for items 3 – 8 is required.
The overall average pass mark for both flights must be 50% or higher.

Multirotor LOS Proficiency Test
Advanced

	Flight 1		Flight 2	
Manoeuvre	**Judge 1**	**Judge2**	**Judge 1**	**Judge 2**
1 – Oral Test			Use flight 1 score	
2 – Pre-flight Checklist			Use flight 1 score	
3 – Tail in vertical rectangle				
4 – Straight and level flight with own turns				
5 – Spike with 360 degree pirouettes				
6 – Figure 8 with heading change				
7 – Teardrop				
8 - Emergency decent (called at any time)				
Score Sub Totals				
Score for each flight				
Percentage				
Average Percentage for both flights				

Pilot Name:	Club Name:
Pilot's Address:	Date:
	Tel No (W)::
	Tel No (C):
Pilot Signature:	SAMAA No:
Judge 1 Name:	Signature:
Judge 2 Name:	Signature:
Club Chairman:	Signature:

A minimum score of 6 must be attained for 1 & 2 and minimum score of 4 for items 3 – 8.
The overall average pass mark for both flights is 60%

Multirotor LOS Proficiency Test
Instructor / Demonstration Pilot

	For official use		
	C1	**C2**	**C3**
FOR AN INSTRUCTORS QUALIFICATION			
ATTACH TO THIS FORM THE FOLLOWING:			
1.) A COPY OF THE PILOTS SIGNED			
—ADVANCED PROFICIENCY TEST			
2.) A written application (motivation) for			
— Instructors qualification or			
— Display Pilot's accreditation			
Sub Totals			

Pilot Name:	Club Name:
Pilot's Address:	Date:
	Tel No (W)::
	Tel No (C):
Pilot Signature:	SAMAA No:
Judge 1 Name:	Signature:
Judge 2 Name:	Signature:
Club Chairman:	Signature: