



**2010**

## **Intent:**

The intent of this program is to be used as **guide** for a training / proficiency program for R/C model helicopter pilots. However it is not intended to replace manufacturers' instructions or recommendations.

**Throughout this program, safety is of primary importance.**

## **Purpose of the program:**

- 1) To provide a safe environment for participants and spectators while watching, learning to fly and subsequently flying radio controlled helicopters.
- 2) To minimize safety hazards and accidents by encouraging model helicopter pilots to have a clear understanding as to how all of the mechanic/electrics operate; that they have read all of the manufacturers' manuals; and that they are able to demonstrate all functions.
- 3) To make radio control model helicopter flying a most satisfying experience.
- 4) Safety is a major factor and with the help of an instructor and a simulator, the student can learn the necessary skills to become competent at any level.
- 5) We must also consider that many of the helicopters are not capable of doing all of the listed manoeuvres; nevertheless, their owners can still be considered competent pilots after demonstrating that they are in full control of the model that they are flying competently.
- 6) The preference is to keep the helicopter pilot at the flying field and not at the parks and back yards in order to teach them their skills. By making this project a three-tier program, it shouldn't discourage anyone from flying safely.
- 7) If your intent is just to hover around, then the Basic level is probably enough, providing that you show all of the safety skills. However, if it is your intent to do any advance manoeuvres, then the advanced section needs to be fulfilled.

It is **highly recommended** that the student purchase a **flight simulator** in order to become proficient in all levels of flying without causing any damage to their own

helicopter. The learning time will be shortened immensely and make the learning curve much safer.

## **Preflight Check:**

### **Mechanical:**

- 1) Check that all links are slop-free and move freely without restriction;
- 2) Ensure nuts, bolts and screws are tightly secured;
- 3) Be sure that locktite, oils and grease have been used as per the manufacturer's recommendations;
- 4) Ensure that the tail assembly is free and that there are no bent pushrods;
- 5) Unfold the blades and check the tightness of both the main blades and tail (rotor) blades. Be sure that they are sufficiently adjusted. Too tight may induce vibrations during the flight (behaviour) which is worse than loose. In fact, loose blades fly smoother;
- 6) If this is a nitro or gas machine, fill the tank at this point and check for any leaks;
- 7) It is recommended to put a paint stripe on each screw as a visual aid so you can see if the screws have turned since they were installed;
- 8) For basic training, one should use a collective pitch setting that has less pitch on the bottom (e.g. -2 degrees). This will insure one does not drive the helicopter into the ground while hovering if the student panics and chops the power;
- 9) Setting the throttle curve or governor for a relatively lower rotor speed (e.g. 1,600 to 1,700 rpm) will also help the novice in the basic hovering and forward flight training.

**Note: # 8 and # 9 will be changed when one transitions into aerobatics.**

### **Electrical Components:**

- 1) Ensure that all wires are properly inserted and strapped down so that nothing will come loose and create a dangerous situation;
- 2) Check the voltage in all batteries and verify that they are fully charged.

### **Transmitter/Receiver:**

- 1) Prior to turning on the transmitter, check the transmitter visually for any broken switches or case damage and make sure that it is set for the right model memory.
- 2) Check position of all switches and trims on the transmitter and make sure that the correct flight mode is being used in order for the low throttle to be set. Lower the throttle;
- 3) Verify that your frequency is available for your use. Normally, there is a frequency board so that you can peg off. If you are using 2.4GHz, abide by the club rules for pegging;

- 4) Extend the antenna and turn on the transmitter. Wait 5 seconds for 2.4GHz to scan and lock on to a frequency, then turn on the receiver switch. Wait for the receiver and gyro to initialize as per your gyro's instructions;
- 5) Check the transmitter battery voltage to be sure it is fully charged;
- 6) Move the controls in all directions and verify servo direction without any binding;
- 7) Make sure that the gyro(s) (flybarless systems now has 3 of them) compensates in the correct direction;
- 8) If this is an electric machine, initialize the throttle hold. However, this may pose some problems with some speed controls if it is set up improperly;
- 9) It is recommended to have a second person holding onto the blades just in case you become distracted and something isn't functioning correctly.
- 10) Do a range check to verify that your radio and transmitter are bound to each other and react as per the manufacturer's specifications.

### **Start-up Sequence:**

- A) Verify that the field is available for your use and that the number of persons flying doesn't exceed the club rules;
- B) If this is an electric machine, initialize the throttle hold;
- C) If this is a nitro, then initialize the throttle hold as well and attach the glow driver and hold the main blades. By using the throttle hold, you will avoid any hot starts;
- D) Make any final adjustment to the mixture of the nitro motor, if necessary, to ensure a good smooth operation;
- E) Move the helicopter to the take-off position in the field and return to the pilot's box;
- F) Make sure that the helicopter is a safe minimum of seven (7) metres in front of you;
- G) Announce the take-off.

### **Post-flight Checks:**

- 1) After bringing the model back to the pit area or bench, perform a quick check for any loose components and especially check every ball link as well as tail and main rotor end play and tail and main blade grip play;
- 2) Make sure that the motor has been stopped with low trim or if it is an electric machine, make sure that the main battery is disconnected;
- 3) Optional would be to burn all of the remaining fuel out of the carburetor by starting the model in the usual way and letting it run until it quits;
- 4) Make sure that the muffler has cooled off before putting it into your vehicle's trunk or on the back seat to avoid burning of materials like seat leather;
- 5) Store the model, tools and equipment in a safe place until the next flying day;
- 6) While cleaning your model, check the components. Cleaning is a good way to inspect your machine.

## **Flying Proficiency Levels:**

There are five flying proficiency levels and a proficiency test as indicated below. After successfully mastering levels “A and “B”, the candidate may receive his helicopter pin after passing the basic level proficiency test. This will give him the freedom to safely fly on his own. The student may be limited by the helicopter that he is using and consideration will be given to him as being competent with this particular type of machine. The next two levels C and D are considered to be of an advanced level and not necessary to be a safe competent pilot.

After level “B”, the pilot should be ready to take the basic proficiency test and, if successful, receive his pilot's pin.

## **Proficiency Levels are as follows:**

### **Beginner Level**

A – Basic Control

B – Hovering Tail in

Beginner Level Proficiency Test

### **Intermediate Level**

C – Side Facing hover.

D – Forward Flight

Intermediate Proficiency Test

### **Advanced Level**

E- Advanced Manoeuvres

Advanced Proficiency Test

## **Beginner Level**

### **Level A - Basic Control**

This level allows the pilot to get a feel of the model's controls and how it reacts to transmitter inputs. Experiment and interact with the model's controls to become comfortable with its movements. Use the fore/aft, rudder and cyclic controls in turn, and watch the model as you give inputs. It's important to give slow and small inputs at first. In this level, try to keep the tail pointed towards you at all times. The moment the model's tail is not pointed towards you, adjust with the rudder controls or reduce pitch and power to return the model to the ground and initial position. It is important when you place the model in the "initial position" to point the tail of the helicopter towards the pilot.

### **Light On The Skids**

Increase pitch and power such that the helicopter is "light on the skids". "Light on the skids" is the situation where the model is floating just above the ground, almost taking off and almost landing. The altitude of the model in this stage is approximately 5 cm, just enough so the model is off the ground, and just enough such that the controls are

fully functional. The helicopter will feel like it's "floating". Lift to an altitude of about one rotor diameter where the model is just out of the ground-effect condition.

The air cushioned under the rotor in ground effect will result in less power needed to hover, but will also render it less stable, requiring more cyclic work to keep it in one place. Therefore, lifting it so that it hovers out of ground effect (approximately the height of the rotor span) will make it easier to hover.

### **Short Hops**

When you have a good foundation of the controls, you should try to lift the helicopter a little higher off the ground, but for only very short duration. These "short hops" will get you working towards an environment that is out of "ground effect". Again, keep the same tail-in pattern when doing short hops. When you increase altitude of the hops, you should also increase the duration of the hops. You will notice that when you move out of "ground effect" you will need to add a little more pitch and power to maintain a hover.

When the pilot is able to sustain a hover in the tail-in pattern over the initial position for roughly a tank of fuel, he should be able to start practicing and advance to the level B components.

### **Level B - Tail-in Hovering**

#### **“45 left and 45 right”**

While sustaining a hover in the tail-in position, yaw the model by using left or right rudder inputs. Yaw the model to one side such that your hovering at a 45-degree angle to yourself. Hold this position for a period of time, then return to the tail-in hovering pattern. Next repeat, by giving the opposite yaw input and hovering at a 45-degree angle to yourself in the opposite direction.

Note that its important to practice the transition between the tail-in, 45 left and 45 degree right patterns.

#### **Directional Control**

Lift helicopter into a hover from the initial starting point approximately 1 to 2 metres in altitude tail-in towards the pilot. Hover, tail-in and move the helicopter 10 metres to the left or right. Hold the hover there for 5 seconds. Move the helicopter back to starting point maintaining the tail-in position. Hold the hover over the starting point for 5 seconds. Move the helicopter 10 metres in the other direction and maintain the hover for 5 seconds. Move the helicopter back to the starting point and maintain the hover for 5 seconds. Move the helicopter forward about 10 metres and maintain the hover there for 5 seconds. Back up the helicopter, tail-in to the starting point holding the hover for 5

seconds over the starting point and land the helicopter. During these manoeuvres, the pilot should strive to maintain a constant altitude.

When the pilot is able to sustain a hover in the tail-in position, 45 left and 45 right tail-in, movement to the left, right and forward and back while maintaining a constant altitude for roughly a tank of fuel, then he should be able to practice on his own without direct supervision and ask for a basic competence test so that the student can fly on his/her own.

Having the knowledge of what an autorotation is can be very important in case of an engine failure. However, it is not a requirement at this level. The instructor should give the student a demonstration of this helicopter-saving manoeuvre. Practicing on the simulator at this point would be prudent.

When the student is comfortable with all of these and the instructor thinks he is ready, he may attempt the Proficiency test for these levels.

### **Proficiency Test for the completion of levels A and B for the purpose of assessing beginner level and the safe flying and controllability of the helicopter**

A student pilot who has successfully completed the previous two levels is obliged to complete this **Basic Proficiency Test**.

To complete this level, the pilot must use his current skills to achieve the following:

- 1) Perform pre-flight checks.
- 2) Have an understanding of the radio and its functions
  - Throttle curves
  - Throttle hold
  - Pitch curves
  - Expo
  - Trim settings and adjustments
  - Gyro functions
  - Start – up Sequence
- 3) Flying program
  - Call all manoeuvres prior to implementing
  - Lift helicopter into a tail-in hover position at an altitude somewhere between 1 and 2 metres.
  - Move helicopter 10 metres to one side maintaining the tail-in position and a constant altitude.
  - Hold the hover for 5 seconds.
  - Move the helicopter back to the starting point maintaining the tail-in and a constant altitude.
  - Hold the hover for 5 seconds.

Land the helicopter at the starting point  
Lift helicopter into a tail-in hover position at an altitude of between 1 and 2 metres.  
Move helicopter 10 metres in the other direction maintaining the tail in position and a constant altitude.  
Hold the hover for 5 seconds.  
Move the helicopter back to the starting point maintaining the tail-in and a constant altitude.  
Hold the hover for 5 seconds.  
Land the helicopter at the starting point  
Lift helicopter into a tail-in hover position at an altitude between 1 and 2 metres.  
Move helicopter 10 metres forward maintaining the tail-in position and a constant altitude.  
Hold the hover for 5 seconds.  
Move the helicopter back to the starting point maintaining the tail-in and a constant altitude.  
Hold the hover for 5 seconds.  
Land the helicopter and hit throttle hold to secure the helicopter.

#### 4) Check-off Sheets

Check-off sheets showing each manoeuvre can be used by the instructor to verify completion of each phase.  
Each pilot will be judged by the instructor and at least one executive member.

- a. Presentation of pilot's pin.  
To be given out at the next club meeting or event.

**Intermediate levels** are as follows and their completion is not a requirement to hold a pilot's pin. However, it is recommended that the pilot continue on with the next levels.

### **Level C – Side On Hovering**

#### **“90 left and 90 right”**

While sustaining a hover in the tail-in position, yaw the model by using left or right rudder inputs. Yaw the model to one side such that you're hovering at a 90 degree angle to yourself. Hold this position for a period of time (Instructor should see, feel that the student has control of the helicopter, not just putting it there and praying for 5 seconds), then return to the tail-in hovering pattern. Next, repeat by giving the opposite yaw input and hovering at a 90-degree angle to yourself in the opposite direction.

## **Level D- Forward Flight**

The goal of this Level is to take off from the initial position, enter forward flight and then return and land safely in the initial position.

Hover over the initial position at 1 to 2 metres in the tail-in position. Yaw the model left or right 90 degrees and sustain a hover as practiced from the previous levels. Proceed to travel in a straight line for approximately 10 metres. Turn the model 90 degrees to the tail-in position and maintain a hover for a few seconds. Turn the helicopter back towards the pilot and travel back to the initial position, turn 90 degrees away from the pilot (bring the model back to the tail-in position) hover for a few seconds and repeat for the opposite side. The student should strive to maintain a constant heading a speed and altitude throughout these manoeuvres.

When the student is comfortable with these manoeuvres, he should feel ready to start making turns in forward flight.

Hover over the initial position at 1 to 2 metres in the tail-in position. Yaw the model left or right 90 degrees and sustain a hover for 5 seconds. Proceed to travel in a straight line for approximately 10 metres. Turn the model 180 degrees and travel back to the initial position, turn 90 degrees away from the pilot (bring the model back to the tail-in position) hover for a few seconds and repeat for the opposite side. The student should strive to maintain a constant heading a speed and altitude throughout these manoeuvres.

**Note: At no time during these manoeuvres should the helicopter be flying towards the pit area. All forward flight should be laterally from left to right, or from right to left (relative to the wind direction and flight pattern in effect at the field at that time) in front of the pilot.**

When the pilot is able to do lateral flying as described above, he/she should start practicing for the Intermediate Level Proficiency test.

### **Proficiency Test for the completion of level “C & D” for the purpose of assessing the intermediate flying and controllability of the helicopter.**

A student pilot who has successfully completed the previous levels and has received his pilot's pin, should work to complete the next two levels. This level brings all the previous levels together to complete an **intermediate pilot proficiency test**.

To complete this level, the pilot must use his current foundation to achieve the following:

- 1) Perform pre-flight checks.
- 2) Have an understanding of the radio and its functions
  - Throttle curves,
  - Throttle hold
  - Pitch curves



Expo  
Normal, idle up 1 and 2  
Auto-rotation  
Trim settings and adjustments  
Gyro functions and set-up

3) Start – up Sequence

4) Flying program

Call all manoeuvres prior to implementing;  
Lift the machine into a hover position between 1 and 3 metres, preferably not eye level;  
Hover for 3 seconds in a stable position;  
Position helicopter at 90 degrees and hover for 5 seconds;  
Repeat but turn to the other side at 90 degrees and hover for 5 seconds;  
Transition into slow forward flight in a straight line and constant speed and altitude for approximately 10 metres;  
While maintaining forward movement complete a 180-degree turn and return to the starting point, turn the tail towards the pilot and hover for 5 seconds;  
Repeat the manoeuvre for the other side while maintaining a straight line and constant speed and altitude;  
Return to the starting point, turn the helicopter tail in, hold the hover for 5 seconds and land the helicopter;  
Shut down the engine.

**Note: At no time during these manoeuvres should the helicopter be flying towards the pit area. All forward flight should be laterally from left to right, or from right to left (relative to the wind direction and flight pattern in effect at the field at that time) in front of the pilot.**

5) Check-off Sheets

Check-off sheets showing each manoeuvre can be used by the instructor to verify completion of each phase.  
Each pilot will be judged by the instructor and at least one executive member.

Recognition of this level should be given to the pilot by the local club executive. This will allow him to advance and become an instructor if requested by the executive. It's called payback time.

Finally, if the pilot demonstrates that he is capable of controlling the helicopter in a safe manner and is able to respect the values of other pilots when flying, then he should receive another certificate for the completion of the 4 levels. This will be up to the discretion of the flight instructor.

## **Advanced Level**

The advanced level allows a pilot to practice and progress to more advanced manoeuvres. The advanced level manoeuvres will be listed for practice and may be completed in any order for testing purposes.

**Note: For these manoeuvres, the pilot should now set up his heli for aerobatics with a mirror collective curve and a throttle curve in idle up mode that will maintain a constant rotor speed. (e.g. -9/0/+9). He may also want to set his heli up with a throttle curve that will result in a higher rotor speed (e.g. 1800+)**

The advanced manoeuvres are as follows:

- Nose-in hovering for at least 3 seconds;
- Fast forward flight with banked coordinated turns;
- Figure 8s with both in-turns and out-turns;
- Slow Pirouettes, (Minimum 2 seconds), in both directions;
- Transition through inverted flight, (e.g. – Immelman turns, half-cuban & half-reverse cuban eights, etc.) ;
- Basic aerobatics (e.g. – Loops, rolls, stall turns, etc.) ;
- Auto-rotation to a complete landing (no bail) ;

When a pilot is comfortable and competent to fly these manoeuvres, then he can perform them as part of a proficiency test for the advanced level.

The pilot could receive, at the discretion of the club, a pin or certificate indicating successful completion of the Advanced Level.

## **Instructors**

A pilot who has completed and passed the intermediate level proficiency test may instruct and examine a pilot at the beginner level.

A pilot who has completed and passed the advanced level proficiency test may instruct and exam a pilot at the beginner or intermediate level.

A pilot that has completed and passed the advanced level may instruct or examine any level of pilot.

Just because a pilot has attained the required levels does not automatically make him an instructor. Instructors are appointed by the club.

The club may appoint a Chief Instructor to monitor and administer the Blades Program for the club. This person should be an advanced level pilot, but if one is not available, then another level pilot may hold this position for coordination purposes only.

## **Glossary of Terms:**

**Altitude** - Distance of the model from the ground.

**Ascending** - Increasing altitude.

**Altitude** – Height above a reference point.

**Buddy Box** – A second transmitter that permits the instructor to pass control to the student.

**Descending** - Decreasing altitude.

**Flybar** – Stabilizes the main rotor disk of a helicopter.

**Ground effect** - The ground effect condition is when the model is so close to the ground. that the disturbance flowing down through the main rotor disk creates a cushion of air under the model.

**Initial Position** - The position and location of the model before take-off. Usually, when training, the initial position is with the model's nose into the wind and the tail pointed towards the pilot. The distance from the pilot and the initial position should be approximately 7 metres.

**Main Rotor** – A large rotor in the horizontal plane of a helicopter that provides the lift.

**Nose-in** - The orientation of the model relative to the pilot is when the model's nose is facing the pilot.

**Pitch** - The angle at which main or tail rotor blades are set. The pitch on the main and tail blades change on collective pitch models. The change in pitch on the main blades allows the helicopter to ascend or descend. In addition, the pitch on the tail blades allows the helicopter to yaw left or right.

**Swashplate** – The device that translates (transfers???) control inputs to the rotor head of a helicopter, for pitch and lateral control.

**Tail Boom** – A horizontal portion of the helicopter that holds the tail surfaces and tail rotor.

**Tail-in** - The orientation of the model relative to the pilot is when the model's tail is facing towards the pilot.

**Tail Rotor** – A small rotor at the tail of the helicopter to counteract the torque of the main rotor and provide yaw control.

**Range Check** - A method of testing the range of the transmitter and receiver relationship. Usually done by turning both receiver and transmitter on, walking away from the receiver with the transmitter in hand ensuring the antenna is collapsed. The paces taken from the receiver until the communication is broken are usually noted during??? each range check. If the paces differ by a large amount from one range check to the next, this may be an indication of radio problems.

**Short Hops** - When the model ascends for a short period of time then descends and lands. This technique allows a beginner pilot to get used to pitch and throttle inputs of the model.

**Yaw** - The rotation of the model around the main rotor shaft, i.e.: tail rotor inputs.

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