

# Heart of Texas Miniature Aircraft Club



## Flight Training Manual

March 5, 2012

# Welcome to the HOTMAC Flight Instruction Program

Welcome to the multi-faceted and interesting hobby of "R/C model aircraft". You have begun a journey that will fulfill you with a lifetime of learning. It can be as simple or complex as the projects that you attempt to undertake. But, R/C club members seem to always have two interests in common. They enjoy building good looking model airplanes, and they love to fly them. Our flight training program attempts to ease the path toward attaining both of these goals. It provides an opportunity for each newcomer to participate in a well structured R/C flying instruction program which can effectively teach you how to prepare an airplane for its first flight and teach you how to fly and most importantly to take off and land. This is a program which strengthens the club, insures a much safer flying environment and is, obviously, a benefit for beginning R/C enthusiasts.

To receive RC Flight Instruction from the HOTMAC instructors you must become a member HOTMAC and the Academy of Model Aeronautics. See membership information on the HOTMAC website: [www.hotmacrc.org](http://www.hotmacrc.org) and the AMA website: [www.modelaircraft.org](http://www.modelaircraft.org).

Our Instructors realize that all student pilots do not have the same life experiences. Most have had no previous flying or building experience and have no idea of the challenges which lie ahead. It is only natural that there are some who arrive in a nervous and somewhat intimidated frame of mind. Therefore, the instructor's initial challenge is to calm his student's fears and attempt to leave the student with a pleasant memory of his first R/C flying experience. A gentle approach, a properly trimmed aircraft, an appropriate throttle setting and at a comfortable altitude of 300 feet or more for those first flights will work to calm the student's fears.

Once the student is reasonably capable of following the teacher's instructions, the operating altitude will be lowered to, a "one error" height of about 100 to 150 feet. Throughout the program, Instructors will emphasize the importance of concentration and following the "Student Progress Check List".

An instructor's primary assignment must always be to maintain a safe environment for his students, other flyers and the spectators present at Speegleville Park. Your instructor will do everything possible to prevent a mishap or loss of your plane. He will save many aircraft repairs in the process. And he will offer his students an opportunity to learn to fly and to realize what fun this hobby can be, especially as a solo flier. However, there are NO guarantees that a mishap will not occur.

A student must accept the fact that his instructor is just another R/C enthusiast who has learned to fly reasonably well and, although unpaid, is willing to go out of his way to assist newcomers to R/C. If the student flies at least twice a week and applies themselves, they will solo within a few weeks and experience no major accidents.

A student should also bear in mind that an instructor is not his personal mechanic or employee. His instructor is a friend who expects his students to fly on a regular schedule, and to try as hard as he does to see that each receives a Solo Certificate. Remember, we all go out to the flying field to have a good time and the very best of those times come when we are flying comfortably all by ourselves. The efforts to teach and to learn are worth every moment.

Remember, **DO NOT FLY ALONE** until your instructor says you are ready and you have completed the "Student Solo Flight Check"!

# Program Structure

## **LEVEL I**

- (A) Aircraft pre-flight inspection
- (B) Introduction to flight

## **LEVEL II**

- (A) Straight & Level Flight, Left & Right Turns (at an altitude of approx 300')
- (B) Giant Circles - Left & Right (at an altitude of approx 300')

## **LEVEL III**

- (A) Oval Pattern- Left & Right (should be offered at 200' or less, unless noted.)
- (B) Figure Eights/ Reverse Figure Eights

## **LEVEL IV**

- (A) Rectangular Pattern – Left & Right with Throttle
- (B) Three Point Fly-over Figure Eight Pattern
- (C) Traffic Pattern & Approach

## **LEVEL V**

- (A) Slow Flight (at safe altitude) & Stall Recovery
- (B) Orientation and Basic Maneuvers (at safe altitude)
  - Loop, Climbing Turn, Roll, Stall Turn, Spin/Spiral Dive
- (C) Taxi & Take off

## **LEVEL VI**

- (A) Trim Adjustments
- (B) Normal Landings
- (C) Forced Landings & Emergency Procedures

# Teaching Guide

## LEVEL 1

### **Pre-flight inspection**

All student aircraft must be thoroughly inspected prior to the initial test flight by an Instructor or other qualified R/C pilot and any deficiencies corrected. An additional formal inspection will be required after any modification or repair of the aircraft or at the request of the student. While examining the aircraft the instructor should discuss the reason for each portion of the inspection and the remedy for any deficiencies found. The importance of an ongoing inspection and maintenance program should be emphasized. Prior to each flight the instructor should call the students attention to the items he is checking before take off, such as carburetor setting, transmitter antenna extension, trim settings, center of gravity, and control movements and surface deflections. (See Preflight Checklist)

### **Introduction to flight**

Before a student's first serious flying lesson, a qualified instructor should set down with him (transmitter in hand) and discuss what "Left", "Right", "Up" & "A Little" means plus the mechanical process of "The Turn". "Left" always refers to both the student's left and the left side of the aircraft. Conversely, a "Right" command always requires that the student move the control stick to his Right and toward the right side of the aircraft.. An "Up" command asks the student to pull the elevator control stick back (toward the bottom of the transmitter

Smooth aileron turns of various radii, at a constant altitude and over a pre-determined ground path can be accomplished only with a considerable amount of practice. A simple 1.2.3 starting point to initiate turns is described next. (1) Bank the aircraft about 15° in the direction of the turn with aileron . Allow the stick to return to neutral. (2) Maintain altitude with the application of small amounts of up elevator, as required. (3) To complete the turn, allow the elevator to return to neutral, level the wing with a brief decisive stick movement in the opposite aileron direction and allow the stick to return to neutral". "Smooth" will come with practice.

Practicing transmitter stick movements on a simulator (flown from the ground, not a cockpit view) will begin the process of orienting the student to getting a feel for a transmitter in their hands. Practice on a simulator is highly encouraged as it speeds the learning process on an actual R/C aircraft.

The use of a "buddy box" system is highly encouraged whereby the "master" transmitter will be used by the

instructor and the "slave" is used by the student. Control of the aircraft is transferred to the "slave" when the instructor holds a switch on the "master" transmitter. Upon release of the switch, control is immediately returned to the "master" and the instructor's control.

A student should also know the basic parts and names of an airplane and be able to describe basic flight theory and how control surfaces direct an airplane.

Some good websites for this information is:

Palosrc.com - Beginners Guide to RC Flight

[http://www.palosrc.com/index.php?option=com\\_content&view=category&layout=blog&id=41&Itemid=50](http://www.palosrc.com/index.php?option=com_content&view=category&layout=blog&id=41&Itemid=50)

AMA – Academy of Model Aeronautics Newcomer Guide

<http://www.modelaircraft.org/files/education/docs/newcomerguide.pdf>

## LEVEL II

The first order of business of any flying session is to check the trim of the aircraft, making certain that straight and level flight is maintained (hands off) at the reduced throttle setting required for that particular training flight. Level II training should be flown at about 300' high. This is at least "two mistakes high". This means the student can make an error and a second error before the instructor intervenes and "takes control" of the airplane. Instructors do not take the aircraft from the student after one mistake unless it is danger. Allow the student to learn from their mistakes. The amount of maximum control surface movement should always be set to fit the student's comfort level.

### **Straight & level flight - Left & right turns**

The student's initial flight experience should be enjoyed at a comfortable altitude, restricted only by satisfactory visibility. It is essential that during any and all training sessions equal numbers of left and right turns be included. Attempt 90° turns first with about a 15° wing bank and concentrate on maintaining a constant altitude. Then start to work on controlling the headings and finally attempt to vary the size (radius) of the turns.

### **Giant Circles - Left & right**

This is an exercise to prove that there is no way that one can learn to fly mechanically from a book. Flying large 360° turns is not easy. Correcting for drift is even more difficult. It requires the Pilot to constantly add incremental control inputs (in all directions) in order to follow the ground path which he wishes to follow.

Remember that Level II is only the first step in the flying program and perfection is not required or expected.

### **LEVEL III**

Both level III and IV should be flown at an altitude of 200 ft. or less. That's a "One error & save" height. If one is to successfully set an airplane down where he wants to, he must be capable of following a predetermined ground path.

#### **Oval Pattern - Left & Right**

The student will attempt to trace a ground path which runs down the center line of the runway. At about 100' beyond the end of the runway the path should turn slowly 180° (away from the pit area and then run in the opposite direction (parallel to the runway). A second 180° turn is initiated at a point such that when completed the aircraft if lines up with the runway center line, at a point beyond the end of the runway. If headings are missed or the aircraft drifts, attempt corrections immediately. The airplane should never fly the pilot.

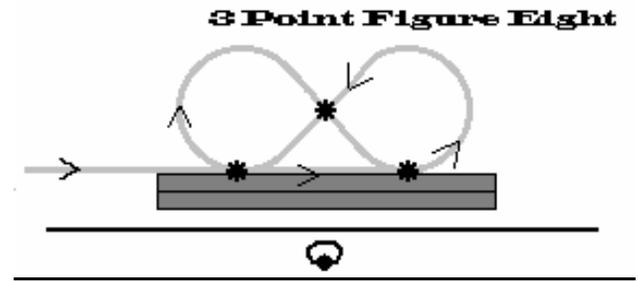
#### **Oval Pattern**



#### **Figure Eights**

This is the single most demanding and beneficial exercise in the entire program, requiring constant control inputs and changing with every variation in wind direction or velocity. Three ground points form a triangle. The base of the triangle lies on the opposite edge of the runway directly in front of the pilot and is centered on him. The apex of the isosceles triangle is the third point and is located directly in front of the pilot. It marks the center intersection of a figure eight flight path whose two lobes just touch the far side of the runway at the first two points of our triangle. The positioning of the triangle is fixed. However, the size should be set to accommodate the student. Extremely sharp turns should not be required and (for this exercise) the shape of the eight is immaterial. The goal

is to be similar to the figure shown.



### **LEVEL IV**

#### **Rectangular Landing Pattern - Left & Right with Throttle**

This segment is a refinement of the "Oval Pattern" - substituting two 90° turns for each 180° turn, the introduction of throttle control and (at the instructor's discretion) rudder control. It introduces the left stick and initiates the use of both hands in the process of controlling the aircraft. As he flies the pattern, the student will reduce or increase power as requested by his instructor. Since rudder function is not absolutely necessary to fly an aileron equipped model aircraft, its introduction is left to the discretion of the instructor or the student. From this point on the student will be expected to maintain physical contact with both control sticks when he is in control of the aircraft

#### **Figure Eight/Reverse Figure Eights**

Flying consistent figure eights, under various wind conditions will require practice. Figure Eights are flown at a consistent altitude and initial turn is "away" from the flight line. Reverse Figure Eights will only be flown once proficiency in Figure Eights is demonstrated. Once the student has proven that he can nail the "points", he's reached his immediate goal and can move on to Level V.

#### **Taxi & Take-Off**

Any problem on the take-off must be resolved in a split second. There is no time to ponder a solution. An instructor (even with a buddy box) offers no guarantee. Therefore the student should have emergency responses firmly planned in advance. Here are a few suggestions. (1) The escape route must be indelibly engraved in the mind of the pilot. Taking off to the right? Turn Left! Taking off to the left? Turn Right! (2) Assuming a take-off to the right, start the procedure from a stationary position on the center line of the runway. Advance the throttle slowly. When the aircraft is holding the proper heading, decisively advance the throttle to full power. (3) From this point on only one directional correction should be attempted. If any problem is encountered before lift-off, chop the throttle and turn left. After lift-off, if there is any type of emergency other than engine failure, turn left and flyaway. If the take-off is successful, fly down the entire length of the runway and

climb out at approx 15°. A take-off to the left is simply reversed

It is not necessary to tie up a club field for taxi practice. After a student's first successful "take-off", they should be capable of practicing taxiing by themselves in any suitable area with the aircraft's wing removed.

## **LEVEL V**

### **Slow Flight & Stall Recovery**

The purpose of this exercise is to demonstrate that "Slow" is not "Safe". An aircraft in "slow flight" is operating at the lowest possible airspeed without losing altitude and is on the very edge of the beginning of the stall. Controls are normally very soft and ineffective and the slightest turn requires immediate additional power to avoid a complete stall. At a safe altitude, the student should attempt to fly both straight and circular flight paths in a "slow flight" mode. As he reduces the throttle setting and slowly comes back on the control stick (in order to maintain altitude), he will discover that a delicate balance between throttle and elevator is required to maintain true slow flight. He will also find that coordinating the rudder with the ailerons of considerable benefit in the turns. Flown properly, the aircraft (with the stick full back) will experience partial stalls in straight and level flight and probably a full stall from a turn that is too tight or too slow. There is no need to fear the stall at safe altitudes. The pilot needs only to return the stick to neutral, allow the nose to drop, add a little power, regain flying speed, level off and climb back up to altitude to try again.

### **Orientation and Basic Maneuvers**

There will be plenty of time in the future for the student to practice and learn various aerobatic maneuvers. The sole purpose of this segment is to offer the student an opportunity to become disoriented and practice recovery procedures. Since there is a certain amount of unnecessary risk involved, both instructor and student have the discretion on what maneuvers to include in this portion of their training.

### **Traffic Pattern & Approach**

The ground path is similar to the rectangular pattern introduced in Level IV with the exception of perhaps a longer approach. The maximum altitude should be about 150'. Power is reduced during the cross-wind leg on the final approach, at the discretion of the student or instructor and the aircraft allowed to descend to approximately 50'. Power should then be applied and the aircraft returned to its original altitude along the flight path. The aircraft should always pass over the entire length of the runway. Remember, "No Slow Flight" here. The aircraft should be trimmed so that (at idle and with no control input) a reasonable rate of decent and safe airspeed is maintained.

### **Rectangular Pattern**



## **LEVEL VI**

It is recommended that a concentrated effort be made to complete this program within 10 days of the time that Level VI is introduced. The student should make arrangements with an instructor (or instructors) for additional flying time as required.

### **Trim adjustments**

This segment of the program should be flown at a safe altitude and if a trainer system is not being employed, great care should be exercised. The purpose is to allow the student an opportunity to experience operating an aircraft which is out of trim and resolve the problem. The student will first be required to make minor trim adjustments about both single and double axes. After which major trim problems will be introduced by the instructor and corrected

### **The Landings**

If the instructor's have been doing their job and student has been doing his, this last step to graduation should be a piece of cake. As the "take-off", the first landings (to be safe) require a little pre-planning. Planned escape routes are most important and are identical to those used for take-off emergencies. If anything unforeseen occurs during the final approach or landing, one simply initiates an "escape turn" and either flies or taxis away to the opposite side of the runway. Remember, as long as the airplane is under power, only a good approach is acceptable. The best time to practice landings from bad approaches is when a "dead stick" has occurred. The first landing or two will probably be under the verbal control of the instructor. The landing pattern and approach will be identical to those already accomplished, except about 50' lower. When the instructor feels that the threshold of a safe landing has been reached, rather than advising the student to add power and go around, he will quietly suggest that the student start the flair and hold the heading down the runway until the aircraft rolls to a complete stop. Only then is the flight complete.

### **Forced Landing Procedures ("Dead Stick")**

Engine failure on take-off and at altitude will be replicated and landing approaches attempted. Teach the concept of the "sweet spot" to capably land the aircraft on the runway after a "dead stick". The first maneuver upon engine failure should be a quick turn to head for the "sweet spot". Before the flying session begins, the instructor should be prepared to discuss wind velocity,

drift, penetration and flying speed as they relate to recovery from sudden power loss. Special emphasis should be placed on engine failure procedures during climb-out. These exercises should be initiated at a minimum altitude of 200' (including engine loss on take off) and be terminated at the instructor's discretion.

### **Final Thoughts**

There is plenty of information on the Web for R/C subjects. Searches will return many sources for information from beginning in R/C to designing and building your own aircraft. There are also many discussion forums on R/C subjects. Use the web, read and study and practice to become the best that you can be in this hobby. And of course you have many contacts within from other HOTMAC members. Ask questions, the HOTMAC members have an outstanding reputation for helping newcomers and beginners.

## Preflight Check List

### Radio Control System

- Servos - Check they are mounted securely to the R/C plane.
- Servo horns - Properly screwed to the servos.
- Receiver - Check that it is mounted securely. Make sure antenna is properly routed and secure.
- On/Off Switch - Make sure it is functioning properly. Old switches can lose contact and receiver loses
- Verify all servo and battery leads are securely seated in the receiver.
- Battery - Use fresh batteries for the receiver/transmitter and use a tester to verify battery capacity and charge retention.
- Make sure battery is securely mounted in fuselage
- Check condition of transmitter antenna.
- Check that servo direction is correctly matched to transmitter (no reversed servos) and they are all centered!**

### Landing Gear

- Check and tighten landing gear screws.
- Inspect wheels. Wheels should spin freely.
- Tighten collars if necessary.
- Check if any of the plane's landing gears have been bent or damaged. Repair or replace if necessary.
- Verify front wheel steers straight (or if a tail dragger it is securely connected to fuselage/rudder) and is aligned with rudder.

### Engine/Propeller

- Tighten all engine mounting screws.
- Tighten muffler screws and secure muffler attachment.
- Check glow plug. Replace if old or damaged element.
- Check your R/C plane's propeller for cracks or damage and balance. Replace if necessary.
- Tighten propeller nut.
- Check spinner condition and tighten.
- Use After run oil!

### Fuel

- Check fuel tank for leaks
- Check fuel hose for leaks, blockage caused by debris or kinks in the line.
- Verify fuel tank is secure inside aircraft.
- Clean and/or attach the fuel filter.
- Use fresh fuel. Old fuel causes many engine problems

### Airframe

- Make sure all hinges on control surfaces are glued/pinned securely in place.
- Check and replace worn hinges.
- Put your name and contact info in or on the R/C plane according to AMA regulations.
- Check control surface deflections are appropriate for the aircraft and surfaces are "neutral".

**Remember - Follow all AMA and HOTMAC Field Conduct and Safety Rules!!!**



# HOTMAC

## Student Solo Flight Check List

Student Name \_\_\_\_\_ AMA # \_\_\_\_\_

1. Review Safety Rules and Field Conduct \_\_\_\_\_
2. Frequency Control Procedures \_\_\_\_\_
3. Assemble and Preflight Aircraft \_\_\_\_\_
4. Start engine and tune. \_\_\_\_\_
5. Perform Flight Maneuvers
  - A. Start & Taxi \_\_\_\_\_
  - B. Take off & Trim Aircraft \_\_\_\_\_
  - C. Rectangle Pattern (hold altitude & heading)  
Left and Right \_\_\_\_\_
  - D. Circles Left/Right \_\_\_\_\_
  - E. Horizontal Figure Eight/Reverse \_\_\_\_\_
  - F. Touch and Go \_\_\_\_\_
  - G. Emergency Landing (Throttle at idle) \_\_\_\_\_
  - H. Take off \_\_\_\_\_
  - I. Landing \_\_\_\_\_
  - J. Taxi Back and Shutdown \_\_\_\_\_
  - K. Secure Equipment \_\_\_\_\_

Instructor:

**Observe Student for SAFE operation** - Was student aware of wind direction and did he/she compensate for it? Was student aware of position of the sun and did he/she avoid flying into its glare? Was student aware of other aircraft in the air and other pilots on the flight line? Was the student confident and in control of his aircraft at all times?

I certify that this student is qualified for unsupervised solo flight

\_\_\_\_\_  
INSTRUCTOR

\_\_\_\_\_  
DATE

\_\_\_\_\_  
INSTRUCTOR

\_\_\_\_\_  
DATE

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