Radio Control Ground School

MPPD 10

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Member NSF

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Purpose of this Course

- This course is intended to assist new members in learning to fly R/C model aircraft in a safe and competent manner that prevents injury to the pilot, other members and spectators and which minimizes the risk of damage to the model.

- This course covers R/C models of various sizes and power in the general category. It does not cover R/C models in many of the special interest categories such as sail plane, helicopter, float plane etc.

Getting Your Wings

- Flying model aircraft is fun. This short course is designed to help you get to the fun quickly and safely.
- It will tell what is expected of you, your instructor and other members of your club.

Outline of Training Program

- Getting Your wings
- Courtesy to instructors
- Trainers to use
- Theory of flight
- Take off
- Basic manoeuvres, straight and level, turns etc.
- Landing
- Flight protocols
- **Safety** Club, MAAC safety rules

- In order to learn to fly at MAAC clubs you must be a paid up member of MAAC. This ensures that you and your instructor are covered by our insurance policy.

- Many new members come to clubs with some RC experience usually in flying models of the “park flyer” variety. Flying larger, heavier and faster models can be very different and challenging.
- It is very important to join a good established RC club and to learn to fly with a club instructor. Only Wilbur and Orville Wright did not have an instructor.

This program will teach you the following:

1. The selection of an appropriate trainer plane.
2. How to prepare your plane for flight.
3. How to safely start your plane.
4. The Safety concerns for other flyers.
5. And Finally, how to fly your plane.

Your Instructor

- Your club will have identified who are their instructors.
- Your instructor is a volunteer and is giving up his or her time to teach you. Please respect that by being on time and by having your plane ready for your lesson.
- Other club members can help you to get your plane ready for your instruction so that the instructor has only to help you learn to fly.

- You will learn how to control your plane in flight by doing circles and eights in both directions, keeping the same altitude. You will learn how to do loops and rolls and how to do a dead stick landing.
- You will learn how to recover from unusual attitudes and other accidental flight situations.
- All this is to show that you have the plane in full control at all times.

- You will be taught the use of the rudder, the forgotten control.
- Finally you will learn how to take off and to land. (Take offs are optional. Landings are mandatory.)
- A student log book should be kept so that an alternate instructor can review your progress. (A sample log book is shown at the end of this presentation.)

Suitable Trainer Planes

- Please leave your pride and joy plane, which you have spent many hours building, at home.
- You will need a plane which is specifically designed as a trainer and does not include flight assists such as gyros. They can be obtained from a good hobby shop or on line.
- You can buy an ARF (almost ready to fly) or build one from a kit. It is a good idea to build one with advice from club members as you will learn how to repair planes and to prepare them for flight.
- Speak to an experienced flyer , your future instructor or to someone at a good hobby shop before making your choice of trainer.

Types of Power

- Model Aircraft can be powered by many different types of power. This course covers only the two most common types found in general category R/C models, namely electric motors and glow plug/gas piston engines.

Theory of Flight

- You probably discovered as a child how airplanes fly. You put your hand out the window of the family car and noticed that as you tipped it up your hand was forced upward and as you tipped it down your hand was forced down.
- An airplane wing works the same way.

- Any object moving through the air displaces some of that air. If the bottom surface of that object is tilted upward at an angle to direction that air is flowing, air is forced downward. Newton's law of motion states that "For every action there is an equal and opposite reaction". Therefore the force created by the downward motion of the air is opposed by an equal and opposite upward force called lift. When the lift force surpasses the force of gravity acting on the mass of the aircraft, the plane rises.

Theory of Flight

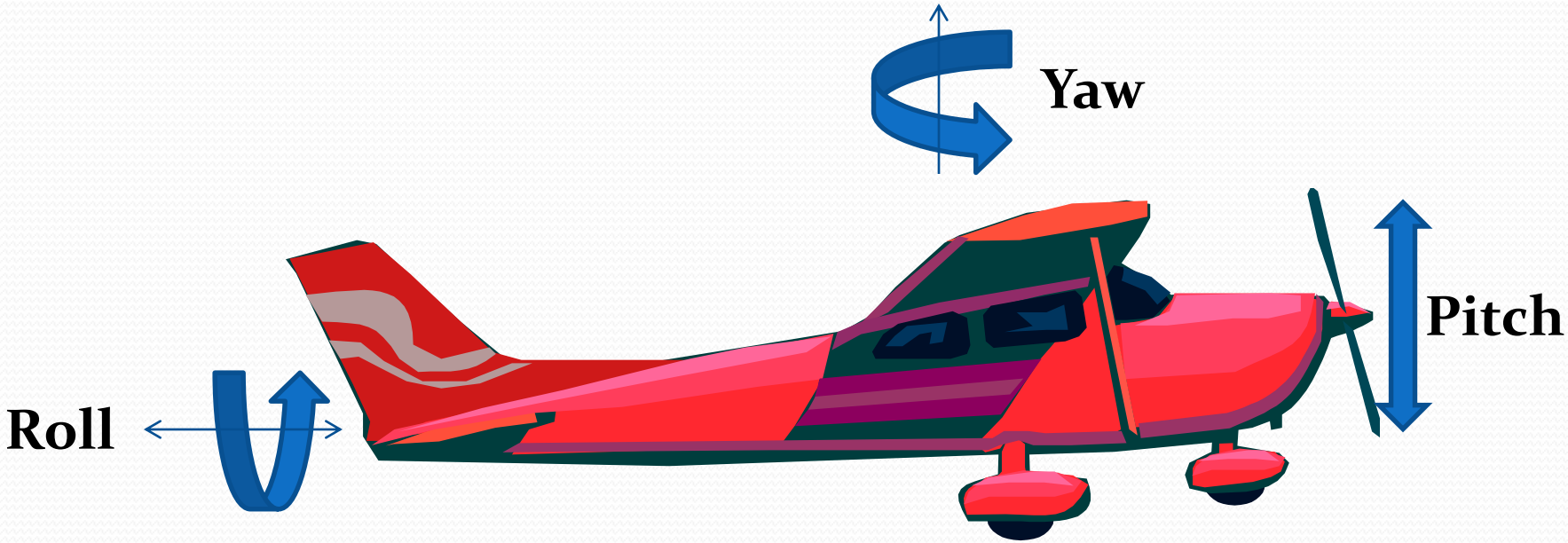
- The angle at which the object (in this case the wing) is tilted to the direction of the airflow is called the angle of attack. Back in the family car again you probably discovered that as you increased that angle you reached a point (probably around 18 degrees) where the upward force on your hand decreased and your hand was forced straight back. You just discovered how a wing can stall. The force that moved your hand back is called drag.

Theory of Flight

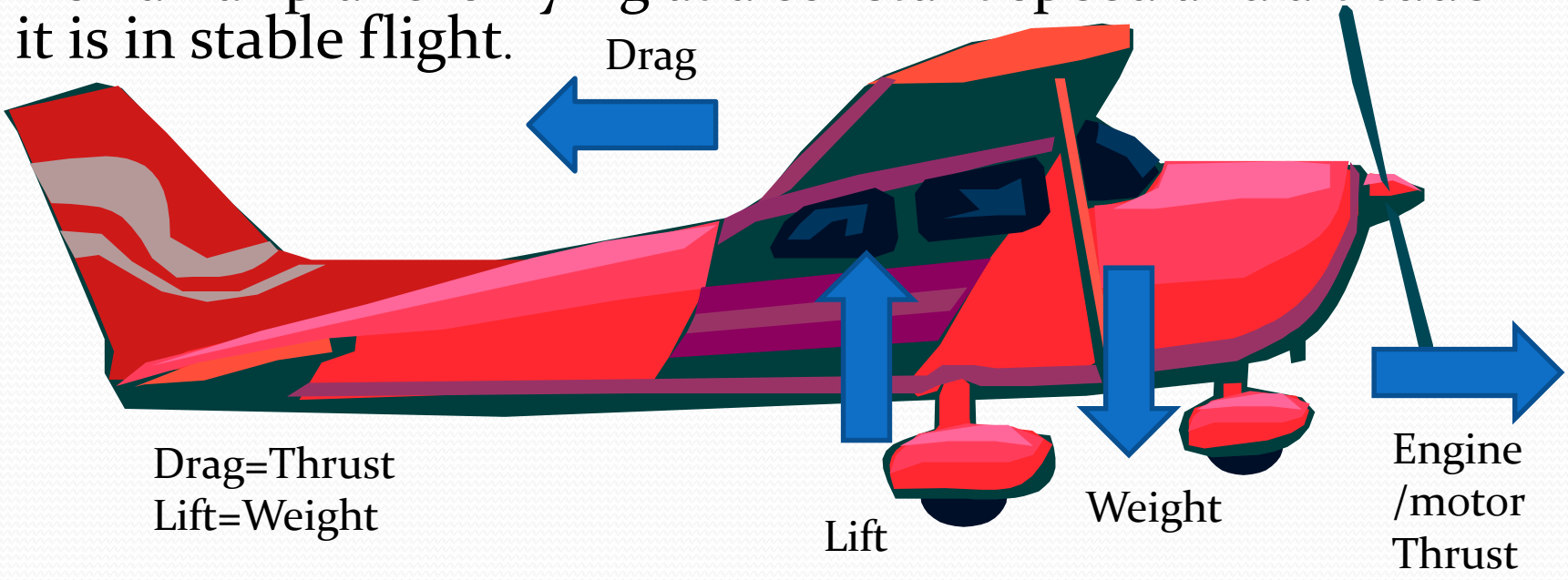
- In airplanes the wing's angle of attack or "pitch" is controlled by one of the airplane's control surfaces called the elevator. The other primary control surfaces are the ailerons that control "roll" and the rudder which controls "yaw". These are known as the three axis of motion and are shown in the following diagram.

- That covers everything you need to know about theory of flight

The 3 Axis of Motion



When an airplane is flying at a constant speed and altitude it is in stable flight.



The weight of the plane is exactly matched by the lift of the wings.

The wind resistance “drag” is exactly matched by the power of the engine.

Any movement of the controls changes that stability as we will see.

The Factors which Cause Your Plane to Want to Turn Left

- Airplanes want to turn left but it has nothing to do with politics.
- There are up to 4 factors which will cause your plane to want to go left on take off. They are propeller precession, rudder imbalance, unequal propeller pitch and engine torque.
- We do not need to go into detail on each of these but!
- Be prepared on take-off to apply **right** rudder.

Low Speed Versus High Speed Flight

- Many a model plane and even full sized plane has crashed because the pilot failed to understand the difference between high and low speed flight. So, listen up!!

High Speed Flight

Once the plane is flying at speed in the air its controls act as expected. Pulling up on the elevator causes the plane to rise. Moving the ailerons to the left causes the plane to turn left. Increasing the engine speed makes the plane go faster and so on. Everything makes sense.

Low Speed Flight

Nothing works the way you expect!!

At some point of low speed the controls change how they operate. This is best determined at, as we say, 3 mistakes high so that you can recover.

Here is what happens and why.

The Elevator

On landing you may find that you will be short of the runway so you pull up on the elevator only to find that your plane immediately crashes.

What happened was that by pulling the elevator the up you increased the angle of attack of the wing which increased the drag of the wing, which in turn slowed the plane down. It could no longer fly at that lower speed. The remedy is to increase the speed of the plane which in turn increases lift and the plane will rise enough for you to make the field.

At low speed the elevator increases or reduces speed!

The Throttle

As we have just seen, the throttle at low speed makes the plane increase or decrease altitude by changing lift.

The Aileron

At low speed the ailerons no longer cause the plane to roll into a turn. Let's say that we want to turn left. Using the ailerons causes the right aileron to go down and the left up. At low speed the right aileron increases the drag of the right wing slowing it down relative to the left. The plane turns right and lift on the right wing is decreased and drops causing the plane to crash to the right. So long plane.

The remedy is to use the rudder with only slight use of the ailerons to turn at low speed.

At low speed the action of the ailerons is reversed and the wing stalls.

Pre-flight Checks

- A novice or pilot under instruction should seek out an experienced flyer for assistance in the following checks. Flight must only be undertaken when all checks are complete.
- Aircraft balance: The recommended balance point for the plane should be checked. This must be done with an empty fuel tank on glow engine planes and electric planes with batteries installed. If in doubt, the plane may be slightly nose heavy, but never tail heavy.

Pre-flight Checks cont.

- Controls: All controls should operate in the correct direction with the recommended amount of deflection. The control surface hinges should be secure.
- Engine or motor: The engine or motor should be checked for secure mounting and correct direction of rotation. The propeller must be checked for secure mounting and correct orientation.

Pre-flight Checks cont.

- A range check for the radio must be made in accordance with the manufacturer's recommendations.
- Receiver and transmitter batteries should be checked for full charge.
- Glow powered planes should be checked for a full fuel tank. Check should be made for fuel leaks. Electric planes must have a full charge.
- The plane must be secured by an appropriate means to prevent uncontrolled movement, before starting the motor or engine.

Pre-flight Checks cont.

- You should be familiar with the operation of both your motor or engine and with the operation and location of controls of your radio. Have an experienced pilot show you.
- Radio Transmitter: You should be familiar with your club rules for controlling radio frequencies and with MAAC policy in this regard. (see MSD para 5)
- 2.4 GHz transmitters must be checked to ensure that they are properly "bound" to the receiver.

Important Safety Notice

- Many modern radios have a fail-safe feature. Such radios allow the operator to preprogram certain control settings so that in the event that the receiver detects a loss of signal from the transmitter the controls will move to the preprogrammed safe settings. For example in most models the throttle fail-safe should be programmed to move to zero or low power. The fail-safe feature and the method of setting and testing it differ somewhat between manufacturers.

Improper setting of the fail-safe feature can result in a dangerous situation such as the motor/engine unexpectedly going to full power instead of low power.

It is important that the fail-safe settings be checked for correct movement, whenever a range check of the radio is performed. The manufacturers' recommended procedures should be used for testing the fail-safe feature. The test must include a check with the transmitter being turned off. The model must be restrained during all testing of the fail-safe.

Starting

Before starting any engine or motor make sure that you are not wearing any loose clothing or transmitter straps which could come in contact with the propeller. Never Stand in line with the arc of the propeller or allow others to do so.

Electric Motors Special Note

- All electric motors should have a means which renders the motor inoperable until ready to fly. This can done by one of several means. from a switch on the transmitter, a switch in the plus voltage to the controller or by a jumper in the battery supply. The switch is turned on or jumper installed, only when at the flight line.

Glow Engines

It is important to establish a safe routine to start your plane. Your instructor or other experienced pilot will show you how to position your fuel filler, starter and glow lighter to that they are close at hand yet not in the way of the propeller. Great care should be taken of glow-lighters which can vibrate loose and come in contact with the propeller.

The electronics and servos in planes are subject to radio interference. Ferrite cores and shielded servo wiring may be needed. An experienced pilot can be of help with this problem.

The Flying Field

- Before flight you should become familiar with the layout of your club field and any local restrictions on flying areas and the like. Your instructor or other club official will inform you of this.
- A typical field layout is appended to this presentation and is taken from MAAC MPPD 8

Take Off

- When less than the maximum number of planes permitted are in the air and all safety issues addressed you may proceed to take off.
- If your flying area is in a region where full size aircraft may be present, a visual check must be made to ensure that none are in the vicinity.
- Before you proceed you should “box the controls” to verify that all your controls operate in the correct direction.

Take Off cont.

- Your plane must be under positive control either carried or held firmly when behind the flight line. No taxiing is allowed in the pit area either on take-off or on landing.
- Proceed to the designated pilot area. You must make the other flyers aware that you are taking off by shouting out "**Taking Off**". Make sure that they hear you and acknowledge.

Take Off cont.

- Proceed to the centre line of the runway and turn into the wind.
- Steadily apply throttle. Do not jam it forward.
- Remember to apply right rudder as needed to counteract any tendency for the plane to turn left as previously discussed.
- Wait for the plane to gather speed and gently apply up elevator.

- Correct the direction with the rudder. Remember that you are in low speed flight.
- Keep going straight forward until the plane gathers speed.
- Keep off the ailerons until the speed builds up and you enter high speed flight.
- Make a clearing turn away from the flight line.
- Enter the circuit in the correct direction.

In flight

- Your instructor will lead you through the following manoeuvres:
- Straight and level flight
- Figure 8 patterns turning away from the flight line
- Maintaining a heading down the centre of the runway
- Loops, rolls and recovery from unusual and unexpected attitudes.
- All of these are to help you to learn to control and **be in control** of your plane at all times.

Landing

- The landing pattern has 3 elements, the down wind leg, the base leg and final approach.
- Prior to landing you must advise other flyers of your intention. Call out "**Landing**" and that you get an acknowledgement.
- The down wind leg is flown parallel to the runway and is used to slow down the plane to about 1/3 throttle.

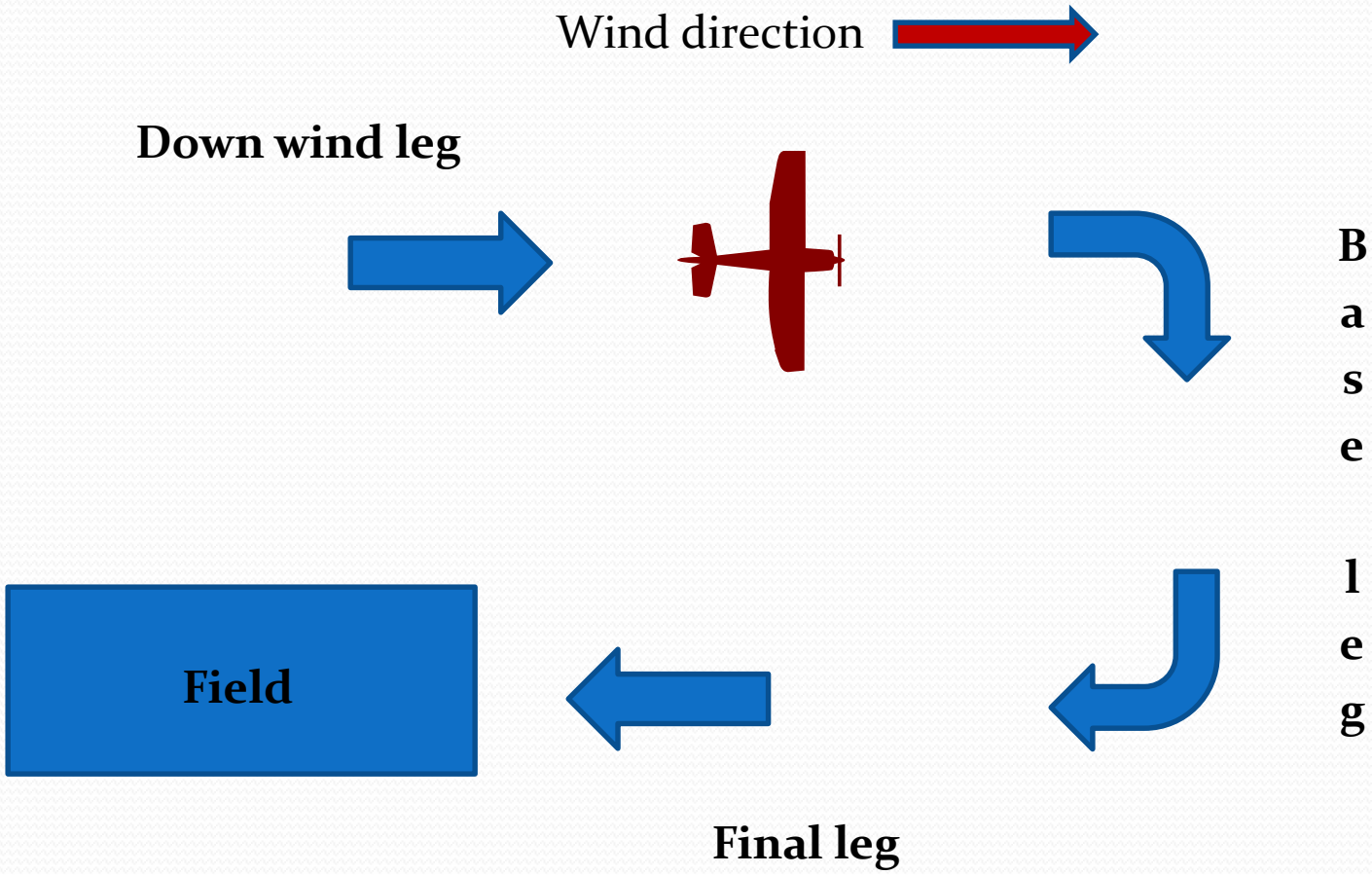
Landing Cont.

- The base leg is used to line up the plane with the runway. A visual marker (a tree or rock etc.) is used as an indicator of when to turn. Gentle application of ailerons is used. Do not stall the wings
- Final is turned and the throttle is used to control the rate of descent. Remember again that you are entering low speed flight.

Landing cont.

- Once you are over the runway, the throttle is further reduced and at the appropriate time a flare is initiated with up elevator. Remember, low speed flight again.
- If you must go onto the field call out "**On the field**". Again make sure that you are heard.

Landing Pattern



Windy Conditions

- Sooner or later you will experience windy conditions . It is important that you learn how to control your plane when there is a wind.
- You must always land or take off into the wind.
- On take off, the rudder is applied in the correct direction so that the plane follows a straight line down the field. If this is not possible the flight must be terminated immediately, turning away from the pits.
- On landing the wind is not often straight down the field. 2 steps are taken.

Windy Conditions cont.

- The final leg must be altered such that the plane will drift onto the line down the runway. That is, if the wind is towards you the final approach line must be farther away from the runway or closer if the wind is behind you.
- Secondly, it may be necessary to apply rudder and ailerons (to keep the wings level) . This should be practiced at a safe height with your instructor before a landing is attempted.

In-Flight Protocols

- Once you have your plane in the air there a number of things you should do.
- All flight must be done in front of the flight line, never behind you.
- The aircraft should be trimmed by using the fine trim on the radio so that it will fly straight and level without any inputs from the pilot.
- If you have gotten your wings you will recall how distracting other planes were as you were learning. Please stay well clear of student's planes and if possible delay your flight until the lesson is over.

In-Flight Protocols cont.

- Planes should fly in a circuit **turning away from the flight line** after take off and continuing in either a clock wise or counter clock wise direction as the take off turn indicated.
- You should call out loudly if you are making a low pass.
- If the wind direction has changed you should advise the other flyers of your direction of landing.

In-Flight Protocols cont.

- If you have an engine or electric motor out you should call out "**Dead Stick**". The other pilots must stay clear while you land.
- Aerobatics should be done well clear of other planes.
- If you are just horsing around you should do this well away from others and not hog the air over the field.
- Again if it is necessary to go on the field call out "**on the field**" and make sure the other flyers hear you and that it is safe to go on the field.

Safety

- We are at the flying field to have fun and to enjoy our sport. Getting injured or hurting others is not fun. Damaging property is not fun either. Safety is therefore a primary concern of everyone.
- Always obey the rules and follow the directions of the club safety officer.

- When you are not flying you must remain aware of any potential incidents with out of control planes.
- Your club will have safety rules which are specific to that club. Know them and follow them.
- MAAC has general safety rules which everyone is expected to follow.
- **A Copy of the association and club rules will be given out and reviewed after this session**.

- **Now go out and have <u>safe</u> fun**

Sample Students Log

Student Name:_____ **6th Division Flyers Progress Report**

MAAC #:_____ Club Membership #:_____ Sheet ____of_____ Student Phone #:_____

Lesson # / Date of Lesson:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Test
Instructors Initials																
PREFLIGHT																
Frequency Board Use																
Control Surfaces																
Range Check																
Engine Start																
Ground Maneuvering																
High Speed Taxi																
FLYING																
Take Off																
Climb To Altitude																
Circuits Right																
Circuits Left																
Straight & Level Flight																
Figure 8's																
Procedure Turns																
Loop																
LANDING																
Landing Pattern																
Simulated Dead Stick																
Landing																
Shut Down																
# of Flights this Date																

Sample Instructor's Notes

Instructor's Notes

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

FIELD LAYOUT

FOR GENERAL CATEGORY RC AIRCRAFT