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M.A.C.I. Training Booklet.

2017

(Specific diagrams for MACI A Certificate included)

CONTENTS

PURPOSE OF THIS BOOKLET

This booklet is primarily aimed at providing support and some instruction to MACI members who are would-be model pilots (and their instructors) and are undertaking flying training and it is hoped that it will assist both the steady progress through the various stages of learning and aid the instructors to provide a reasonably consistent and structured approach to their pupils whilst learning the basic skills. It is also for those who wish to complete a MACI A certificate to comply with the requirement of **S.I. 563 of 2015** https://www.iaa.ie/docs/default-source/publications/legislation/statutory-instruments-(orders)/small-unmanned-aircraft-(drones)-and-rockets-order-s-i-563-of-2015.pdf?sfvrsn=6 and so fly SUAs (Small Unmanned Aircraft) of 4 kgs and over.

This booklet will set out the manoeuvres required for the MACI A cert Fixed wing exam with diagrams for illustration purposes (from page 20). Manoeuvres for other disciplines will be listed and it is hoped that in time the booklet will be expanded to include diagrams for those also.

The document does not attempt to make you a competent pilot on its own but assumes it will be used by you alongside regular instruction from an instructor at your local model flying club.

If you are reading this as an instructor, this booklet does not provide a 'how to do it' guide as it assumes you have a very good level of flying and training competence. What it is hoped this booklet can do is support you in providing a consistent and structured approach to your pupils so that if a student is being instructed by different instructors that they are not confused by totally different approaches to training.

It is well known that flying training often falls to a few willing volunteers in any club who can have their own flying enjoyment limited by the demands of multiple students to get into the air on a regular basis. The responsibilities of an instructor are significant when you consider that the instructors are helping to set the standards and level of competence by which students will spend the rest of their model flying careers operating their models.

However, the rewards for an instructor are when a pupil who was all thumbs finally goes for his/her first solo flight and comes back after a successful flight with a big grin across their face and a big thank you to their instructor. For those more experienced pilots who wish to complete an A cert it is still a good idea to read this booklet and ask your club instructor for advice.

This Booklet assumes that pupils start with little or no knowledge or experience of flying models or aviation in general. We all learn at different rates and some of us find hand/eye coordination easier than others. Age also plays a big part in the time it takes to train our brains to control our hands instinctively. It is important that you try to train regularly (weather and instructor availability permitting) as this will ensure a steady progress rather than relearning the skills due to a significant time lapse since the last session.

There are a lot of terms used in aviation which have specific meanings and are not always evident, if they have not been properly explained. It is very easy for experienced model flyers/instructors to assume that everyone understands the terms they are using and many forget the confusion and uncertainty they experience when they first heard the terms. If you are a pupil **DO NOT BE AFRAID TO ASK** if you do not understand, only by asking do you learn.

Never ever feel foolish about asking basic questions, if you do not ask in the early stages how can you expect to build on the basics if they are not there in the first place. Also, do not forget that many experienced model flyers take a great pride in being asked for help and guidance.

As much as flying a model is a practical skill to learn, involving good hand eye co-ordination and a level of practice that makes actions (at least partly) instinctive, there is also a reasonable amount of theory to learn.

This theory is important to help understand how and why certain things can happen and more importantly supports the safe operation of models.

We all have different learning styles and some instructors are more capable than others in supporting the different learning needs of various pupils. It is important that instructor and pupil understand each other's needs in this respect and adapt, as best they can, to ensure good communication and good learning progress.

Good instructors will gently introduce you to the various elements of flying a model so that you are not overwhelmed and slowly but surely your actions will become more instinctive and you will have to think less about your actions and the models reaction to your input, leaving you free to be more proactive than reactive.

During these early stages most of the decision making will be done by your instructor(s) and communicated to you but as you progress they will allow you to make more and more of the decisions as you demonstrate your knowledge, experience and judgement.

In the early stages of learning your flight times should be no greater than 10 minutes and your instructor may even give you a short break every five minutes, as your concentration will have been very intense. Fatigue can quickly set in and concentration levels falter if short breaks are not taken.

It is also important that before commencing training of any sort that the pupil and instructor read and understand **S.I. 563 of 2015** which is the law of the land at present. It is also a good idea for the pupil to have a copy of the **MACI Code of Safe Practice** to use as a guide. It is even more important that the instructor is fully versed in the **MACI Code of Safe Practice** and the requirements of **Appendix L** http://maci.ie/wp-content/uploads/Regulation_PDFs/MACI-App-L-2017-web.pdf (available on the MACI website) so as to give the pupil the best possible advice and training.

Included in this Booklet is a log sheet with the A cert Fixed wing manoeuvres that the pupil and Instructor can use to record each level of achievement and it will show the pupil his/her progress. The log will also be of use to another instructor when meeting the pupil for the first time as he can see how far the pupil has progressed. It will also be of use to the Solo pilot wanting to achieve A cert fixed wing status in that the required manoeuvres are there for reference. The log sheets are available for B cert fixed wing, A + B cert Heli and A + B cert Glider.

Please contact the MACI A + B Coordinator abcoordinator@maci.ie for the required version or for any information about the MACI A + B Scheme.

AERONAUTICAL TERMS.

The following is a list of aeronautical terms that the pupil will come across from time to time during the learning process. There is much reference material on the internet, so if you want to enhance your knowledge in this area there is plenty of opportunity for study between flying sessions.

These are just some of the basics you will need to get started:

ALTITUDE – The distance above a nominal Sea Level,
ANGLE OF ATTACK – In aviation, angle of attack (AOA,) is the angle between a reference line on an airfoil (line drawn between the centre of wing leading edge curve and the sharp edge of the wing trailing edge, often called the Chord Line) and the vector representing the relative motion between the body (wing) and the air through which it is moving. e.g. Angle of attack is the angle between the body's reference line and the oncoming flow of air.
ARTF - *Almost Ready to Fly* this usually means a model that is already constructed and covered but requires some final assembly such as joining wing halves together, fitting tail and control surfaces and installing engine and radio equipment etc. The advantage is that most ARTF models are jig built so that if assembled carefully they should fly reasonably straight and true.
BEC - *Battery Elimination Circuit* this is usually an additional part of the Electronic Speed Controller (see ESC below), although can be a separate circuit, to take the relatively high voltage of the electric propulsion motor battery and reduce it to a suitable voltage to power the radio receiver and servos. This eliminates the need to carry a separate battery for the radio receiver and servos, reducing the models weight.
BUDDY BOX SYSTEM – This is where two Radio Control Transmitters (Tx) are linked together, either hard wired or via a radio link, with the instructor having the Master Tx and the student having the Slave Tx. This allows the Instructor to hand control to the student or take it back from the student without having to physically hand over a Tx. The Master transmitter can sometimes be set up to only transfer certain selected primary controls to the Slave Tx.
CENTRE OF GRAVITY (C OF G) – The Centre of Gravity of an aircraft is the point over which it would balance. This is particularly critical in the front to back line as the C of G has a major impact on the flight performance of a model and if significantly outside the defined position will make the model unflyable.
CIRCUIT – This is the pattern usually flown when manoeuvring to land but the positions are often referred to in communications between instructors and pilots of models during general flying. Note: The direction of a circuit may be right or left dependent upon site conditions, no fly areas and wind direction etc.
Note: Some flying sites require all models doing general flying (particularly at lower heights) to fly in the circuit direction when multiple models are in the air to minimise the risk of midair collisions.
CONTROL THROW – The total amount of movement (relative to transmitter stick movement) of the controls surfaces of the model or the amount of motor rpm relative to the throttle stick movement/position.
CROSSWIND – When the wind is not blowing towards the exact direction of take-off or landing causing a model to want to turn towards the wind.
DEADSTICK - A term called out by a pilot when his/her model's engine or motive power has failed and he/she is committed to land the model.
DIHEDRAL – The upward angle of a fixed-wing aircraft's wings where they meet at the fuselage. The dihedral effect is to make the aircraft more willing to return to the level in the roll axis, however too much can make the model appear to rock left and right with the slightest upset.

ESC - *Electronic Speed Controller* this is the electronics that sit between the radio receiver and motor to convert the radio signal to electrical supply (electrical impulses for brushless motors) to the motor to allow proportional throttle control of the motor.

FAIL SAFE – If a models receiver goes out of range of the transmitter or is only receiving corrupted signals due to interference for a set period of time the receiver will set the servos and associated controls surfaces to positions preset by the user when setting up the radio system. It is currently a requirement for this to mean the throttle moves to low power (motor off - for Large models, electric powered aircraft and gliders) so that the model will descend and not fly off.

GROUNDLOOP – When directional control of a model is lost whilst on the ground (usually during take-off or landing) and the model completes at least a 360 degree horizontal turn.

HEIGHT – The distance above Ground Level, (in this Booklet , Height = ft, Distance = meters)

KNOTS- Speed measured in nautical miles per hour. (1 Nautical mile = 1852 meters, 1 Statue Mile = 1609 meters) therefore 1 knot is slightly faster (approx 1.15) than 1mph.

LIPO (NICAD)— Types of batteries for supplying power to models. See **MACI Code of Safe Practice** for more information on batteries.http://maci.ie/wp-content/uploads/Regulation_PDFs/MACI-App-L-2017-web.pdf

OVERSHOOT – (correct full size terminology is Go Around) When a model approaching to land has power applied and the model climbs away just before touchdown. This may be intentional for training purposes or it may be that the approach and landing is abandoned due to some problem, such as a gust of wind, or an obstruction on the runway etc.

PITCH - A model aircraft in flight is free to rotate in three dimensions: pitch is nose up or down about an axis running from wingtip to wingtip. *(See also Roll and Yaw*).

PITS – The area set aside for the preparation, checking and maintenance of models for flight.

ROLL - A model aircraft in flight is free to rotate in three dimensions: roll is rotation left or right about an axis running from nose to tail. *(See also Pitch and Yaw).*

RTF - *Ready to Fly,* as ARTF, but the final assembly and motor/radio equipment installation are already completed, the model will usually just require the radio equipment being set up and batteries charging before flight.

RUNWAY OR FLYING STRIP – this is the area set aside for the safe take-off and landing of model aircraft.

RX – Radio Receiver

STALL – A condition in aerodynamics and aviation where the angle of attack (*see above AoA*) of a wing increases beyond a certain point such that the lift begins to decrease. The angle at which this occurs is called the critical angle of attack.

SUA— Small unmanned aircraft (model aircraft). See **S.I. 563 of 2015** for definition

TAIL DRAGGER – This is a type of aircraft undercarriage, or landing gear, arranged so that the main wheels are slightly ahead of the centre of gravity and a small wheel or skid at the rear of the fuselage, often just below the fin/rudder.

THERMAL - Thermals are areas of air which, because they are warmer than the surrounding air, are actually rising. If a model or more specifically a glider is passing through air which is rising faster than the glider is descending then the model will actually climb whilst on the glide. So long, that is, as the model stays within this thermal.

THERMAL TURN - The normal manoeuvre used to keep the model in an area of rising air is the thermal turn. This is basically a series of continuous 360 degree turns in either direction, left or right. If this manoeuvre is correctly performed then the model will fly at constant speed in a gentle turn and will gradually drift along in the direction of any wind. If the model is within a thermal it will gradually climb. If it is not then it will descend steadily.

TOUCH AND GO - To land a model and quickly apply power to speed up the landing/takeoff roll and get the model airborne again, without stopping the model.

TRICYCLE UNDERCARRIAGE – This is a type of aircraft undercarriage, or landing gear, arranged in a tricycle fashion. The tricycle arrangement has one wheel in the front, called the nose wheel, and two or more main wheels slightly behind the centre of gravity.
TX – Radio Transmitter
YAW - A model aircraft in flight is free to rotate in three dimensions: yaw is the turning left or right of a model (wings remaining level) around a vertical axis through the centre of the model. *(See also Pitch and Roll).*

GETTING STARTED RADIO SYSTEMS.

Whilst it is quite possible to learn to fly with fewer channels, we would recommend that, as a minimum a 5 or 6 channel set (to control at least elevator, throttle, rudder and aileron) is purchased. You can learn to fly on a 4 channel set but you may find that such a set is difficult to buy these days and a 5, 6 or more channel set will give you more options in the future. The more modern computer sets will have several model memories as well so that several models can be added to one transmitter which is not possible with more basic cheaper radios.

There are two popular types of transmitter modes used.

MODE 1, (sometimes called ‘throttle right’) the right-hand stick controls the throttle and ailerons (or rudder when only 3 functions are in use) and the left-hand stick operates the elevator and rudder (or elevator alone when 3 functions are used). This mode is usually popular with aerobatic pilots because it offers more precise control during aerobatic manoeuvres.

MODE 2, (sometimes called ‘throttle left’) the right-hand stick controls the elevator and ailerons (or rudder when only 3 functions are in use) and the left-hand stick operates the throttle and rudder (or throttle alone when 3 functions are used). This mode is used by the majority of model pilots because it more closely resembles the controls of the joystick in a full size aircraft.

Which mode you use usually depends on which club you join or whichever mode the person teaching you to fly uses. Neither mode is better than the other, it will usually come down to whichever mode your instructor is using.

The two main frequency bands used in the Ireland for model flying are 35MHz (34.945 to 35.305MHz = 36 channels) and 2.4GHz frequency (2.400 to 2.4835GHz).

The 35MHz frequency is an Irish/UK only frequency and reserved for airborne models exclusively. It is the frequency that has been in use for a number of years but is beginning to be overtaken by more recent 2.4GHz equipment. There is often relatively cheap second hand 35MHz equipment available as many model pilots continue to upgrade to 2.4GHz equipment.

The main problem with 35MHz is that the transmitters and receivers operate on one of the fixed (narrow band) channels allocated within the frequency band. If someone else within range transmits on the same frequency (channel) by mistake, complete control of the model can be lost, with disastrous results, often referred to by model flyers as ‘being shot down’. For this reason all clubs with 35MHz radios will have a control system, many of which use a peg to indicate when the channel is occupied and only the person having the peg can switch on their transmitter. Not all clubs use the same system, in the same way, so it is important to get a thorough briefing on how the system works at the site or sites where you intend to fly and then discipline yourself to use it properly every time.

2.4GHz radio control equipment uses a spread spectrum (Direct Sequence Spread Spectrum - DSSS). or channel hopping (Frequency Hopping Spread Spectrum -FHSS) techniques to avoid interference with each other and any other 2.4GHz transmissions present. With many spread spectrum radios all transmitting at the same time they are very unlikely to interfere with each other as the spread of radio signals are random, changing, or coded. In most cases any signal conflict happens for such a brief moment, the receiver does not appear to notice it.

This removes the need for transmitter control systems for 2.4GHz transmitters at club sites as it means that multiple transmitters can be switched on at the same time and they will find enough suitably clear paths for the signal to get to the receiver to ensure the signal gets through without corruption. Different manufacturers use additional techniques to enhance the signal and data reliability.

Whereas the 35MHz frequencies will pass right through most objects such as trees, fences etc. 2.4GHz propagates much more like light, being either absorbed or reflected by some objects in the environment.

The absorbing and reflecting of the 2.4GHz signal results in occasions when the receiver antenna may be shielded by parts of the model, or may be subject to the arrival of multiple reflected signals at slightly different times due to the varying distances travelled, this is called multi-pathing. The effects of shielding and/or multi-pathing mean that it is quite possible the receiver will be unable to receive the transmitter signal clear enough to extract the data being sent.

The solution to this problem is to use more than one antenna and/or more than one receiver in the model. Mounting of these antennas or receivers in different places in the model allows the processor that is part of the receiver system to continuously identify the best and cleanest signal from which to extract the data. It is extremely import to follow the manufactures instructions with regard to receiver and aerial installation especially for 2.4GHz.

2.4GHz systems also have failsafe systems as standard and information can be readily found in the information supplied with the radio system of the manufacturer's websites. It is a requirement for Large model of 7 kgs and over as per **MACI Appendix N.** http://maci.ie/wp-content/uploads/Regulation_PDFs/MACI-App-N-2017-web.pdf

GETTING STARTED. SUITABLE MODEL.

The choice of suitable training aircraft is wide to say the least. Some are more suitable than others: a few are excellent.... but some are poor. In the early stages of learning you will probably be flying quite high at about 200-300ft so too small a model will be difficult to see and judge attitude. The ideal trainer is a high wing aircraft of around 1.4m (55") to 1.53 m (60") wingspan. The high wing makes it very stable so that it is easy to fly and the reasonably-sized wingspan means that it can be seen clearly at a fair distance. It should be of simple construction, yet robust since it will probably have to withstand some rough handling. It is, perhaps, best if it has a tricycle undercarriage for easy ground handling and straightforward landings. The wings may be held on by rubber bands or breakable nylon bolts to enhance its crash-proof qualities. The model ideally should have 4 functions (throttle, elevator, ailerons and rudder). Aileron equipped models can be a little easier in windy conditions. Finally, and importantly, it should not be too heavy and be relatively inexpensive!

You can buy an ARTF, build your own model, buy second hand. Whatever you do, do not buy a large scale warbird as your first model. Building the aircraft yourself from a kit or plan is good if you have already had some experience of model construction or if you have experienced help readily available. There are now an excellent range of very reasonably priced ARTF trainers available and many can be sourced from your local model shop.

Each club will have its own ideas on a suitable trainer and you should look around on the flying field and seek advice from one or more of the senior club members. Also seek help and advice with the building and/or fitting out of your model as there are a host of little tips and tricks that experienced modellers have acquired to ensure a successful *(and importantly safe)* flying model.

GETTING STARTED. ENGINES.

Whatever aircraft you buy, make sure that your intended engine or increasingly now electric motor will provide adequate power to fly it. Have power in reserve; it will be there when you need it and you can always throttle back when you don't. For virtually all training aircraft a range of engine/electric motor sizes are recommended and it will pay to go for the largest engine/electric motor size recommended for your aircraft. There is a bonus in choosing a largish engine/electric motor in that it will be suitable to power more advanced aircraft when the time comes. Make sure your IC engine has an adequate silencer so take advice from club members and make sure that the silencing and propeller choice arrangements on your model are adequate.

There are many different types of internal combustion (IC) engines available now, powered either by Methanol (Glow Fuel) or Petrol and both are available as two stroke or four stroke engines. Once again talk to your local club about which would be most suitable for the type of model and the noise limitations for the site you will be flying from.

New internal combustion engines may need running in before they can be run at full power. If you have no experience with model internal combustion engines it is worth doing this at your club flying site so that club members/instructors can show you the safe and proper way to undertake this and you can gain experience and confidence in starting and setting the engine before attempting to learn to fly.

A word of warning for those with electric motors.

If an IC motor stops running it will remain so until it is deliberately re-started by the modeller. However, an electric motor can burst into life anytime when it is supplied with electrical power. You should always treat an electric model as if it were about to burst into full power especially when the battery is connected. Keep the propeller clear of all loose objects and particularly clear of yourself and other persons. Remember also that a stalled electric motor will still be drawing current trying to turn whilst the propeller is jammed and the usual result of this is either a destroyed ESC at best or at worst a Viking funeral. So, if your electric model arrives in a heap remember the first thing to do is reduce the throttle immediately.

Further advice about propellers, fuel and batteries can be got from your instructor, fellow club members, and the internet. Suffice it to say the handling of all these items can be hazardous if safety protocols are not followed so make sure you know how to use all of them. There are ample instructions available to keep the modeller safe. The **MACI Code of Safe Practice** (Appendix L) is a good place to start.

Batteries especially must be charged with the manufacturer's recommendations and special care must be exercised with LiPos. Again, follow the instructions. If in doubt, **DONT** until you find out the correct procedures.

GETTING STARTED. HOW THE CONTROLS WORK.

There are four key forces acting on a model aircraft: **Thrust** which is pulling the aircraft through the air but the air flowing over and around the aircraft creates **Drag** trying to stop it moving forward. As long as the thrust is greater than the drag the model will move forward. The more thrust compared to drag the faster it will move.

Next, the air flowing over and around the wing will create **Lift,** which must be greater than the **Weight** for the aircraft to fly. The faster the wing moves through the air, the greater the lift created and the more the aircraft will climb. Likewise if the wing is moving too slowly then the weight will exceed the lift and the model will start to descend.

On a Mode 2 transmitter the right-hand stick controls the elevator and the ailerons (rudder in 3 channel mode). This control is spring loaded so that it always returns to the neutral position when released (on a Mode 1 transmitter the throttle and elevator are on different sticks but the controls work exactly as the Mode 2 descriptions).

Moving the stick back towards you will apply *Up Elevator* and raise the nose of the aircraft from level flight, moving it away from you will apply *Down Elevator* and lower the nose.

Moving the stick to the right will cause the ailerons to move, right aileron up reducing lift on that wing and the left aileron down increasing lift on that wing and the aircraft will bank to the right and turn in that direction.

Moving the stick to the left will cause the ailerons to move, left aileron up reducing lift on that wing and the right aileron down increasing lift on that wing and the aircraft will bank to the left and turn in that direction.

On the left-hand control stick, back and forward movement operates the throttle. This control is not spring-loaded but operates on a ratchet so that it remains in whatever position it is set. Moving the stick away from you will increase engine/motor speed and moving it towards you will reduce engine/motor speed. With the stick fully forward gives full power: fully back stick but with the trim still fully forward, gives flight idle for IC engines. With the stick fully back, with the trim also fully back, will stop the engine running. For electric motors, just moving the stick fully back should stop the motor (and for gliders apply the prop brake, if the ESC has one). You will need to set this all up on the ground and you should ask your instructor for help doing this.

Side to side movement on this left-hand stick operates the rudder in the appropriate sense on 4-channel aircraft. This control is spring loaded so that it always returns to the neutral position when released. On 3-channel aircraft (elevator, rudder and throttle) it is usually left unused as the rudder is connected to the 'aileron' control on the right-hand stick.

Alongside each of these four primary controls on the transmitter are sliding or clicking levers, which are the trims for each control. They work in the same sense as the stick they are associ-

ated with. These effectively alter the neutral position of the related control so that by using them, when the aircraft is in the air, you can cancel out any out-of-balance forces which make the aircraft tend to climb/dive or bank/turn.

Get very familiar with your transmitter. Hold it as if you were flying and get to know where all the controls are by touch. When you are actually in the air there will simply not be time to look at the transmitter to find out where a particular control is located so keep your fingers and thumbs on the sticks at all times.

SO A QUICK RECAP.

Elevator.
The elevator is used to hold the aircraft level. Backward movement on the stick will cause the nose to rise and the aircraft to climb, although not for long unless power is increased. Similarly, forward movement on the stick will cause the nose to go down and the aircraft will dive, building up a lot of speed unless power is reduced. So you see, the throttle and elevator controls affect one another to an extent.

Aileron.
The aileron control is used to keep the wings level when in level flight. Moving the aileron control to the side will cause the aircraft to bank in that direction. When the aircraft has banked about 20^{o} use the control to stop the aircraft banking further *(either backing off the control input or applying slight opposite control momentarily, dependent upon aircraft characteristics)* and to hold that steady angle of bank. The aircraft will now start to turn, but it will also tend to drop its nose so be ready to apply a little 'UP' elevator to keep the nose up. This will also help the aircraft to turn. To straighten out from the turn, simply apply opposite stick control to bank the aircraft back until the wings are level (relaxing the back pressure on the elevator as the aircraft wings return to horizontal) and the aircraft is once again in level flight.

Rudder.
Used in conjunction with the ailerons will help the model make a coordinated turn in the air but also has the advantage that when the model is on the ground it can be steered whilst taxiing by use of the rudder which is usually also linked to the nose or tailwheel to give accurate ground manoeuvring.

Throttle.
The throttle control determines the amount of power the engine is providing to fly the aircraft. Full throttle is used for take-off, overshooting and many aerobatic manoeuvres. Low throttle settings give glide, taxiing power and, with the trim fully back, "engine stop" facility, (most new transmitters now have a dedicated engine stop button or control). Intermediate throttle positions are used for different conditions of flight and that power setting which gives a pleasant, relaxed flying speed, neither too fast nor too slow, is known as 'cruising power'. The settings for this varies between aircraft, but is normally rather less than half throttle.

INSURANCE AND SAFETY CODES.

You will require third party insurance before attempting to operate your model. If you have joined the MACI then your membership will provide you with third party insurance, provided you operate your model responsibly, as guided by the MACI rules and regulations.

The **IAA** is the body responsible for formally regulating all aviation in Ireland There are legal obligations under **S.I. 563 of 2015** for model aircraft and these must be adhered to before and during model flying. This **S.I. 563 of 2015 i**s essential reading before you operate your model.
Most model flying clubs will have some sort of safety system in place. These are usually in the form of club rules i.e. no fly areas, location of pits and pilots during flying, flying time limitations, number of models in the air at once, etc. Whilst many of these will be explained to you by your instructor and/or other club members it is important that you establish what all the rules are for yourself, so that you do not inadvertently break any of them.

GOOD MANNERS.

There are some issues that impact safety without you fully realising it, an example may be running an engine at full power on the ground for long periods of time close to where pilots are flying their models, making it difficult for them to hear their own engines, etc. Also, be aware on flying sites with public access that pilots are warned if members of the public inadvertently wander close to or onto runway/landing strips, etc. The general rule is to ask before doing anything that will affect pilots that are flying models. You must also communicate with fellow pilots, as you are flying, stating your intentions such as “Landing or low pass” and listening to any responses in case someone has a higher priority need, such as an engine failure or someone is collecting a disabled model from the landing strip.

FINAL CHECKS.

Before you take your aircraft to the flying site for its first flight there are certain checks, which must be carried out.

BALANCE (Centre of Gravity).

Make sure that your aircraft balances at the Centre of Gravity point shown on the plan with any fuel tank empty but if electric motor powered with the battery installed. If you do not know where this point should be, balance your aircraft so that you can pick it up level with your fingertips under each wing at a point approximately one-quarter to one-third back from the leading edge. Check also the lateral balance to ensure that one wing is not heavier than the other (balance on the spinner or prop nut and the fuselage, near the rudder). If it is, make it balance by adding weight to the ‘light’ wing’s tip.

CONTROLS.

Ensure that the control surfaces move in the correct direction and that they operate smoothly and there is no binding of any of the control linkages. At home, switch on the transmitter, then the receiver, and move the sticks to check the controls, while standing behind your aircraft: stick forward - elevator down: stick left - left aileron comes up, right aileron goes down: rudder left - rudder moves left.

If doing your checks at the flying field, you must ensure that the frequency control system is complied with BEFORE switching on. (*Note: if your model is electric and uses a BEC it is safer to remove the propeller from your motor to conduct these tests at home, or ensure the model is fully restrained at the flying field, as your motor will be live and any fault, incorrect setting or stick operation could cause the engine to go to full power).*

WHEEL TRACKING.

Push the model along the ground and see that it runs straight, without any wheel binding. If it veers off right or left, correct this by adjusting the nose or tailwheel.

ENGINE/MOTOR.

With the aircraft suitably restrained, start the engine and check that the transmitter control operates the throttle correctly without any trace of stiffness. Check that 'fully forward' on the throttle control gives full power: 'fully back' gives a satisfactory idle: 'fully back' with the throttle trim also fully back stops the engine. If any of these controls are out of adjustment re-set them to ensure safe and proper operation.

If your model is electric powered it is best to remove the propeller for initial tests in the aircraft. *(Always disconnect the flight battery before removing or fitting the propeller.)* While doing this also check the rotation of the motor, which should be anticlockwise (looked at from the front) for a standard propeller on the front of the model. Now re-fit the propeller, ensure model is suitably restrained and the propeller is clear of any obstruction and check that 'fully forward' on the throttle control gives full power:

VISION.

If you have any eyesight correction requirements, especially at distance, remember it is critical that you can see the model clearly at all stages of the flight, so ensure you take your corrective glasses or lenses with you. If the weather is going to be sunny or very bright you may also want to take sunglasses and a hat with you. You are now ready to go to the flying site for your first flying lesson.

It is assumed that the pupil has already received advice about a model and radio systems from his new club or on the internet. He has joined the club and paid his MACI fee and has arrived for his first flight.

AT THE FIELD. PRE- FLIGHT CHECKS.

Before your model is flown for the first time your instructor will repeat all the basic checks you have carried out at home, along with necessary pre-flight and post-flight checks on your aircraft for its first few flights and explain to you what he is doing. Your instructor will then ask you to do these for yourself and let them become a matter of ingrained habit.

Your sequence of checks before you fly (pre-flight checks) should be:

a) Check the aircraft thoroughly for any damage which may have occurred in transporting it: wings and fuselage for surface damage, tail for damage and security.

b) Check that all hinges and linkages are secure; both at the control surfaces and at the servos (a bang on the tail can often unhook a clevis). Check that all servo mounts are secure. Assemble the aircraft for flight.

c) Check the undercarriage for correct alignment, security and tracking.

d) Check that the engine or electric motor is securely mounted and that no screws or bolts have vibrated loose. Check the throttle linkage for security. Ensure that the propeller is undamaged and securely bolted on.

e) If you are using 35MHz equipment comply with local control requirements. *(if model is electric see (g) below)* then switch 'ON' the transmitter followed by the receiver. Now check all controls for full movement in the correct sense. Check that the control surfaces are in their correct position with the transmitter trims at neutral.

f) Carry out a range check at the beginning of every flying session, or if you have had a crash, for example or if any changes have been made when the aircraft has been repaired). Your instructor will show you how to do this and you will also find advice in the radio manufacturer's instructions.

DO NOT ATTEMPT TO FLY IF YOUR RANGE IS BELOW THAT REQUIRED.

Have your radio checked and repaired if your range is down. If your model is powered by an electric motor it is advisable to carry out the range check with the motor running (with the model suitably restrained) to ensure no ill effects from Electro Magnetic Fields produced by the high current involved. You are looking for all the controls to continue working correctly and smoothly, with no jittering of control surfaces.

g) If your model is powered by an electric motor ensure that the model is suitably restrained before installing the battery. Some clubs require that the motor's battery is not connected up until the model has been moved from the Pits to the flight line ready for taxi out and takeoff.

h) If your radio equipment has failsafe facility, check that this is correctly set at the beginning of every flying session. With an IC engine aircraft you can do this by checking the throttle servo moves to throttle closed when you switch off the transmitter without the engine running. If your model is powered by an electric motor your will have to ensure the model is suitably restrained, install a battery and power it up to about 1/3rd power then switch off the transmitter (be extremely careful doing this as the model will go to full power if the failsafe is incorrectly set). The motor should stop if your failsafe is correctly set.

i) For an internal combustion engine powered aircraft, fuel up the aircraft and, after making sure that the model is properly restrained and checking no one is within harm's way of any potential propeller failure, start the engine. After allowing it to warm up, open the throttle fully and check that the engine picks up cleanly to full power. Pick the aircraft up carefully and hold it with the nose pointing up at about 70 degrees. Ensure that the engine does not falter or cut. If it does it will almost certainly be set too lean and you should re-tune by opening the main needle a little and then retesting until the engine runs happily with the model's nose pointing up.

j) With the aircraft suitably restrained, open up to full power and re-check all flying controls once again.

k) Close down the engine. Switch OFF the receiver, then the transmitter, *(If you are using a 35MHz Tx lower the aerial, if you do not intend to fly for a time and clear your frequency control system).* Refuel if necessary.

l) Once the engine has been set for the day, as in (i) above, don't fiddle with the mixture needle on the engine's carburettor. If you find that the engine won't run reliably then the problem is almost certainly elsewhere, usually dirty fuel (fit an inline fuel filter to your fuelling rig), faulty plug (try your spare) or a mechanical fault in the engine such as an air leak in the carburettor or main fuel line. Your instructor should be able to help diagnose and advise on this one.

m) If you require eye protection or correction glasses/lenses make sure you have them on.

When these checks are completed your aircraft is ready for its first flight of the day. Always remember to switch your transmitter on first and allow it to boot up fully before switching on your receiver, (*With a 2.4GHz Tx always ensure it is held up from the ground whilst switching on and booting up as some manufacturers Tx systems do a search of the 2.4GHz band to check for free bandwidth and you want the Tx to 'see' everything that is being transmitted at the time).*

AT THE FIELD, POST FLIGHT CHECKS.

a) After landing taxi the aircraft clear of the runway/landing strip but not into the Pits, shut down the engine and then carry or wheel the model into the Pits.

b) If the model is powered by an electric motor, disconnect the motive power battery, *(If fitted with a BEC system this will also switch off the receiver)*

c) Switch the Receiver OFF, then the transmitter OFF.

d) If using 35MHz radio equipment ensure your Tx antenna is retracted and clear your frequency on the control system in use at the site.

e) Check the propeller, undercarriage and airframe for any damage sustained in flight or on landing.

f) Check all fastenings for security (wings firmly attached, engine and silencer secure etc.).

g) Check control linkages/horns are still intact and not bent or damaged.

h) Clean down the aircraft checking integrity of all flying and control surfaces as you go, (*It is important to remove all oil and fuel residue on glow and petrol powered models as this can damage painted and film covered surfaces and lead to oil soaking into wood with possible subsequent failure of glued joints etc.).*

i) If electric motor powered, remove the battery, insulate any exposed battery contacts and store the battery safely. It is useful to have a system for noting that the battery is now depleted so that you do not accidentally install it back in the model for the next flight.

SUBSEQUENT PRE-FLIGHT CHECKS.

For subsequent flights you will need to perform post-flight checks after every flight. After refuelling or changing the battery you will need to do a full and free control movement check before taxiing out for take-off and ensure you are wearing your eye correction or protection if this is required.

FIRST FLIGHT.

Now that you have the model and the necessary support equipment you will be just waiting to get the model airborne, albeit probably with some trepidation. Your instructor will get the appropriate frequency control sorted out and check your model over.

He will check:
a) Sound construction of the model;
b) Wing for warps;
c) Wing and tail square to fuselage;
d) Attachment of the wing to fuselage for security (minimum of 3 strong bands on each side for banded-on wings);
e) Radio installation, security of all plugs and sockets, security of servos, clevises and all hinges.
f) Radio range & failsafe operation;
g) Correct position of the Centre of Gravity (balance point);
h) He will connect up and check the Buddy Box system (if in use) for correct control movement from both transmitters.
i) Correct rotation and throttle operation of an electric motor (if used).

He will now conduct a test flight, Usually he will check the aircraft's taxiing and, when satisfied, will take-off and climb to a safe height. He will then trim the aircraft out (using the trim controls on the transmitter) so that it flies straight and level 'hands off' at cruising power. He will also check the handling of the aircraft at high and low speeds, climbs and dives and may do a few mild aerobatics. He will tell you what is going on all the time.

After landing and going through the post flight procedures, he will carry out any changes in the settings of the control surfaces, which have been shown to be necessary during the test flight and explain what he is doing, and why. He will re-set the elevator, rudder and aileron linkages, if necessary, to give straight and level flight 'hands off' with the transmitter trims back at neutral.

Now it is your turn.

He will discuss with you what you will be expected to do for your first flight and this is your opportunity to ask any clarification questions. Your instructor will show you how to use your fingers/ thumbs on the sticks. Not all clubs use a Buddy Box system so the usual method of transferring control in the early stages of instruction is for the instructor to hand the transmitter to the pupil. In the early stages of training without a Buddy box the instructor will often take back the transmitter to restore the model to straight and level flight before handing it back to the pupil. Remember to face the model at all times! At this early stage you will only be using the right-hand stick to fly the aircraft (Mode 2), but keep control over both sticks so that you become accustomed to the correct position of your hands. Stick movements are very gentle. Remember what we said before, moving the stick forward will lower the nose of the aircraft, bringing it back towards you will raise it. Moving the stick to the left will make the left wing go down: to the right, the right wing will go down. Always be 'light' in touch on the controls - it is pressures on the stick rather than large movements which will give the smoothness in flying which must be your aim.

However, you must apply sufficient control movement to make the aircraft respond in the way you want. How far do you move the controls? **'Enough'** is the only answer!

For the first few flights the instructor will get you to fly straight and level to start with and getting you to make gentle turns at the end of each straight run. This is an important starting point as getting the model back to straight and level is the recovery point for any flight upset either introduced by you or any turbulence. Don't try to 'fly' it - just correct it when it banks and get the wings level: similarly try to stop it climbing or diving if it has a tendency to do so.

Your instructor will stand close by you to supervise your flying or to show you the necessary corrections to make. He will turn the aircraft from time to time to keep it in easy view. He will probably take control now and again to allow you to relax since you will be concentrating so hard that 2-3 minutes at a time is quite enough. After 10 minutes or so he will land the aircraft and taxi it to the edge of the runway/flying strip and shut down the engine.

Your instructor should then discuss the flight with you. Take the opportunity to ask any questions and clear up any points which may have bothered you. During your flying one thing will have become perfectly obvious.... it isn't as easy as it first looks or quite as easy as flying on a simulator! But don't despair - it will all fall into place quickly enough.

ORIENTATION.

One thing you will discover on your first flight - how difficult it is at times to determine exactly which way the aircraft is turning - or even which way it is going! Your ability to control the model depends to a very large extent on being able to see it clearly and to understand its position in the air.

The way to avoid serious orientation problems is to keep your eyes on the model at all times and to keep the model within an easy visual distance, plus keep a mental picture of what your aircraft is doing. Your troubles will only start when the model is at a distance. If, accidentally, your model has got towards the limit of visual range, all need not be lost. If you cannot tell if the aircraft is flying towards you or away from you there is a simple test. Move the transmitter stick to the left slightly. If the model banks in the same way as your control movement the aircraft is flying AWAY from you: if it banks in the opposite way it is flying TOWARDS you. If the aircraft is flying across your line of sight, turn it until it is flying towards/away from you and apply the same test.

You may also find it difficult to judge if the model is climbing or diving during turns, especially whilst close to overhead or flying quite high. Things like engine note i.e. propeller/engine speed will increase and the note will change in a dive, the controls will become a bit more sensitive as the models speed increases. Likewise, if the model is climbing the engine note may labour a little (although not to the same extent as it will increase in a dive) but the controls will feel a little more sluggish as the model slows down slightly. Do not worry as you will gradually get the hang of this and you will become more aware just what the model is doing as you progress through your training.

When flying in a wind of any strength you will find that your model can be carried away from you very quickly when it is travelling downwind. It is essential not to let it go too far. If you do, not only do you stand a good chance of losing control because you just can't see the aircraft properly, but it is a long and slow slog back to your position against the full strength of the wind. There is another major factor - if your engine stops it will be difficult or impossible to glide the aircraft back to your position if it is too far downwind.

So always try to keep your aircraft upwind of your position as much as possible. By doing so, you will save yourself from falling into some very difficult situations.

Some beginners try to fly by 'pulsing' the controls - giving short dabs of control and letting the stick flick back to neutral. Don't on any account do this - it is bad technique and you will never achieve the smooth flying you require by doing this.

Now, here is your first cardinal rule: **NEVER, BUT NEVER, TAKE YOUR EYES OFF THE AIR-CRAFT WHEN YOU ARE FLYING.** If you do, you will certainly become disorientated and may even lose sight of your aircraft, or be unable to locate it quickly. It is a great temptation to look down at the transmitter when you have to re-trim, for example. Avoid this at all costs. Become thoroughly familiar with the layout of the transmitter controls so that you can locate any of them quickly by touch alone.

So, your first flight is completed and you should go over it several times in your mind, discussing any problems or queries you have with your instructor before you fly again. Don't be in too much of a hurry to get in the air again - assimilate the lessons you have learned, realise what you have to do to correct the mistakes you made the first time and be determined to make your next lesson a 'learning' one and not simply a repeat of the first one.

Your next few flights will follow similar lines to the first, with your instructor doing the take-off and climbing the aircraft to a safe height. He will then hand over to you to continue practising straight and level flight and gradually introduce you to left and right turns. He will be right with you, as be-fore, ready to correct any errors which may put the aircraft in a difficult or dangerous position. If you get too low or too high, he will take over from you to bring the aircraft back to the right height and probably position it so that your view is better for judging the turn.

You will find when you enter a turn that the nose of the aircraft tends to go down and the aircraft loses height and gains speed. Similarly, when levelling out the aircraft will tend to climb and lose speed.

To overcome these problems and perform level turns you should pull back gently on the elevator stick (RH stick Mode 2 Tx, LH stick Mode 1 Tx) when you have put on sufficient bank for the turn and use the elevators to hold the turn level. Don't allow the aircraft to over-bank, 20^{o} of bank is quite sufficient at this stage. You will also notice that as you apply the up elevator it appears to tighten the turn slightly.

Coming out of the turn, all you need to do is to relax the back pressure you have applied during the turn as the aircraft straightens up and you will find that it will remain in level flight - provided you have not built up any excess speed in the turn by diving slightly and the model was properly trimmed in the first place!

Your aim throughout the flight is to fly level and perform turns in both directions without gaining or losing height. This requires a great deal of concentration and, again, your instructor will take con-trol from time to time to give you a break and have time to gather your thoughts. He will, of course, be talking to you through most of your flying at this stage and encouraging you to make the correct control movements to make the aircraft do what you want. He will also take control to prevent the aircraft from getting too far away. After landing, again, you should discuss the flight with your instructor and ask questions on anything you did not fully understand. This flight pattern

will be repeated in subsequent flights until your instructor is satisfied that you can control the aircraft adequately.

REMEMBER Always be gentle on the controls and avoid rapid movements which can lead to over controlling.

TAXIING.

After the first few lessons, your instructor will start to get you to taxi the aircraft to the take-off point from which he will still do the take-off and initial climb. Your instructor may give you some taxi practice to ensure your left hand can get some practice with steering. This would normally be done when the flying strip is not too busy and if other members are taking a lot of notice you are not doing so well but once they stop taking notice you know you are getting the hang of it.

Taxiing is not difficult: but you must be careful with the application of power as there are no brakes! Hold full up elevator whilst taxiing, this reduces the risk of the model nosing over, or the nose wheel digging in. Use the throttle slowly and only in short bursts until the aircraft begins to move, then, reduce the power. If you don't reduce power the aircraft will run away from you since the power required to get the aircraft moving is much more than it needs to keep moving.
Steer the aircraft by the rudder control since this will have been connected to the nose or tail wheel.

Control the speed by blipping the throttle. If you have problems, just close the throttle and let the aircraft come to a halt: then start again. You will notice that any cross wind will tend to weather-cock the model into wind. As you become more proficient, the use of into wind aileron will help reduce any tendency for the wind to get under a wing tip and flip the model.

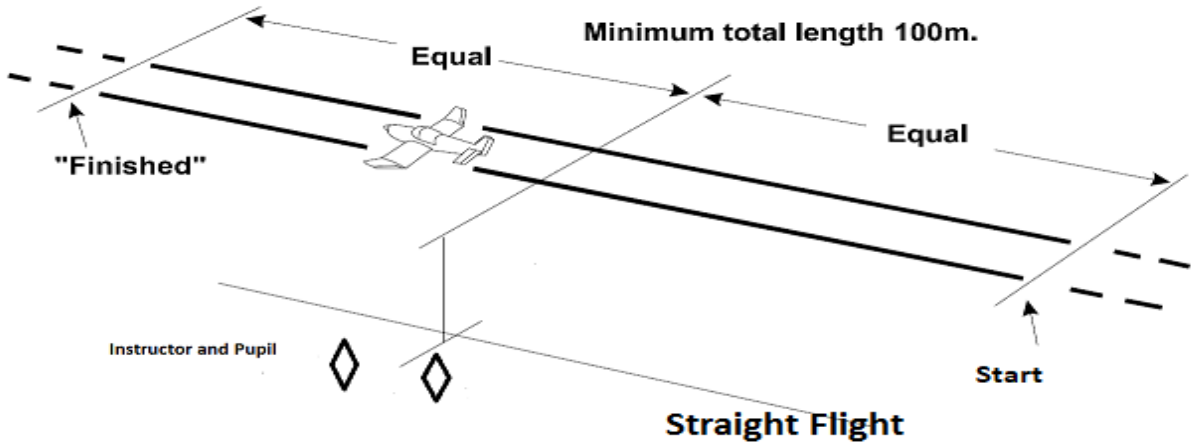
If you are asked to taxi the aircraft back from where it has landed to where you are standing, ALWAYS (if possible) bring the aircraft up to you at the end of the taxi run with it coming INTO wind. The reason for this is that the aircraft will be moving more slowly and will stop more quickly when you close the throttle than if it had the wind behind it. This is part of safe flying!

A final point to remember - never taxi your aircraft back into the pits, or pointing directly towards the pits. It is very dangerous to attempt to manoeuvre directly towards or in a crowded area and any radio interference, engine throttle linkage failure or misjudgement can cause a great deal of damage and possibly serious injury too.

DON'T DO IT!!

A CERTIFICATE MANOEUVRES.
STRAIGHT FLIGHT.

This will probably be the first manoeuvre your instructor will get you to practice. It is simple enough. Just fly into wind and keep the wings level and the height and speed constant. As you can see it is one side of a rectangular circuit. You can then turn around and fly downwind. Now you have done two sides of a rectangular circuit. By flying four of these straight flights with a

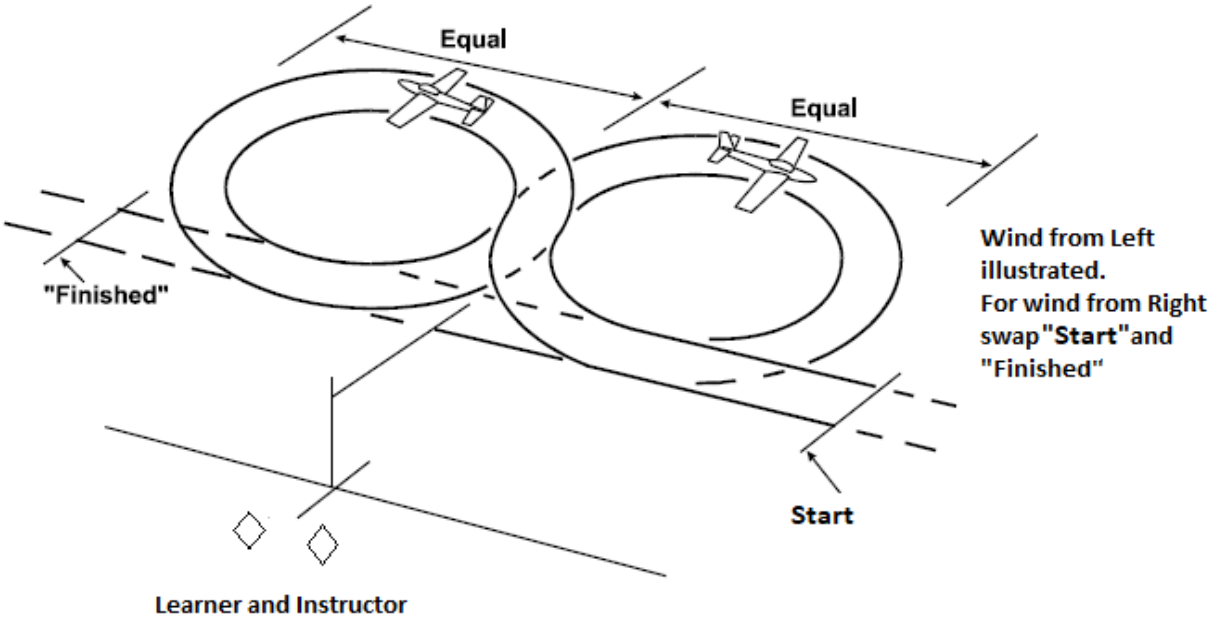


Wind from the left shown.
Swap direction for wind from the right.

90 degree turn at each end you will have flown a rectangular circuit. Remember, no matter how complicated some manoeuvres seem they can be broken down into their component parts and when you practice each part and add them together then you have the complete manoeuvre.

FIGURE OF EIGHT.

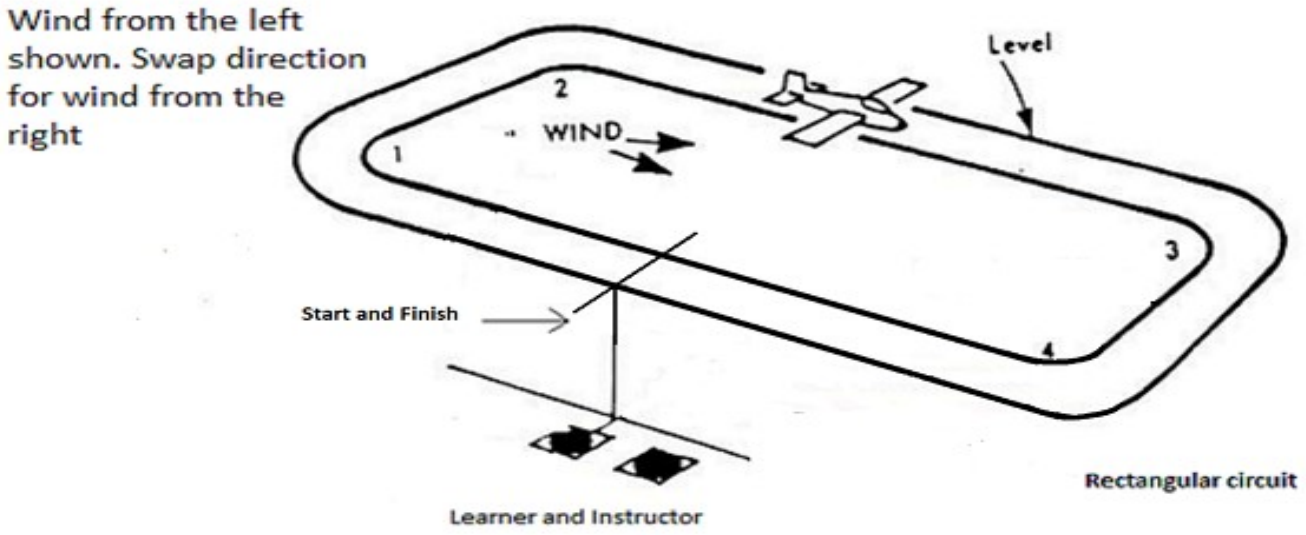
After you start getting the hang of basic control of the model it is important to carry on with the development of your skills by learning to accurately position the model in the air. Your instructor will probably ask you to fly a 'figure of eight', (See diagram below) with the cross-over point directly in front of you.



The turns should be steady with the angle of bank not exceeding 30°. Height should also be constant. You will be making due allowance for the wind so that the cross-over point remains in front of you each time although this may mean varying the angle of bank to keep the diameter of the circles formed by the turns reasonably constant. Note that one half of the manoeuvre is a left-hand circle and the other half is a right hand circle.

RECTANGULAR CIRCUIT.

As a variation, your instructor may ask you to fly in a rectangular circuit like this: (See diagram below)



Fly these rectangular circuits with both right and left-hand turns. Remember, this manoeuvre is excellent practice for the approach and landing. Don't let the aircraft get too far away and let your instructor know if you have problems.

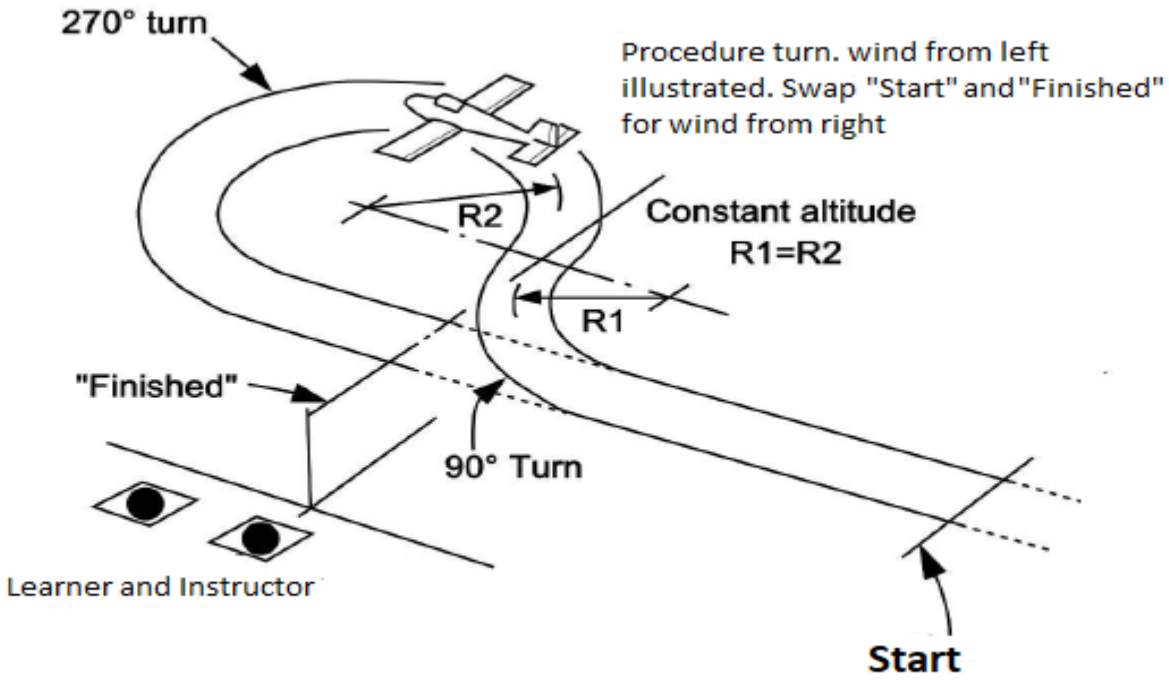
After some practise with these circuits, try a modification. From level flight, on the furthest away long leg, climb the aircraft 50ft. Fly the crosswind leg level at this new height and when you have turned onto the nearest long leg, commence a descent down to your original height, levelling out when you get there. Then repeat this until you can fly this pattern accurately and confidently.

Whilst this sort of flying may appear to be a little boring please stick with it, you are trying to get your brain operating more and more instinctively. This is so that you are getting to the point where you just think about what you want to do, or where you want to position the model next and your fingers automatically adjust the transmitter control sticks the right amount to achieve it.

REMEMBER - IF YOU GET INTO TROUBLE, LEVEL THE WINGS FIRST, THEN RECOVER.

PROCEDURE TURN.

The procedure turn is an excellent manoeuvre for changing direction in the air when transitioning from one manoeuvre to another.



It can be used to change from a left hand circuit to a right hand circuit or vice versa with ease and allows a means for giving the novice sufficient air space to complete a 180° direction change without getting disorientated. Quite simply, the model is flown along in a straight line and at the appropriate moment a 90° turn is initiated then a 270° turn is made to put the model flying back in the opposite direction to which it started. For example, when doing left hand rectangular circuits you could use the procedure turn after you have completed a rectangular circuit and passed the pilot position to start a rectangular circuit in the opposite direction by returning to the pilot position but in the opposite direction.

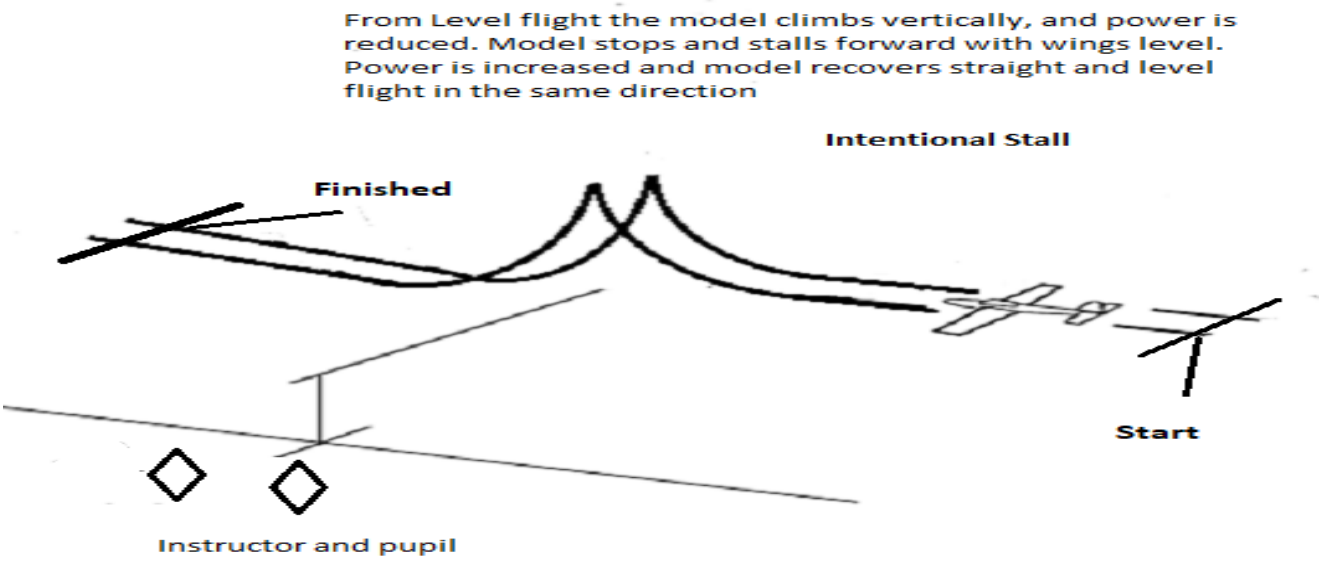
INTENTIONAL STALL & RECOVERY.

Now that you can control the aircraft competently in normal flight, it is time for you to explore what happens when flight is not normal, so that you can recognise when this happens and know what to do about it.

In previous lessons you have been taught to concentrate on keeping the speed of the aircraft reasonably constant. Your instructor will now take you through what happens when the speed is allowed to slow down. *Remember that the speed is relative to the air not the ground for example flying into wind will appear slower than flying downwind.*

Your instructor will get you to position the aircraft in level flight at a safe height. You will then close the throttle and, instead of allowing the nose of the aircraft to drop and the aircraft descend, you hold the nose up with the elevator and try to maintain height. The speed will fall off and, as it does, the aircraft will get more and more nose up. Increased elevator will hold the nose up for some time, but the point will come when the speed has fallen to the stage where the aircraft will no longer continue to fly and the aircraft will 'wallow' (and the controls will feel 'sloppy' and quite

ineffective), the nose will then drop sharply despite the application of full ‘up’ elevator. One wing may also go down quite sharply, known as ‘dropping a wing’. This is the stall.



Recovery is straightforward. Release the back pressure on the stick, open the throttle, and allow the nose to drop and the aircraft to dive and accelerate back to flying speed. If the model has dropped a wing you will need to level the wings once the speed starts to build up again, then apply power, before levelling out from the dive.

You will find that you regain full control very quickly. Actually you will find that you have control almost as soon as you stop trying to hold the nose up, so don’t be worried about losing control for a few seconds.

The points to be learned from this exercise are:
If you allow the aircraft to slow down too much you can lose control. At a safe height this does not matter, but it can be serious near the ground.

a) Remember the recovery action - lower the nose, power **ON** then ease the aircraft out of the dive.

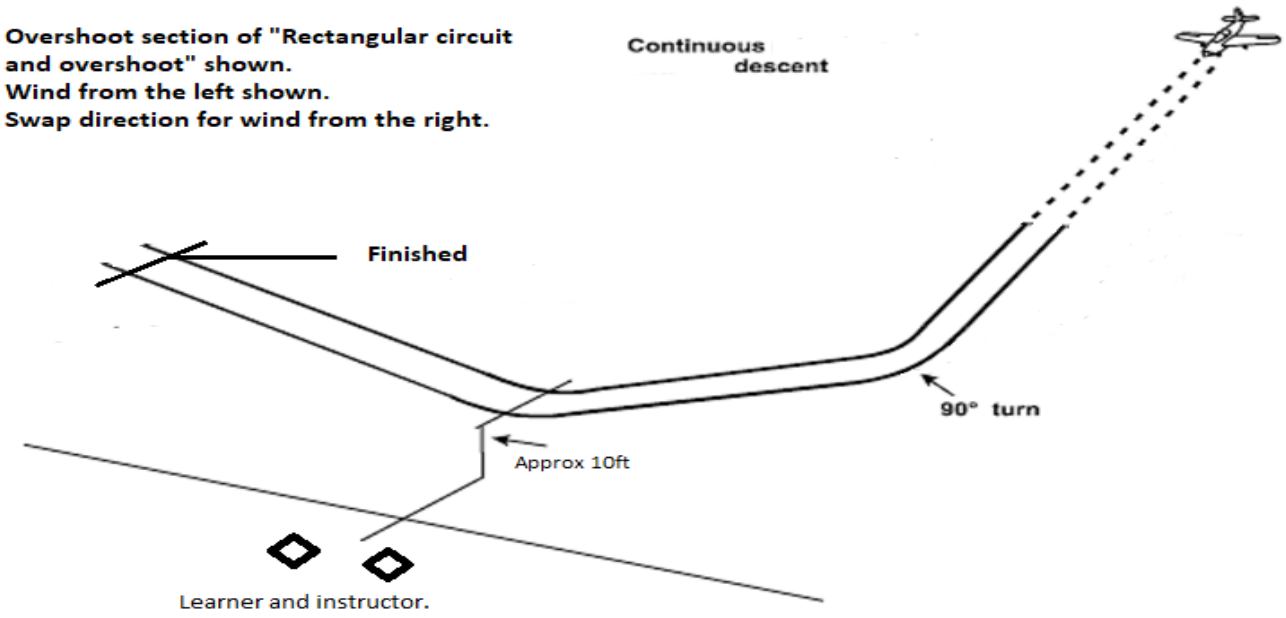
b) Don’t be afraid to practise the stall and recovery at a safe height. You will soon recognise when the speed is getting too low, controls becoming sloppy or ineffective and a stall is imminent. In this way you will appreciate the need to keep a safe flying speed when the aircraft is near the ground.

c) Practise the stall and recovery in turns also. The behaviour of the aircraft may be slightly different in that a wing may go down fairly sharply and, if not corrected, the aircraft may enter a spiral dive, but the recovery action is the same.

REMEMBER - IF YOU ARE IN TROUBLE, LEVEL THE WINGS FIRST. THEN, RECOVER FROM THE DIVE TO LEVEL FLIGHT.

OVERSHOOT.

This is a simple manoeuvre to teach the pupil how to abort a landing due to possibly high landing speed, too high an approach to the runway or an obstruction on the runway etc.



Your instructor will probably start you off by getting you to fly the ‘rectangular’ circuit at a constant height to get you used to the turns and positioning the aircraft correctly. As your skill improves he will get you to descend to the touchdown point so that you can practise approaches. He will tell you to overshoot at some point on the approach and to do this you simply open up to FULL throttle and climb straight ahead with wings level to circuit height. Then reduce power and continue with the next circuit.

You will soon find that you can tell when you are making a good approach: the wings are level, the aircraft seems to be on rails, heading straight for the touchdown point and you feel confident.

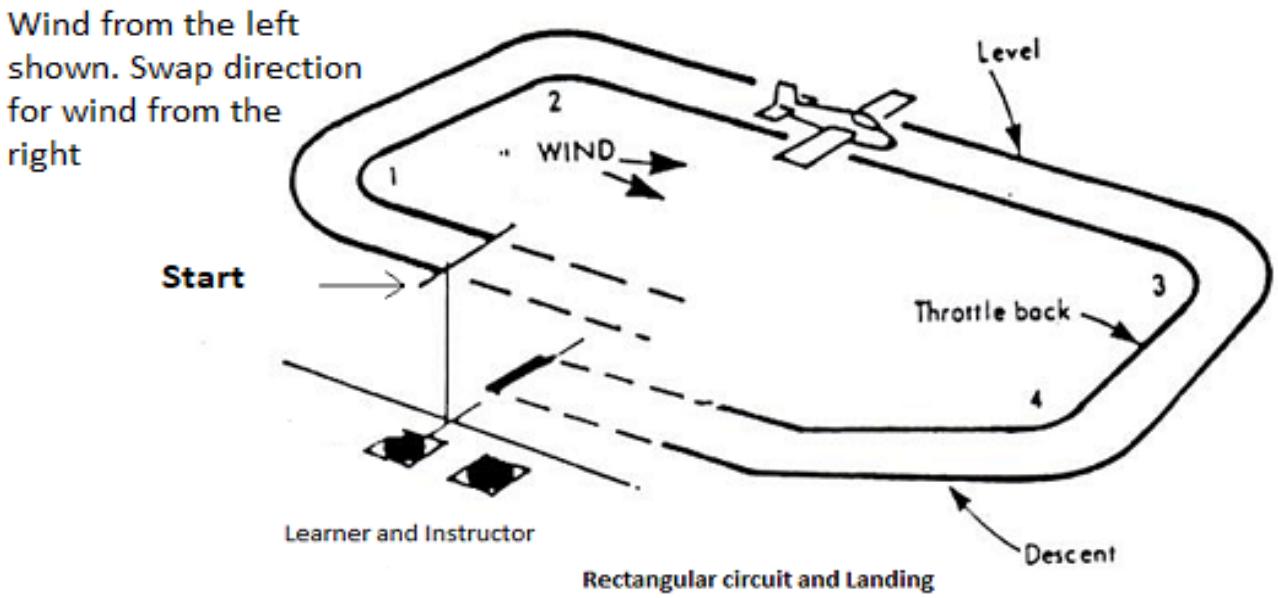
If an approach is not good you will find that you can tell this equally easily! On these approaches your instructor will be close to you, ready to help if things look like going wrong, but he will let you carry on with the approach as long as possible. As you begin to get it right he will let you come lower and lower before calling ‘overshoot’.

CIRCUIT & LANDING.

Now that you are becoming more confident and competent at flying & positioning the model exactly where you want it and you are able to recover from unusual attitudes, it is now time to begin tackling the circuit and landing.

To achieve a good landing it is important that the model is set up correctly from the start, by flying a rectangular circuit whilst adjusting the height to turn onto final approach at the correct height to then descend at a steady rate to arrive at the beginning part of the runway/landing strip about 10 - 15ft high.

The landing circuit looks like this:



Rectangular circuit and Landing

You join it where the dotted line starts since you will already be in the air. Circuit height is around 100 to 150 feet and your instructor will have shown you what the correct height looks like. Although a right-hand circuit is used to illustrate this lesson, the circuit can be either right or left-hand. You can use ground based references such as trees, hills on the horizon etc. that are within your peripheral vision to assist with this positioning.

After settling your aircraft at the correct height and positioning it correctly into wind, fly about 100m upwind of your position and turn *crosswind*. Remember that the wind will tend to blow your aircraft towards you so keep it heading slightly away from you on this leg. When you reach the next point, turn downwind. The downwind leg is parallel to the landing direction and about 50m out.

Once established on the *downwind leg*, reduce power by 2 or 3 notches and you may also need to hold in a tiny bit of up elevator, this will slow the aircraft down a little, ready for landing. Keep the height constant. When the aircraft has passed level with you and gone a further 50m, or so, turn onto the *base leg*, again 'crabbing' the aircraft so that it does not drift further downwind. Now reduce power to a little above idling. Aim to turn the aircraft onto *final approach* to line up with the runway/landing strip at a height of about 50ft at the end of base leg. Don't forget that this is a descending turn as you are on low power now and the nose of the aircraft will be noticeably down to maintain speed.

The aircraft should now be heading straight for the landing point, more or less directly into wind, with the wings level and descending with a little power on. If the aircraft is undershooting the planned touchdown point, open the throttle a notch or two for a few seconds: if too high, close the throttle completely. In other words, regulate the descent by means of the throttle.

When the aircraft has passed the beginning of the runway and descends to a height of about 4 - 3ft, give a touch of UP elevator and fly level with the ground, closing the throttle completely if it has not already been closed. As the aircraft sinks, try to keep flying a few inches above the ground until it loses flying speed and touches down. As a tricycle aircraft it will probably not bounce very much, but remain on its wheels and you only need to keep it running straight with the

rudder until it stops. Should it bounce, hold the controls exactly as they are - don't try to correct and you will find that the aircraft will settle down again without further help.

Sometimes when a model stalls onto the runway the result is usually a large bounce in the air, in which case a momentary touch of throttle will help the model from stalling again and bouncing even harder the next time it meets the ground, or if you are getting more experienced you can open the throttle and go around and try again. Essentially doing a touch and go.

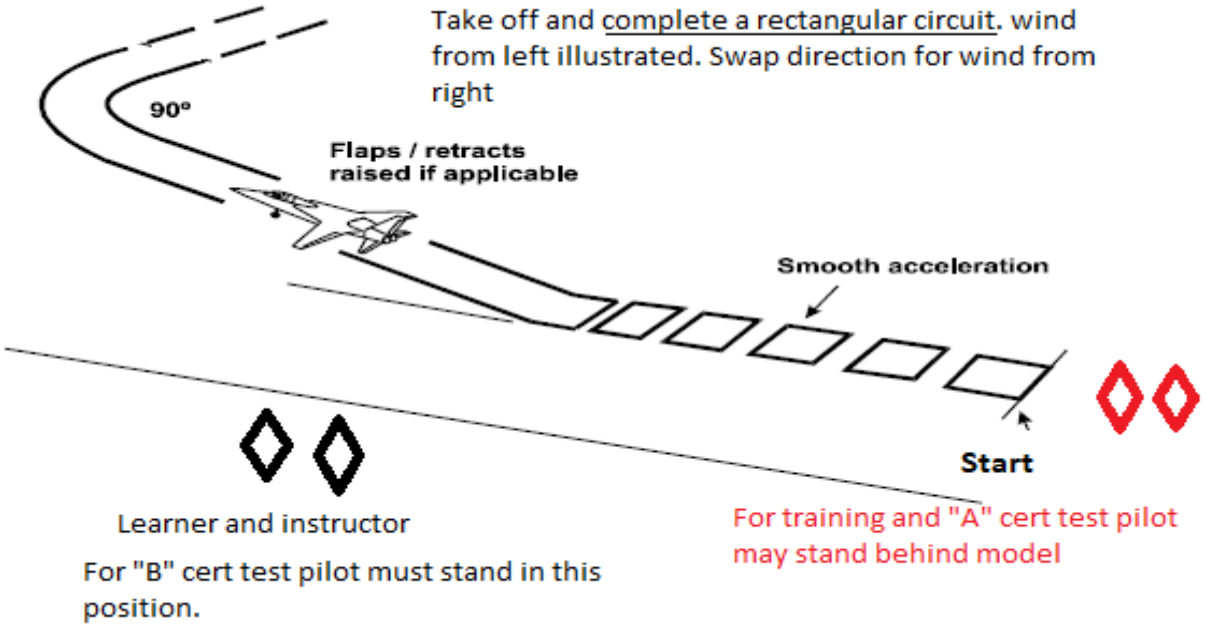
You will soon find that you can tell when you are making a good approach: the wings are level, the aircraft seems to be on rails, heading straight for the touchdown point and you feel confident. If an approach is not good you will find that you can tell this equally easily! On these approaches your instructor will be close to you, ready to help if things look like going wrong, but he will let you carry on with the approach as long as possible. As you begin to get it right he will let you come lower and lower before calling 'overshoot'. Eventually he will not tell you to overshoot and you will find - somewhat to your surprise - that you have actually landed!

Landings are the one manoeuvre that you will and should continue to practice throughout your entire model flying career and whenever the flying strip has little activity it is a good time to practice these over and over again. This is also one of the most satisfying manoeuvres to get absolutely right, with the perfect 'greaser' touchdown.

REMEMBER - NEVER TRY TO LAND OFF A POOR APPROACH - A BAD APPROACH WILL MEAN A BAD LANDING. GO ROUND AGAIN AND HAVE ANOTHER GO.

TAKE-OFF AND CLIMBOUT.

You are now, at long last, ready to learn to get the aircraft off the ground and up to your normal flying height. It's a lot easier than you think!



Your instructor may choose a quiet period on the runway or landing strip to give you some practice with accelerated takeoff runs but closing the throttle just before take-off speed is reached to ensure you are able to maintain a straight track during the take-off run. This is because you will

be using your left hand to control direction via rudder/nosewheel/tailwheel (which you have not been using very much up to this point).

It is important that tracking is kept as straight as possible by anticipating a natural swing to the left (caused by engine torque) by applying a little right rudder and any effects of cross wind, which will tend to turn the model into the wind. This is important both from a safety point of view and to ensure the model is fully under control at the point of lift off, which is one of the most vulnerable points in any flight, as the wind and any turbulence starts to affect the model whilst it is still accelerating and controls are a little sluggish. It is also important to start the take off from a position in front of the pilot area, rather than backtracking to take off moving past the pilot area, as any swing on takeoff could put pilots in this area at risk.

When it comes to your first proper take-off, ensure that all trims are in their correct (neutral) positions - throttle trim fully forward then check with other pilots that it is safe to proceed out onto the runway. Begin by carrying the aircraft to the take-off point (in front of the pilot area) and position the model with it pointing as directly into wind as the site layout and safety allows. Check that your take-off path is clear and that no-one is coming in to land or is on the runway or landing strip. Call “Taking Off” to the other pilots.

The last thing before take off is check that your controls are moving in the correct directions.

Open throttle smoothly to the fully open position and, as the aircraft gathers speed, keep it on a straight path by use of the rudder. *If you are flying a tail dragger model and the grass on your strip is a little long you may need to hold a little up elevator on initially to stop the model nosing over but as speed starts to build this can be released to avoid the model getting airborne prematurely.* When the aircraft has gained flying speed, a gentle backward pressure on the stick will lift it off the ground and into a climb. Once away from the ground your aircraft will tend to climb steeply - avoid this by using the elevator to hold a gentle, but steady climb - keeping the aircraft on a straight path even if it wants to turn.

Commence a turn in the desired circuit direction when the aircraft has reached 50 ft or so and continue climbing to your operating height - around 150 ft. Level out and reduce to cruising power. Now you can see the point of all the previous exercises!

You will need to practice take off in a variety of wind conditions to become proficient at dealing with accurate tracking and any upsets the model may experience whilst in the 'low and slow' state just after getting airborne.

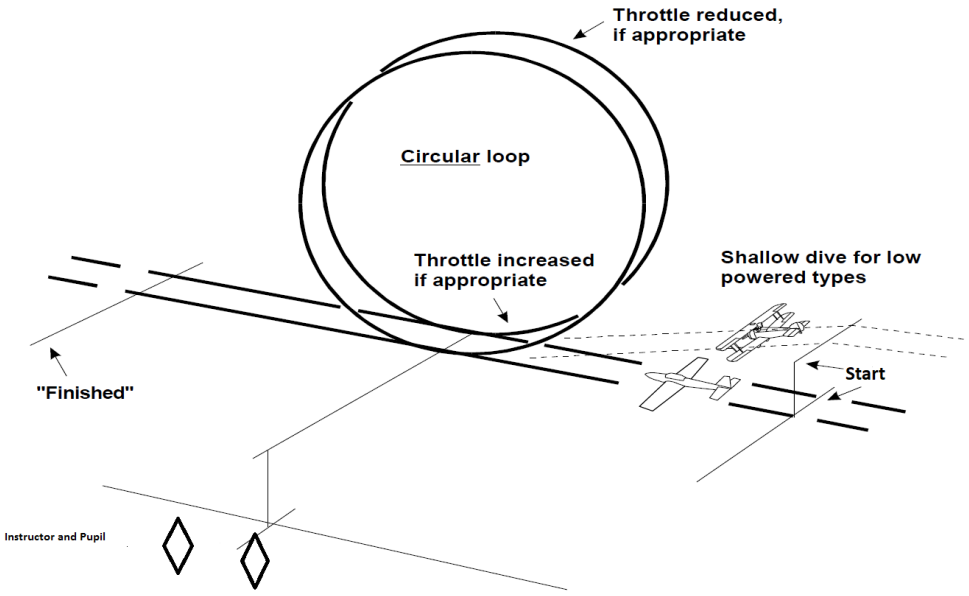
SIMPLE AEROBATICS.

During your training your instructor will get you to perform simple aerobatics mainly to get the feel of the model in unusual situations and give you a change from flying straight and level which for some pupils can become boring. At this stage much of your flying up until now has been at some height and your instructor will probably have recovered your aircraft from unusual attitudes for you, when you have got things slightly wrong. It is now very important that you become proficient at positioning the model and recovering from more unusual attitudes etc as once you start operating the model closer to the ground the time available for recovery becomes much less and you will have to push the control stick(s) in the right direction first time. To assist you with this your in-

structor will probably teach you some simple aerobatics such as a loop and a roll. This will not only help you to improve your control ability but will get you used to seeing the aircraft in some unusual attitudes.

LOOP.

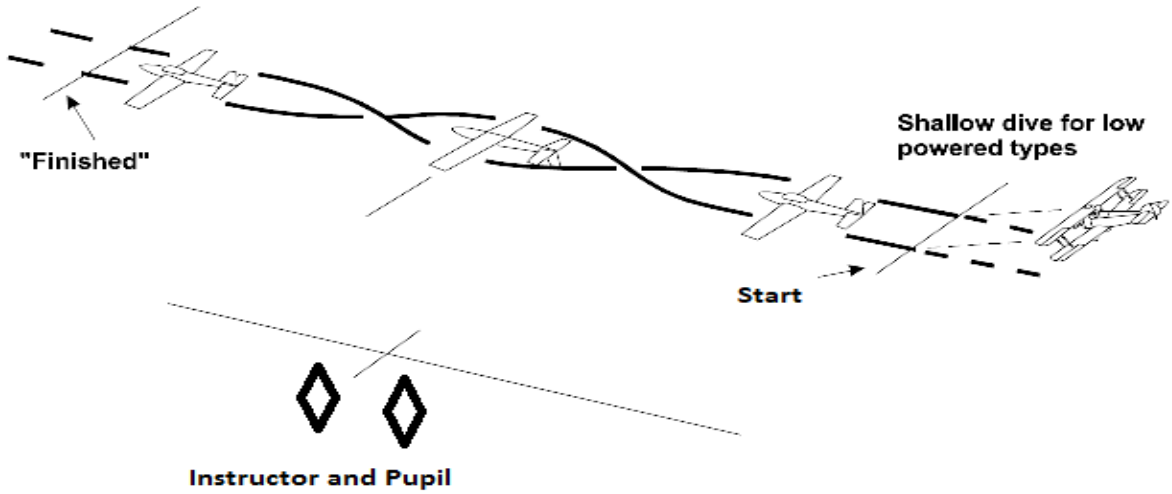
This is about the simplest of aerobatics manoeuvres.



With the model at a safe height, open the throttle fully and make sure that the wings are level. Now push the aircraft into a slight dive to build up speed, then ease back on the elevator, keeping the wings absolutely level, and keep the aircraft going round the loop by a steady increase in back pressure on the stick. As the aircraft comes to the top of the loop, you can ease off the back pressure slightly and begin to throttle back to avoid picking up too much speed. Now recover to level flight by maintaining some up elevator until nearly level. You may not succeed in getting right round the loop at the first attempt, but keep trying and remember to pull back a little harder as the aircraft reaches the vertical.

ROLL.

This is a more difficult manoeuvre and can only be done effectively by a model with ailerons.



That is not to say that a model without ailerons will not roll, only that it will be a somewhat un-gainly manoeuvre. Start by flying level, then raise the nose slightly and apply full aileron in the direction you wish to roll. All being well, the aircraft will roll completely without too much trouble. However, you may find that when the model is inverted it may start to dive. Don't worry - keep full aileron on and the aircraft will complete the roll and you can then recover from the dive. Always make sure that you have plenty of height before practising this manoeuvre. To perform a good axial slow roll, you will need to use momentary 'down' elevator when the aircraft is inverted, but this will come with practise. It is not good practice to abort a roll half way round (whilst inverted) by pulling into a half loop as this can be catastrophic if insufficient height is available and you do not want to develop instincts for pulling out of an aborted roll in this way, because sooner or later it will cost you a model and could be dangerous.

ENGINE FAILURE IN FLIGHT. DEADSTICK LANDING.

Up to this point any problems caused by an engine failure in flight will have been handled by your instructor. Now that you are coming towards the point where you will soon fly solo it is time for you to learn how to deal with a 'deadstick' landing yourself. Engine failure can, of course, occur at any time in a flight and the most difficult times to cope with are:

a. Shortly after take-off
b. On the landing approach

If the engine should cut shortly after take-off before much height has been gained immediately call 'Deadstick' loudly to inform other pilots, then just lower the nose of the aircraft to maintain fly-ing speed and make the best landing you can straight ahead, making only very small turns to avoid any obstacles. Don't try to turn back to the landing area - to attempt to do this is to invite disaster.

If you lose the engine on the approach, much the same advice applies. Lower the nose, keep the speed up and land straight ahead as best you can.

Engine failure at height is another matter. Height gives you time to assess the aircraft's position relative to the landing area and to position the aircraft in a descending circuit aiming to touch down one-third of the way up the landing strip. Always remember that a lot of height is lost in a descending turn and that the nose must be kept down to maintain flying speed. Without any slip-stream from the propeller the flying controls will be less positive, particularly the elevator, so keep the speed up at all times.

Other pilots need to know that an emergency is in progress so always call **'DEADSTICK'** very loudly as soon as you recognise that your engine has stopped. If you hear this call when you are flying, keep your aircraft clear of the circuit until the emergency is over.

It is worth noting that total engine failures in flight are not always inevitable. Often an engine will go 'sick', particularly shortly after take-off. The engine misfires, loses power and generally shows every sign of stopping - which it will if allowed to continue. However, by reducing power to about two-thirds throttle you may be able to retain sufficient power to continue the circuit and land safely. This, of course, means that your engine was set too lean to start with, so ensure that you open up the needle valve a little to give a richer run next time and do a ground check to ensure

that your engine really is running slightly on the rich side. Electric powered models can lose power very suddenly if the battery is allowed to drain too low. The model needs to be flown as if the engine has failed. However, if the throttle is fully closed sometimes the battery can recover enough to give a very short burst of power on final approach to adjust the approach if necessary.

FORCED LANDINGS. GLIDE APPROACH.

Though not part of the MACI A + B achievement scheme it is worthwhile practicing simulated deadstick landings as the biggest problem for nearly all flyers, experienced and novice, is a panicked reaction to an engine or motor failure and an urgent desire to land at all costs without spending a couple of seconds to assess the situation and react accordingly. How many times have you seen someone either overfly the strip by approaching too high and too fast or failing to make the strip at all by leaving it too late to turn towards the strip and running out of airspeed and field.

For safety reasons, your instructor will begin this exercise by teaching forced landings with the engine throttled back called a glide approach. This will enable you to avoid any potentially disastrous situations and also enable more practice approaches to be made since you can overshoot and climb back up to try again.

The instructor will climb the aircraft to a fair height upwind of the landing area and then throttle right back. At this point, he will put the aircraft into a normal nose-down glide and will demonstrate the descending circuit and the two ‘key’ positions - downwind and final.

You will be shown how to reach the first ‘key’ position halfway down the downwind leg at the right height, either by taking a short cut to get there if the aircraft is a little too low, or by extending the circuit if you are too high. Your instructor will continue on the downwind leg until the aircraft is just past the downwind end of the landing strip, then turn base leg. The point at which this turn is made will depend on the height of the aircraft and the wind speed. A low height or a brisk wind will require an early turn and too much height or a calm day will require a slightly later turn. Your instructor will demonstrate this to you.

The second ‘key’ position is the point where the turn onto the final approach path is made. Your instructor will show you the correct height but will also demonstrate that this will vary with the wind conditions. He will also show you that a lot of height is lost in this final turn to line up with the runway.

Once the turn is completed it is only a matter of keeping the wings level and the flying speed up to complete the landing, usually the instructor will perform an overshoot to save time on repeating the exercise. Your instructor will show you that if your aircraft is too high after you have completed the turn from downwind to crosswind you can lose height by extending the crosswind leg and turning in to the runway when your height is right. This may even mean flying beyond the landing path and making an ‘S’ turn to get back, but this is quite permissible in an emergency.

You will then have the opportunity to try the exercise out for yourself. Your instructor will be at hand to help you and to give you advice during the exercise.

When your judgement has improved sufficiently, and only then, will your instructor get you to stop the engine in flight and perform the forced landing completely without power. You will find that the aircraft loses considerably more height in the glide and that descending turns require the nose to be well down to maintain flying speed and that the flying controls are quite ‘sloppy’.

The exercise is exactly the same as before but, of course, this time you are committed to a landing. Always remember that height is your ally - it is better to land a long way down the runway than to have to land short in possibly rough ground. It is possible to rectify most errors of height by modifying the last part of the circuit. Similarly, if the aircraft is too low on turning crosswind, the turn can be continued directly onto the landing path.

This exercise should be practised until you can cope with an engine cut at various ‘safe’ heights at the upwind end of the airfield. so that whenever an engine failure is experienced ‘for real’ you are safe and competent enough to get the aircraft down in the right place without endangering others.

Once the model has landed do not rush out to recover the model, check with other flyers that it is safe to do so, hand your transmitter to another club member for safe keeping whilst you inform everyone very loudly that you are “On the Runway to recover a model”.

If after a genuine engine failure where the model is unable to make a successful circuit and landing and the only way to get it down appears to be a landing towards the pits or people, it is better to land the model quickly in the rough at the far side of the strip or where a clear area is known to exist and accept any damage to the model, than to risk a semi controlled arrival towards people, risking injury or worse.

In an emergency the model is the lowest priority.

The cardinal rule is – “Ditch if necessary, to avoid people”.

It is also important to conduct a post flight investigation to establish why the engine has failed and ensure that this is corrected before any further flights are attempted.

REMEMBER - ALWAYS CALL ‘DEADSTICK’ LOUDLY WHEN YOUR ENGINE STOPS SO THAT OTHER FLYERS ARE AWARE OF YOUR EMERGENCY AND CAN KEEP OUT OF YOUR WAY.

YOUR FIRST SOLO.

You have now learnt all the basics of flying a model aircraft and your instructor will brief you on flying your first completely solo flight. The instructor will probably choose a day when the weather is good and the wind is nicely aligned with the runway to give you the best chance of a successful and trouble free flight. Although you will have done all the elements on your own, many times, this can be a nerve racking event, to say the least.

Your instructor will ensure that you have fully understood everything during the training and briefing and may even go through a few of the key safety issues again with you. The really important thing now is to just relax and enjoy the flight.

Take your time and ensure you have done everything correctly before committing your model to flight.

Whilst your instructor will not be standing by your side you can be sure a careful eye will be kept on you and the models entire flight, including all your pre and post flight checks. Of course, if you get into difficulties he will be there to help but he will have complete confidence in you otherwise you would not be let go on your own. After you have completed your flight now is the time to sit back, relax and have that cup of tea. Your instructor will always be there so that you can be offered any further help, tips and guidance if and when you ask for it.

CONGRATULATIONS.

You have now gone solo - although you may not have fully realised it at the time, this is the accumulation of all you have learnt over recent weeks or months and is one of the biggest steps forward you will make in your model flying career.

You can now fly your models weighing up to 4 kgs or if you wish you could contact your club examiners and attempt the MACI A certificate test. Successful completion of this test will allow you to fly models up to 25 Kgs weight and be in full compliance with all MACI and IAA rules.

All the latest information on the regulations regarding the MACI A + B Cert scheme is available at http://maci.ie/wp-content/uploads/Regulation_PDFs/MACI-App-L-2017-web.pdf

HAPPY FLYING.

A Cert Flight Log

		Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Name											
	Schedule	Level	Level	Level	Level	Level	Level	Level	Level	Level	Level
	Take Off										
	Rectangular Circuit Left Hand										
	Rectangular Circuit Right Hand										
	Figure of Eight										
	Procedure Turn										
	Straight and Level (upwind)										
	Intentional Stall and Recovery										
	Overshoot										
	Rectangular Landing Approach										
	Landing										
	Instructor's Signature										
	Membership Card	Yes/No									
	MACI Card	Yes/No				Level 1=	Poor		**Ready for**	**A Test**	**Yes**
						Level 2=	Fair				**No**
						Level 3=	Good		Issue new	Sheet	Yes
		Levels 3 to 4 should ready for Solo Flight				Level 4=	Very Good				
		Levels 4 to 5 should be ready for A Cert.				Level 5=	Excellent				

MACI Training Booklet 2017

Schedules for Fixed Wing, Heli and Glider A + B Certs.

SCHEDULE OF MANOEUVRES FOR THE A CERT "FIXED WING" EXAM.

Pilots may stand behind the model on Take Off for the A Cert but must return immediately to the designated pilot position after take-off and remain there for duration of test. The Pilot may be assisted to the agreed position. Manoeuvres are centred on Pilot position

1. Take off and climb to approx. 50m (165ft), then complete a rectangular circuit away from the pits and ending over the Take-off Area.
2. Fly the opposite hand rectangular circuit, at a similar height beginning and ending over the take-off area.
3 Fly a 'figure of eight' course with the cross-over point in front of the pilot.
4. Procedure turn (upwind) and finishing downwind.
5. Straight and level flight (upwind) followed by a downwind free pass.
6. Intentional Stall and recovery (upwind).
7. Overshoot by turning away from the pits and completing the balance of a rectangular approach with a simulated landing at low speed.
8. Continue upwind and complete a rectangular landing approach for landing.
9. Landing within the designated landing area.

SCHEDULE OF MANOEUVRES FOR THE B CERT "FIXED WING" EXAM.

Pilots must stand in the designated pilot position at runway edge for take-off and remain there for the duration of the test. The model may be carried to the take-off position by an assistant if required. Manoeuvres are centred on Pilot position.

1. Take off and climb to approx. 50m (165ft), then complete a rectangular circuit away from the pits and ending over the Take-off Area.
2. Fly the opposite hand rectangular circuit, at a similar height beginning and ending over the take-off area.
3. Fly a horizontal flat figure of eight course followed by a free downwind pass.
4. One inside loop (upwind).
5. One outside loop (downwind).
6. One split S (upwind) followed by a downwind free pass.
7. Stall turn away from pits (upwind) approx. 50m (165ft),from centreline.
8. Complete two consecutive rolls into wind (noting rotation Left or Right)
9. Complete two consecutive rolls downwind. (opposite rotation to above)
10. Gain height and spin three complete turns and recover upwind.
11. Enter into a rectangular landing approach into wind and overshoot with simulated landing at low speed.
12. Continue upwind and complete a rectangular landing approach and land into designated landing area.

SCHEDULE OF MANOEUVRES FOR THE A CERT "HELICOPTER" EXAM.

During all manoeuvres the height should be kept constant using the reference of skids at eye level. Manoeuvres are centred on Pilot position.

1. Take off and hover "Tail in" over the centre pad Take off point for 20 seconds.

2. Hover the helicopter slowly either left or right approx. 5m and stop. Hover for 10 seconds and return to start point finishing with a 5 seconds hover. (Do not land)

3. Hover the helicopter slowly to the opposite side approx. 5m and stop. Hover for 10 seconds and return to start point finishing with a 5 seconds hover. (Do not land)

4. Hover the helicopter slowly forwards approx. 5 metres and stop. Hover for 10 seconds and return to start point. Hover for 5 seconds and land on the centre Take off pad.

5. Take off, Hover "tail in" as above for 10 seconds, **turn 45^{o} either left or right** and fly forward at a slow hovering pace to perform a large open "Figure 8" in front of the Pilot. This should be at least 20m in overall length, symmetrical about the pad. The manoeuvre finishes by stopping over centre pad, rotating 45^{o} to the tail in position and hovering for 10 seconds before landing.

As the Helicopter passes over the centre pad in Figure 8 it must be clearly "sideways on" to the Pilot. The nose is always pointing in the forward direction of flight.

Manoeuvres 1, 2, 3 and 4 must all be completed before landing. Where an attempt is called on individual manoeuvre, the pilot will start again from the take-off pad with a 10 seconds hover then proceed through remaining manoeuvres until completion of No.4. The candidate should remain at the one nominated Pilot position.

The examiner will define the "Pad" and flight area in advance. Where possible the 10m square and centre should be clearly marked.

SCHEDULE OF MANOEUVRES FOR THE B CERT "HELICOPTER" EXAM.

The Pilot should remain in one position approx. 10m from edge of box at all times.
Where possible the 10m square and centre should be clearly marked.
The airspace to carry out the flying manoeuvres will be defined in advance by the Examiners.

All manoeuvres must be carried out in front of the Pilot in a similar manner to the Fixed Wing schedules. Manoeuvres are centred on Pilot position

1. Perform one standard "side on" hovering triangle over an approx. 10m square. Take-off and landing are part of the manoeuvre.

2. Perform one standard schedule "side on" hovering rectangle over an approx. 10m square. Take-off and landing are part of the manoeuvre.

3. Take off from "landing pad" into forward flight left or fight only and climb to a height of approx. 50m (165ft). Continue flying forward and perform a full circuit of at least 100m length away from the Pits area.

4. Return once again along the previous flight line and perform a full opposite hand circuit of at least 100m in length.

5. Continue flight and perform one Stall Turn at least 20m (65ft) in height approx. 50m after passing centreline.

6. Descend and return to the hovering area turning 90^{o} to perform a 10 second "Nose in Hover" within the 10m hovering square.

7. Resume flying on the flight line to perform a "Double Stall turn". The horizontal segment of this should be centred and may be up to 100m in length. Note that the Stall turns must be performed in opposite directions i.e. each 180^{o} rotation is **away** from the pilot line.

8. Finish flight by performing an autorotation (throttle hold) approach at 45^{o} to the vertical and land within the 10m. Model should descend "side on" from left or right direction only and smoothly touchdown.

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SCHEDULE OF MANOEUVRES FOR THE A CERT “GLIDER” EXAM.

1. Launch the model and gain height.

2 Fly for ten seconds straight and level across wind.

3. Fly for ten seconds straight and level across wind in the opposite direction to (2)

4. Perform one 360 degree left hand turn, away from slope

5. Perform one 360 degree right hand turn, away from slope

6. Perform two consecutive 360 degree 'thermal' turns, either left or right,

7. Fly into wind and perform a straight stall and recovery.

8. Fly a rectangular circuit in front of the slope in the opposite direction to that chosen for the landing

9. Fly a rectangular landing circuit opposite to that flown in (8) and land within 20 metres of a pre-designated spot. Model may fly behind pilot at examiners discretion.

SCHEDULE OF MANOEUVRES FOR THE B CERT “GLIDER” EXAM.

1. Launch the model, gain height and complete one horizontal circuit (either left or right hand) in front of the pilot.

2. Fly a horizontal figure eight with the crossover point in front of the pilot.

3. Fly two consecutive loops across wind.

4. Fly crosswind left to right and complete a stall turn away from the slope.

5. Fly crosswind right to left and complete a stall turn away from the slope.

6. Complete 10 seconds straight and level inverted flight across wind.

7. Perform one axial roll across wind, either from the left or right.

8. Perform one axial roll across wind in the opposite direction to (7), rotating in the opposite direction to (7).

9. Perform a three turn spin with exit in the same direction as the entry.

10. Fly a left hand rectangular landing approach and overshoot.

11. Fly a right hand rectangular landing approach and overshoot.

12. Fly a rectangular landing approach either left or right hand and land within 15 metres of a pre-determined spot. Model may fly behind pilot at examiners discretion.