Getting Started In Flying Radio Controlled Model Aircraft

By Malc Nicklin

If you are reading this little booklet you are obviously interested in becoming involved with model aviation. There are a few important points you need to be aware of:

1. In untrained or undisciplined hands model aircraft can be lethal.

2. These Radio Controlled Model Aircraft ARE NOT TOYS and need to be taken seriously and handled responsibly at all times.

3. They may be Miniature Aircraft but they have all the characteristics of the full size and like the full size aircraft they come under the control of CASA who have appointed MAAA to administer under CASA part 101 which covers Model Aviation in Australia.

The Aviation Family Tree.

Global	FAI World Body
Other Nations	Australia
National Authorities	CASA Military Commercial Model Aviation Private
Airlines	Charter UAV MAAA Light Ultra Light Sport Rockets
State Assc.	NT Qld NSW Vic WA ACT SA Tas
Club	

The State Centre

The Western Australian Model Aircraft Sports Centre (WAMASC Inc) Club is located in Whiteman Park off Beechboro Rd North - 3.36Km North of the Reid Hwy junction and 4.84Km North of the junction of Benara Rd. Coming from the Gnangara Rd. end of Beechboro Rd. North it is 4.17 Km. It is home to WAMASC Club, the largest club in the state and is the designated headquarters for our governing body, Aeromodellers Western Australia (AWA).

We have several special interest groups that share our facility; and the day you choose to fly will generally dictate which of the groups you may encounter. However, the field is available every day for members and we encourage all members to fly on different days from time to time in order to meet and interact with their fellow members.

What type of things can I fly and when can I fly them?

At the State Centre we cater for Fixed Wing, Helicopter and Control Line Aircraft.

The facility is open 7 days a week, 8am until dusk, with the exception that it may be closed on days when the Fire Danger Index (FDI) for the Lower West, Metro Coastal Plain equals or exceeds 39. The actual FDI for any given day can be accessed through our website Resources page.

We are a family friendly club and encourage junior and senior members alike.

Check out the Club Web Site for W.A Model Aircraft Sports Centre on :-
www.wamasc.org.au

The State Centre is progressing into becoming one of the country's best Miniature Model Aircraft Centres and proud of the fact that the facilities have so far been created by the hard work of its members past and present.

The State Centre is going from strength to strength and we are looking forward to the very near future when we will be holding more Local, National and International events here.

Some of the events will include but not limited to the IMAC (International Miniature Aerobatic Club) these Models can be over 50% the size of the full size aircraft that participate in performing fantastic aerobatics displays.

Gas turbine jet aircraft are a leading edge of technology for model aircraft and are capable of speeds in excess of 400Km/h with onboard computers assisting the management of the jet engine's performance and the stability of the aircraft itself.

The methanol and electric powered helicopters should not truly fly like they do, defying conventional laws of aerodynamics for this type, as the pilot's finesse the controls to put on displays that are worthy of a Russian ballet dancer on steroids.

Pattern aircraft are so called for their precision aerobatics by the pilot controlling the aircraft in a sequence of patterns in a control area that they must not go out of called "the box" and is very skilful in its execution.

Control line models which were the first to be controlled by the pilot, tethered to a line going around the pilot in a 10 meter diameter circle. This is not child's play when you see the Top Guns fly these models in combat!

General sport flying can be electric/gas powered models, electric ducted fanjets, electric powered gliders, combat and scale models.

So there you have it, there is an avenue for all special interests within the sport to the highest International level. Something for everyone so to speak!

So what is next you ask?

As a visitor you may attend the centre twice free of charge to use the facilities if accompanied by a financial member of one of the club at The State Centre. After this time, if you decide to pursue one of the avenues of flying model aircraft you will be required to join the resident club.

Why join a club?

First of all, the types of aircraft that we fly must be flown in accordance with C.A.S.A. (Civil Aviation Safety Authority) regulations Part 101.
This is the same authority that controls the air space around the Nation.
Not to observe these regulations is a criminal act against criminal code 6.1.
CASA views the breaking of these laws very seriously and will not hesitate to prosecute to the fullest extent of the law. Offenders will be and have been prosecuted locally for flying models either dangerously or illegally in areas not approved for flying models.
The safety of the public and our members is our primary concern when operating miniature aircraft.
To complicate matters, in the metropolitan area we have two major airports and an RAAF base to the North, which are controlled by the same airspace regulations, as are we modellers. We are not allowed to operate within five kilometres of these locations.

What about the planes that I see flying in my local park?

The only model aircraft that you can fly in the local parks are the small electric powered plastic and foam type that are called Park Fliers – hence the name "Park Flyer".

Restrictions on where to operate

There are no three strikes when breaking the rules laid down by CASA and if proven that a model was flown illegally near the restricted area like airport approach paths and the like, you risk prosecution. A recent case saw the airline operator also pursue one lawbreaker for the costs of a mandatory inspection of their full size aircraft after he flew his model too close to it. These rules apply equally to a Park Flyer, even though he or she may be unaware of it!
These miniature aircraft can cause serious injury, even death, if not controlled competently at all times, both on the ground and in the air.

Accidents do happen and in these politically correct days of litigation for fun and profit, without insurance it could conceivably cost you that new car, the family home or everything you ever owned to pay legal fees or compensation to the injured party.
In our opinion, it's just not worth it.

You must be insured against Personal Injury and Public Liability unless you are prepared to lose everything. This insurance is thoughtfully covered by your annual fees when you are a club member!
When you join a registered Model Aeronautical Association of Australia (MAAA) affiliated club you are automatically fully insured for almost any event, providing you are operating legally. This coverage is good for almost anywhere in the world.

The instruction is free so why try and do it alone?

We at the WAMASC Club have a number of qualified MAAA instructors for fixed wing aircraft who are more than happy to impart their not inconsiderable expertise. All you have to do is turn up and pay attention! This booklet is aimed predominantly at the fixed wing flyer, but the principles are for the most part the same with helicopters. Should you wish to pursue this discipline, we have many members who would be more than happy to assist you. For the moment, we will speak of fixed wing.

The Training Officer and your instructor will take you through the following;

: The MAAA rules
: The Centre Safety Procedures manual
: Conduct (etiquette) at the field
: The use of the Transmitter (frequency) Compound
: Inspection and the structural integrity of your Aircraft
: Setting up of the aircraft for safe flight (control rigging, fail safe, tuning etc)
: Checking the balance of your model (Centre of Gravity, rotor balance and track etc)
: Safely starting, tuning, operating and shutting down of the Motor

Oh yes, the one that interests you most! Teaching you to fly and land in a safe manner. Most people gain their wings in about 10 to 12 weeks, some take longer and others less.

Pilot skill standards – what are “wings”?

On the completion of a simple test to prove that you can get the model up and down safely, you will be awarded a set of Bronze Wings, which will allow you to fly solo without an instructor.

The Bronze Wings is the first step, then to improve your skill levels, it is on to Silver and Gold if you wish to develop your skills further. You may even wish to instruct other flyers yourself one day.

You may be perfectly happy with your skill levels at Bronze standard. It’s progressive, but to fly solo all you need is your Bronze Wings. Remember, once you have taken off, landing is compulsory and our Instructors will teach you how to do this safely. You may even be able to use your aircraft again after the landing.

The training is carried out in 4 stages, using the buddy box system allowing you to try your hand at flying with the assurance that if you don’t feel comfortable or you lose control, your Instructor can take over instantly .This system is the safest way to learn. Your control box is attached to the Instructors main control transmitter by a 2 metre

long cable that connects the two units.

At anytime that your Instructor needs to take over the controls it's only a matter of releasing the button on the master control transmitter.

All of this also applies to the helicopter discipline. Helicopter specific trainer purchase, setup and instruction is dealt with in a separate chapter.

Now the what's - what Model, what Motor, what Radio Equipment do you purchase and what about Package Deals?

What Model?

First of all, you need a model that is easy to fly and robust enough to take a few knocks and hard landings and not cost a fortune. A "Trainer" sounds about right.

What Trainer?

First of all look for a trainer that has a tricycle undercarriage with one steerable wheel at the front and two main wheels part way down towards the back under the wings and not the other way around, the same as the big airliners of today.

The other combinations with the small wheel at the rear or even a skid are called tail draggers as that is what they are doing.

The major problem with the tail dragger is the directional properties or lack of while on the ground.

Even experienced pilots from time to time end up with the dreaded ground looping where the plane will go around in circles and defy the pilot's efforts to go in a straight line.

This you don't want when learning to fly, so the tricycle arrangement that has a steerable nose wheel is the better option, you don't want to receive the "come on keep it straight" from your fellow members when it's windy. Even full sized aircraft can experience this when it is windy.

Ground looping can happen when the wash off the propeller hits the vertical stabilizer and the pressure acting on the vertical stabilizer pushes the tail around. Weathercocking on the other hand is when the wind turns the model into the wind and that's the only way it wants to go never mind your efforts to convince it otherwise.

The High wing trainer is much more stable to start training with and having the wing mounted on the top of the cabin you are less likely to drag the wing tips on the ground when landing.

Yes I know you want that Spitfire with retracting undercarriage and flashing lights and guns on the front of the wings but you will just have to wait. All good things come to those who learn to crawl (go solo) before they can walk (high performance aircraft) the walk.

Ready to fly (Plug and Play)

With today's technology in advance electronics, motors and batteries it was just a matter of time before the ready to fly models became available on the market.

These models are just what they say they are, Plug & Play, the model is normally made from plastic or foam and comes complete with the Radio Control system and batteries ready to be charged up with its own supplied charger and away you go.

Normally classified as Park Flyers for the obvious reason you may be able to fly them on the local parks but only where the local authorities have given permission to fly these models on their land.

Check with the local council of the park that you intend to fly at first as some council and shires are now making restrictions of flying these Park Flyers on some of their Parks.

A.R.F. models.

On the market there are a number of good trainers called A.R.F.'s (Almost Ready to Fly).This means that just a few hours work with some glue and installation of the motor and radio equipment, you are about ready to go.

A.R.C. (Almost Ready to Cover).

These models require a little more work in that much of the structure is already built, but requires covering and then assembly, engine and radio installation as per the ARF style

Kits:

Require some model making hand skills in cutting out individual components, sanding, shaping, drilling and general marking out, and assembling all these individual components into the finished model.

Plans: (Generally referred to as Scratch Built)

Building a model from plans only, takes some considerable time and skill to produce the model.
Transferring details from the plan to the material is where the skill is needed to make the individual components, then assembly as in a kit, covering or painting and so forth. This system is for the more dedicated and experienced modeller.

According to students that have purchased a RTF or ARF model, the disappointment is not the same when you crash one of these models (this happens to all of us at some time!) compared to a model that has taken you months of work to produce.

I personally know the feeling of constructing a model over 18 months to see it crash on the very first flight.

You too will crash a model but it's a part of the hobby and at the start of your training you will get very disillusioned about bending the undercarriage or breaking a wing.

This starts the next stage of this hobby: repairing your model. We have all had to learn how to do this at some point. So you are not alone and the vast amount of knowledge your fellow members have in repairing models will help you along, just ask for advice and methods to get you back in the air, that's what we are here for and what being a member of a club is all about.

What Motor?

On the market there are as many manufacturers as there are grains of sand on the beach. Well, maybe not, but which one is the best for you?

Basically motors fall into these categories:

- Glow
- Electric
- Petrol
- Turbine

You are a beginner, so humour us and let's not go near turbines for the moment.

Glow

A good motor is one that is reliable in starting, running and you can obtain spares from the local model shops. A good choice would be an OS 46 AX glow motor or similar. As most trainers are designed for 40 to 46 cu. inch size motor, this will fit the bill.
The glow motor runs on methanol with oil and other additives to make up the fuel. It is started initially by connecting an electric current to the glow plug on top of the motor cylinder head and spinning the prop over by hand or an electric starter.

Once running, the electric current is removed from the glow plug and the motor is running on its own and ready to take to the skies.

Glow motors are available in both two and four stroke, single or multiple cylinders and are the most common motors used in radio-controlled aircraft due to their flexibility and reliability in running.

Petrol

Petrol motors are now becoming very popular on the larger models but this is not because they are more powerful, on the contrary you need a bigger motor for the equivalent glow motor. On the other hand, running cost of petrol motors is usually much cheaper in the bigger models than running a glow motor that may use up to 4.5 times more fuel than the petrol motor to fly the same size model.

Petrol motors also have a better running reliability than that of Glow motors in certain circumstances but at this stage we are looking at training and learning to fly so all things petrol are another story for another time.

Electric

Electric motors are now getting very popular with both trainers and some larger models with multi motor configuration such as the Lancaster Bomber with four motors.

The advantage of an electric motor is you don't have to wipe down the oily mess that gets on the model and drips oil over the dining room table after a good days flying

The sound is another issue for the purist, but now you can get the authentic sound of the motors that
were installed in the full size aircraft that runs alongside the electric motors speed from tick over to
full power. The sound of the Merlin motor in your own model Spitfire, all those 12 cylinders on

song and coming from a built in amplifier and sound module is a wonderful thing!

The electric motors used in our models come in several formats of design and have their own place in the types of aircraft to be installed in. The basic types of motors used are as follows :

The Brushed Motor which is a normal DC motor that is controlled by an electronic speed controller to regulate the speed of the motor by adjusting the voltage fed to the motor and controlling the speed of the propeller.

The inrunner and outrunner motors are AC motors that have no brushes to connect the electrical
current to the revolving part of the motor as do the brushed motor.

The inrunner is called this because the inside of the motor is the part that rotates inside the windings, the winding being encased in the frame work of the motor which is attached to the model via a suitable mount attached to the bulk head of the model.

The outrunner is where the revolving part of the motor is on the outside and the windings are on the inner part that is attached to the framework and fixed to the motor mount and bulkhead.

The speed controller can be as simple or as complex as you like and comes in several formats, linear switched and poly phase variable frequency.

Linear controllers, control the voltage to the motor by adjusting the voltage from zero (motor stopped) to full voltage (maximum power). These linear controllers are limited to the smaller motors as they generate quiet a lot of heat.

The heat is a bi-product of the power being reduced to the motor from the power sauce which in this case is the power contained in the battery. The heat is a waste of energy so this method of speed controller is very inefficient as the energy lost to heat could be flying the model instead.

Switched Controllers are somewhat more efficient to the Linear Controllers as the current is switched to the motor in a Mark Space ratio at full voltage from the battery.

This is somewhat like you switching the motor Off and On via a switch; the longer you leave the switch closed the more power goes to the motor. Leaving the switch fully closed will give the motor full power, leaving it open will result in the motor being in the stopped condition. Therefore giving the motor power for 50% of the time it receives 50% of the energy over time.

Changing the speed and duration of the power going to the motor therefore controls the speed of the motor and the propeller and the speed of the aircraft.

Poly Phase Motor controllers are the most efficient and uses the same method of motor rotation as used in large industrial motors, (phase rotation).

The motor has a number of coils located around the static part of the motor called the stator, equal numbers of coils are brought out to three leads. The current is switched to the coils in turn going around the stator so producing a rotating field which the rotating part of the motor called the rotor which contains a number of fixed magnets tries to catch up with the rotating field.

The frequency of the current going to the coils can be in the range from a few hundred times per second to many thousand times per second (Hz to KHz) giving the controlling of the speed of the motors shaft and the propeller.

Other features but not limited too on speed controllers are the, Battery Eliminating Circuit (BEC) which gives a regulated supply voltage out to the receiver and servo at a regulated voltage of 5 to 6 volts or selectable to your equipments requirements.

The battery voltage feeding the motor is much higher than that required by the receiver and servos and must be fed with the correct voltage.

When the main battery voltage feeding the motor starts to fall the smart controller starts to shut the motor down in a series of Off and On to indicate it's time to land before the battery goes down to low to operate the receiver and servos.

The electric motors that are available are very powerful and can range from a fraction of a horsepower to the tens of horsepower, therefore they still require the same respect you would give any other powerful motor.

The manufactures of these speed controllers have built in several safety features that reduce the chance of you starting the motor on full power when connecting them to the main battery.

This can be in a range of procedures that you have to perform with the transmitter throttle that arms the speed controller after you have connected the batteries, from cycling the throttle to maximum then back to the off position to arm the controller.

The controllers also have an audible warning device built into them that can indicate the number battery cells that are connected to the system. These are a number of functions that are built into these clever electronic devices and the operating handbook that comes with these units must be read and fully understood before operating them. This is probably too much detail for the beginner, but it does give you an appreciation of the sophistication available to us int eh electronics field. This of course is advancing in lewaps and bounds every year so it is best to consult fellow modellers specialising in electric flight as they will be best placed to give you the latest information.

The larger electric Models are now powered by the Lithium family of cells Lithium Polymer (Li-Po), Lithium Ion (Li-Ion) and Lithium iron phosphate Li-Ferrous (Li-Fe PO4).
They all have different terminal voltages per cell Li Ion 3.6v, Li Po 3.7v and LifePO4 3.3v, these cells require a dedicated charging system that will fill the requirements of each type of cell being charged.
When these cells first came on the market and were made up into a battery format they were not fitted with balancing leads as they are today, it was soon proven that they do require a balancing circuit to get the best out of each cell. Those not fitted with the balancing circuit started going BANG big time.
You will have noticed that there is only a fraction of a volt between the types mentioned and you may say so what it's only 1/10 of a volt here and there and you are correct but these new cells are not so forgiving as the old Lead Acid, Ni Cad & Ni MH cells of old.

They require the correct voltage when charging and must be fitted and charged using a balancing system when more than one cell is connected in series forming a battery. Failing to use the balancing system the cell will not be charged to the same finish charge terminal voltage. This can create heavy currents flowing through some of the cells creating heat to a dangerous level to the point they explode.

The soft cell packs are the most venerable to mechanical damage and should be treated with the upmost respect when handling and transporting.
You may have seen fire retardant pouches that the cells can be charged and transported in, these are not a gimmick they do work if a cell does go feral it will assist you to remove it to a safe area without touching the cells that will be extremely hot and cause damage to both the person and the surrounding area.
Some safety notes for your consideration

Never charge a battery pack unattended.

Always use a dedicated Battery charger for the cells being charged and ensure the charge rate and voltage are set correctly.

If charging more than one cell in series (Battery) make sure the balancing circuit is correctly terminated so each cell is balanced while charging is taking place.

These family of cells can Ignite if not matched and charged correctly and so should never be charged inside a motor vehicle, near flammable materials and on wooden work benches.

Ideally they should be charged in an area where if something did go wrong while charging it would cause no harm to people or property.

Never charge battery packs inside of the model typically the soft cell type which could ignite the model while charging.

If the cell is damaged mechanically and is deformed in shape or (Heavily Swollen) remove from the model if still installed.

Cut one wire at a time to remove the pack from the model if the plug/ socket can't be reached.

Discharge the pack by placing a load across the leads such as a car or truck tail lamp (globe) of 12 or 24 volts depending on the voltage of the pack and wait till the pack is fully discharged.

When fully discharged pierce the soft cell pack type with a sharp object nail, screw driver and place the pack in a container of salt water to render the cells safe to dispose of in the general rubbish bin.

Cells and Batteries contain a very high level of energy and should be given the utmost respect when handling them, if shorted they can give severe burns to the body and should never be left where children can gain access to them.

When storing and transporting these types of cells try and charge or discharge to 50% of full capacity, this gives a safety margin as cells have been known to explode after being left fully charged and at the other end of the scale if left discharged the cells will become permanently damaged.

If you make your own battery packs up please ensure all cells are of the same Manufacturer, Same Type Li Po, Li Ion and so on) same voltage and same capacity (Ah rating) and C rating.

Failing this the cells will explode as very high circulating current will flow internally within the cell structure.

Some of these cells have a High “C” rating which controls the amount of current that the cell can deliver to a load in normal working condition (NOT A SHORT CIRCUIT). Example if the cell has a capacity of 2000mAh (2Ah) and has a “C” Rating of 20C the cell will be able to supply a current of 2000mAh x 20C = 40,000mA or 40 Amps for a given time as stated on most cells by the manufacturer.

If a battery pack was made up to give 11.1 volts using 3 Li Po cells at this capacity the pack could deliver 444 Watts of power or 0.6 Horse Power over the time stated. Not bad for a little battery Pack.

It also shows how much power there is contained in these cells so take care when handling them .Please…

Turbine

As we said earlier, let's not go here for the moment. But as a quick overview: Miniature turbine or jet engines for our sport look, sound and smell just like the full size aircraft counterparts – because they are perfect miniatures of the full size product. They burn kerosene, they produce thrust and they move our jet aircraft very fast around the sky. These engines are controlled by a computer engine management system (FADEC – full authority digital electronic control) just like their full size counterparts. We have experts in this field too should you wish to venture into this exciting end of our pursuit.

Some other types of motors used in our sport are diesel and pulsejets, which have their own place in aero modelling.

What Radio Equipment?

Again a number of manufacturers are on the market but J.R., Spektrum and Futaba brands seem to be the favourites, with good reason.

It's a must for both legal and safety reasons that this equipment operates in the 36 MHz band or the 2.4 GHz bands, which are the only frequencies that can be used at this site. The MAAA our governing body have a list of Manufacturers and radio equipment on the 2.4 GHz that are certified to be used here in Australia and your equipment will come with a certified "C" tick to indicate compliance with the regulations regarding the use of this radio equipment. The policy and list can be found in MOP058 on the MAAA site and can be found at: http://www.maaa.asn.au/

As previously mentioned connecting two like-equipment manufacturers can make up a buddy box system e.g. J.R. to J.R. or JR to Spektrum by a 2 metre cable for training purposes.

A further good reason for choosing J.R. Spektrum or Futaba equipment is that we have both J.R. and Futaba buddy box system cables that can be used for training purposes without the need of purchasing a buddy box of your own, which is a cost saving. But if you truly desire some other manufacturer's system, then you may have to supply your own buddy system in order to be trained.

You may hear the mention of Computer Radio equipment. This, put simply, is a method of storing information about individual models control characteristics in terms of travel, direction and movement. A number of models and types of models can be stored separately in the transmitter to be called up when required, which saves time having to reprogram the transmitter every time you chose to fly a different model.

A further consideration to look at is how you want to control your model; this is referred to as "Mode". The Mode is the way the two sticks or gimbals are set up for the primary flight controls of the aircraft. The primary controls are what make the aircraft climb and descend and bank left and right.

Mode 1 the elevator that makes the aircraft climb and descend is controlled by the left stick. Moving this stick towards you the model will climb and descend when pushed forward.
The left stick also operates the rudder, which yaws the aircraft sideways like a crab and also steers the model whilst on the ground.

The right stick moved to the right will bank the aircraft to the right and the opposite with a movement to the left.
Left and right with the stick correspond with the same direction as the model will yaw or turn on the ground.
The right stick also control the motors throttle on a ratchet so you can set the throttle and govern the speed of the motor. Pushing the stick forward increases the motor's power and likewise pulling it back will put the motor into idle.

Mode 2 is more like the controls of a full size aircraft flown with a "Joy Stick". The right stick controls the primary controls up, down, left and right. The left stick controls throttle and rudder for yaws and ground control. It's a personal choice and the arguments will go on which is the best. But if you have never flown before it does not really matter, you should choose whichever you feel comfortable with. Your choice of instructor may also influence the mode you choose.

What about Package Deals?

You must realise that they are put together with one thing in mind - cost. But what do you get? Well! Models, motor and radio equipment have been mentioned with some manufacturers indicated to give you an idea, but basically you get what you pay for. The more expensive the equipment, usually the more features (and channels) you will get. But for basic flying training, it is not necessary to have all the "bells and whistles" up front so your first radio can be a relatively cheap purchase. Your local hobby shop will have a selection of packages he can offer you.

However with the 2.4 GHz band being the most popular units being purchase now Spektrum have some nice units but we would only recommend their DX7s and upward and leave the DX6i for use with Park Flyers.

The advantage of the 2.4 GHz system is that you don't need to purchase frequency crystals that lock you on to a particular frequency which can be a drawback if someone else is operating on the same frequency as you and therefore you have to wait and take turns in flying.

Some of the new 2.4 GHz systems have two way communications between the receiver in the model and your transmitter on the ground, giving you the state of the on board batteries , the speed of the motor in RPM, the height the model is above the ground and the air speed and more.

We discourage the practice of taking your eyes off the model, which is a dangerous practice, so until you are very familiar with both your aircraft and the flying field, do not be tempted to do this. Some manufactures are using voice over to let you know the telemetry coming from the model so if you must know, there are safer ways to do it.

All this has come about starting around 2004 when 2.4 GHz was in its infancy and is now the most common form of controlling models either on land, water or in the air.

Like all new products there have been some issues with these systems, which have mostly been addressed by the manufacturer to the point where they are becoming a very robust system.

Note: Check Mal's personal comments in do's and don'ts with some issues with the 2.4 GHz systems.

Now for the "How"

How do I get started?

First of all you approach the club Training Officer who will give you a run down what is required, that is, what you need to know in terms of the regulations and safety procedures that apply at the State Centre. Once he is satisfied that you are up to speed, he will hand you off to an instructor.

Next stage, purchase an A.R.F. trainer for a 40 to 46 cu. inch size 2 stroke motor or electric motor equivalent.

Note: Some trainers now come with an electric motor attachment if you want to go down the path of using electric motors, this attachment is simply fitted on the bulkhead to take the mounting of an electric motor that is suitable for the size of trainer you have chosen.

The electric and glow motors come out about the same price. The electric speed controller and batteries are the most expensive item compared to the electric motor its self.

You will require a battery charger to charge the batteries after every flight but that's only like you purchasing the fuel for the glow motor. The batteries used can be used many times which is also a cost saving.

The correct size motor, speed controller and battery combination will be found on the box the trainer came in when it's a combined glow/electric model or electric model in its own right. A good model shop with knowledgeable staff will put you on the correct track for your purchase.

An OS 46 AX is good choice of glow motor for around $150.00.

With motors you get what you pay for, and generally speaking cheap motors can be less reliable and have a shorter life. An unreliable motor could cost you a model.

The OS 46 AX is a powerful motor and can take you from trainer to aerobatic model using the same motor, so remember this when you go to purchase your motor. The model shop may recommend a motor, which is cheaper and less powerful on the basis that it is all that is required to fly a trainer.

This is somewhat true but then you have to purchase another motor when you go to the next level, and the theory that you don't need all that power does not wash as the motors have a throttle that controls the power just like your car.

The radio equipment should be in the mid price range - that is, 6 Channels with re-chargeable batteries (Ni MH) both in the Transmitter and Receiver. The recommended batteries are the ones contained in a block (not loose batteries that clip into a battery carrier for the airborne supply).

Loose cells may vibrate and become disconnected from the terminal clips that hold them in place and you then lose power to the receiver and lose the model.

A Computer Type System on the Mode you have chosen is the system to look for if the budget allows.

As with other hobbies, as you progress, you will be looking for added features. You may wish to expand the controls like Flaps and Landing Gear to that new model after the trainer.

It is a good idea to ask your questions before buying anything.

This will allow you to buy wisely, in terms of price, quality and warranty backup.

It will save you a lot of money and hassle, as well as minimising your training time.

Ask other members for their advice and what they think of your choice. You can do this while you are sitting down having a drink and a burger at the BBQ. This is another good reason why you should join a club, we all have the same interests and the knowledge available to be shared is endless.

With a little knowledge of what you want to purchase before going shopping you are less likely to get fobbed off by sales staff that just want your money and a quick sale.

We can guide you to some of the better model shops around that give good pricing and service and with some offering possible club discounts, this can be very cost effective.
.

Don't forget some shop owners have no idea about actually flying model aircraft and have never been involved in the hobby, so have a chat to us. . If you get stuck we will even give you instruction on ways to put your model together.

To start with the model as we have mentioned previously should be a trainer and at the time of writing this booklet a model called a Boomerang is available in both the 40 and 60 motor sizes at a very reasonable price.

The radio system should be in the mid price range and should be either in the 36 MHz or 2.4 GHz bands. No low price park flyer systems or systems that are not supported with a conformity "C tick" that conforms to Federal, MAAA and Local Club requirements please!

The onboard battery pack should be in the form of a rechargeable block and not loose cells. If the system is on the 2.4GHz band then a 5-cell battery pack i.e. (6 volt) should be used.
The motor choice should be made either the conventional glow motor or electric motor your choice will determine the model they are to be installed in.
A very nice motor that will give many years of service if looked after and will take you from trainer to aerobatic model as previously mentioned is the OS 46AX made by one of the leading motor designers of Japan.

A spare Glow Plug as recommended by the motors manufacturer. These plugs are a consumable product and just don't last forever.

Fuel to run the motor in the form of Glow Fuel should be of the Methanol Synthetic Oil blend with 10% Nitro Methane, We do mix our own fuel from time to time at a very competitive price and can be purchased from the club.

The fuel is blended with the best Methanol and Morgan Cool Power Synthetic Oil and 10% Nitro Methane; Bi annual mixing is carried out under the supervision of two of our most experienced members that have connection in the aircraft and chemical industries.

These members decant the fuel to your requirements into you own supplied containers, which should be of a black sturdy plastic and airtight.

The ideal Glow Stick for starting the motor is a self-contained rechargeable cell instead of a cell and a flying lead or a flying lead from a power panel on the flight box. The Glow Stick can be placed in an empty pocket (for safety reasons one that doesn't have keys and loose change in). You don't want to short the Glow Stick out in your pocket; it could weld the keys or coins together and cause severe burning.

The model shop may have told you or implied that you need to have a Power Panel and a 12-volt battery to run the Glow Driver, Electric Pump and an Electric Starter. No you don't. However they are convenient and a Power Panel built into a flight box if you choose an electric starter can be a good thing.

Using a power panel as a supply for the Glow Driver is not a very good idea.
A better option is the Glow Stick; there are no flapping leads that may get snagged in the prop when starting. No heavy flight box to carry out and back from the flight line with a large battery and starter just in case the motor stops

A Glow Stick fully charged will last you many flights and if you always recharge it before the next time out making sure it is fully charged, you will always have a reliable and portable means of starting your engine.

Consider a Flight Box

A nice flight box to put all your bits in to show you mean business when you come to the field.

There are inexpensive commercially built flight boxes available from your hobby shop or there is any number of suitable toolboxes available from the local hardware store, or you may choose to make your own. Have a look at what some of the other members have.

A flight Box is basically just an equipment tidy box, somewhere to put all your tools and bits and pieces and a convenient way of transporting your gear to and from. A portable folding work stand to go with the flight box is also a good inexpensive option available from the local hardware.

Some handy tools and equipment

A selection of small jeweller type flat blade screwdrivers used for adjusting the motor fuel jets.

A plug and prop spanner (not adjustable spanners).

A selection of Philips and flat blade screwdrivers to suit the screws on the model.

A selection of Allen keys that will fit the motor and other socket headed screws.

Some nice cleaning cloths for whipping the model down at the end of a days flying.

Window cleaning sprays are ideal for cleaning the model down.

Hand cranked fuel pumps are ok for the normal sports model for both, fuelling and de fuelling the model.

A piece of 20 mm diameter dowel around 200 mm long (broom stick end ideal) for using as a chicken stick for starting the motor.

A strap or some other means of restraining your aircraft when starting or tuning the engine
is a safety requirement.

Although some radio equipment comes with battery charges included make sure you are charging them correctly, this goes for when you have to replace a 4 cell battery pack(4.8 v) for a five cell battery pack (6.0 v).

Multi function battery charges are available at a reasonable cost that will do a number of different battery styles including your Glow Stick driver, receiver packs, and transmitter pack and 12 volt lead acid batteries. Make sure you purchase a charger that has a balancing circuit adaptor for charging the lithium style batteries.
The balancing charger will be essential if you go down the electric powered model path.
If the wings are held in place by the use of rubber bands make sure you change them regularly as the fuel and sunlight rots them. A large bag of rubber bands that are suitable for your model may be purchased from the Office Stationary supplies.

You are not alone when you become a member.
SO COME ON DOWN
HAVE FUN AND DREAM OF THAT NEXT MODEL!!!!!!!

Some Do's & Don'ts

Don't try and do it alone in the back paddock, you have a better chance at winning "Lotto" than you have of teaching yourself how to fly an aircraft or helicopter. You will probably crash your model and jeopardize everyone around you. Should you succeed, you will probably not know the correct way of doing things. And learned many bad habits and more importantly you will most likely not know the regulations covering model aircraft which will mean you are flying illegally and not be covered by any insurance

Don't fly at any site on your own – do take a friend. You will note I have not called these aircraft "Toy Planes". They are miniature aircraft and operate with powerful motors that at the first chance will bite, giving you the first look at how the inside of your hand works. They can inflict dreadful injuries. Today's electrically powered models are also very powerful and can start without warning, so please, respect that spinning thingamajig at the front.

Don't adjust the motor setting from the front leaning over the arc of the prop. Always adjust from the rear and if possible have a helper or have it tethered pointing away from other models or observers.

Don't fly without being a member of a club and do have up-to-date insurance.

Don't forget that compensation costs more than being a member of a club.

"IT'S JUST NOT WORTH IT"

Do try and keep that receiver antenna away from the battery pack, servos, wiring and metal push rods and wires, especially with the 2.4 GHz systems a minimum of 50mm from the antenna to any metal object and liquids that includes the fuel tank and ballast water tanks in gliders.

Do try and keep your 2.4 GHz receiver cool and don't wrap the receiver up in foam to protect it as these little receivers contain a micro processor much like the one in a computer and do warm up.

Do try and keep your 2.4 GHz receiver antennas in the clear and don't place little bits of fuel tubing over the little antenna wire. This will greatly affect the performance of the equipment.
.N.B. Remember when using the 2.4 GHz system our bodies contains liquids some more than others so don't let yours or someone else's body come between your transmitter antenna and your model. If the antennas can't see each other by direct line of sight they can't talk to each other.

This is not an issue with the 36 MHz systems, which can see around corners through trees, and bushes and peoples bodies 2.4 GHz can't so remember keep your antennas in the clear.

N.B When purchasing your 2.4 GHz radio equipment please insist that you have a 5-cell battery pack (6.0v) for the onboard power supply feeding your receiver and servos.

The 4 cell packs only produce 4.8volts and this voltage can and sometimes does drop below the threshold working voltage of the micro processor inside the receiver when all servos are working together.

Having 5 cells in the flight pack gives you 6 volts and that little more head room of voltage for safety.

Do use hook and eye tape (Velcro) for mounting the 2.4 GHz receivers to the model that gives it some protection from vibration and is easy to remove from the model when required.

Do keep the antennas wire in one piece on the 36 MHz system, don't cut it, bend it back on itself or bunch it up as treatment of this type will affect the range.

Do use plastic clevises on the motor throttle if the throttle arm is a metal type. This can cause interference problems to the 36 MHz equipment.

Do use metal clevises on other control surfaces as some plastic types that are supplied with some of the kits can and do fail.

"THIS IS A SAFETY ISSUE".

Do put pins into the hinges of the control surface by drilling a small hole through and gluing in a toothpick then trimmed off flush.

A dress-making pin can also be used by first cutting the pin to length, so it does not pass all the way through the control surface. Then, make the hole through the plastic hinge with a hot pin held in pliers. This is a safety requirement and MUST BE DONE

Do mount the receiver on / off switch the opposite side to the motor exhaust to stop the residue from the motor getting into the switch.

If the switch is the slide On/Off type try and mount the switch so that it is “On” when the switch is pushed backwards.

Installing the switch inside the model with a push / pull wire that when pushed in switches the receiver “ON” is a better idea. A small crocodile clip put in place between the end of the push wire and the fuselage side. This stops it from getting accidentally pushed in during transit of the model to and from the field.

Do wrap the receiver up with some foam held in place with tape or rubber bands on the 36 MHz band receivers.

These types of receivers are a very sensitive piece of equipment inside the model and rely on a device called a quartz crystal to keep it on frequency. This relies on its own internal vibration to keep the receiver in tune; other vibrations will cause the delicate device to fail.

Do use at least 8 good-sized rubber bands, if this is the method that holds the wings on your model. Use 4 in a diagonal pattern to form a cross in the centre and 2 either side in line with the fuselage.

The wing should not rock on top of the fuselage when fitted correctly

Do change the rubber bands regularly as they do perish with fuel and sunlight.

Do dust your rubber bands with talcum powder and store in an airtight container when not in use.

Do try and place the fuel tank when installing in your model so that the centre between the top and bottom of the tank is 10mm lower than the main needle valve on the motor.

Do use a fuel filter in line on the fuel tube from your fuel container to the fuel tank on the model, the holes in the carburettor are very small and soon get blocked.

If you don’t put dirty fuel in the models fuel tank to start with you shouldn’t require one installed on the model.

Never the less if you should insist on installing one in line to the motor make sure it’s not a finer filter element than the one in the filler tube from the main fuel container.

If there are any smaller particles that got past the first filter then the second one will start to clog up restricting the fuel flow to the motor making it run lean.

This can cause the dreaded dead stick or damage the motor by running lean.

Do put an air cleaner on the intake of the motor as our local sand loves to damage motors.

This can be purchased from the local model shops or you can make your own from a small square of panty hose material held in place with a number 6 “O” ring that are used on your sink water tap obtained from the local hardware shops.

Do ask other members around the field and observe some of the advertising boards around the site for model shops near to your location.

While on the subject of observing, could you clearly see the models that were flying at the field when you visited us to see what it was all about?

Sometimes it’s worth having your eyes checked and also purchase a good pair of Polaroid sunglasses as you will be looking at the bright sky for some time, the Polarizing effect of these glasses reduce the glare and the reflective light off of clouds.

By moving your head from side to side you will notice the enhancing effect of these glasses by making the model clearer in the sky.

The last Do ……..Do have some fun and happy landings.

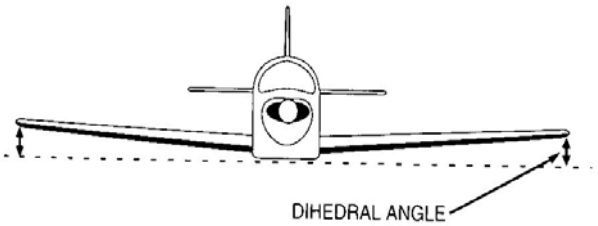
All our Members will be pleased to give their assistance and advice to get you going down the path of this fantastic hobby of flying miniature aircraft.

The one thing that most of us dream about is flying an aeroplane and now is your chance.

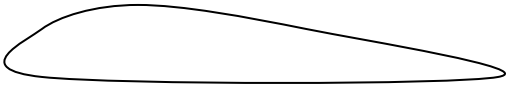
The Principles of flight

We could ask the birds, they have been at it for years but we want to fly a model aircraft so a basic knowledge of how they do would be a good thing. It took man awhile to find out from the birds just how they did it but to put it into practice was another thing entirely.

Ask most people, who made the first flying machine that carried a man, they will answerer straight away the Wright brothers, and unfortunately they will be wrong by about one hundred years. An English man from Yorkshire by the name of Sir George Cayley 1773 to 1857 sometimes called the father of aviation. In the year 1799 he had inscribed on a silver medallion the principles of the angle of attach and on the other side of the medallion was inscribed a drawing of a glider.
Some of his other findings were the four forces required for flight, being, thrust, drag, weight and lift and also the principle of dihedral, the angle between the wing root and the wings tips, which is what gives the aircraft stability in flight.



The most significant finding was that a curved wing at the top and flat surface on the bottom gave more lift than that of a flat wing section.



He made several flying machines (gliders) that carried first a young boy of ten, then a larger machine that carries the boy's father 275 meters on Brompton Dale in the north of England.
These principle still stand today with modern flight and are adapted into the construction and design of our model aircraft, free flight models have to be designed truly well as once in the air have no controls from a pilot on the ground.

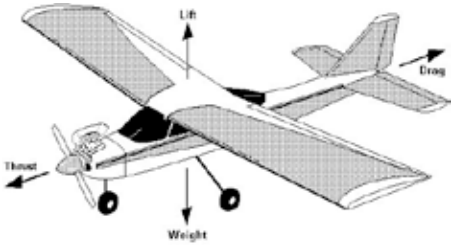
The stability has therefore got to be designed in to the construction so it will fly without any input what so ever from other sources.
The models we fly are assisted by the use of a radio control system that moves the control surfaces in response to the direction and amount of movement from the control sticks called gimbals on the radio transmitter, the receiver in the model passes this

information to the mechanical servos that in turn move the control surfaces.

This steers the model around the sky, but how does it do it?

We must first look at how the model actually gets up there and stays up there.
First we look at the four forces of flight, weight, lift, drag and thrust;

Weight, which we refer to as gravity, speaks for its self, the total amount of weight including the construction of the airframe the motor the fuel to run the motor and the radio equipment in our case, to control the aircraft.



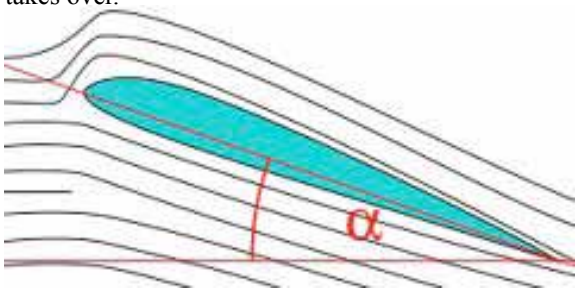
Lift is means to overcome gravity the requirement to counter act the total weight of the aircraft, plus an extra amount to give it the ability to lift the aircraft into the air.

Drag is the resistance to forward movement. Pressure and air friction cause skin resistance acting on the total airframe as it moves through the air together with the total weight will combine to resist the aircraft from moving forward. .

Thrust is the power being applied to the airframe to overcome the drag and weight plus that extra to move the total resistance and weight forward.

Angle of attach is a relationship of the centre line of the wing aerofoil section from the leading edge to the trailing edge, this angle is the amount that this centre line is set higher at the front (leading edge) in relationship to the rear edge (trailing edge) to the oncoming air flow. This angle of attack can range from a few degrees to 15 degrees, which is the critical angle of attack, this causes so much drag and turbulence on the top of the wing that the wing will refuse to fly and not produce lift. This is referred to as stalling the wing and when this happens the aircraft will fall as there is no lift and weight (gravity) takes over.

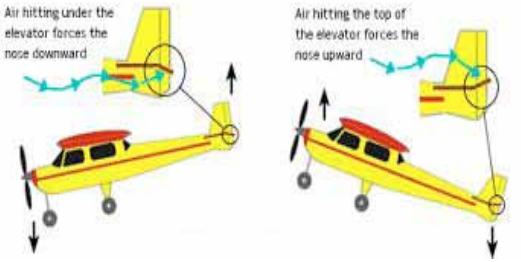
Airflow



α = the degre of the angle of attack

The aircraft designer will have calculated the amount of degrees angle of attack required to give sufficient lift and the amount of thrust to overcome the weight and the drag to move the aircraft forward and push the wings into the oncoming air flow for the wing to create enough lift at the angle of attack of the wing at the designed speed. These entire factors have to be taken into consideration at the point of design.

If the aircraft is flying too slowly and then put into a steep climb, the wing may get to the critical angle of attack to the oncoming air and stall the wing and the aircraft will fall until the designed forward speed is again reached creating sustain lift.



This angle of attack is adjusted by the tail plane and elevator attached to the tail plane at the rear of the aircraft, the elevator when angled down in relationship to the tail plane produces lift on the tail plane. You may have seen the large aircraft deploy flaps on the main wing to increase lift at a slower speed when landing or taking off, this then is the same principles acting on the tail plane. As the elevator is angled down it gives more lift to the tail plane which in turn lifts the rear of the fuselage, this then reduces the angle of attack of the main wing to the oncoming air.

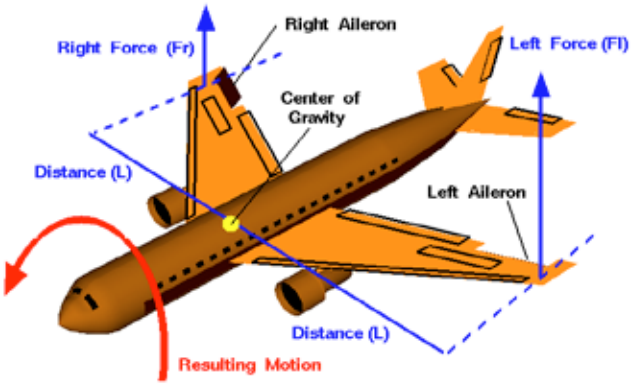
The reduction of the attack angle reduces the lift of the main wing and consequently weight (gravity) starts to take over and the nose of the aircraft will drop, this then tends to increase the forward speed in an attempt to gain back some of the lift lost. The aircraft now starts to descend in a controlled manner by adjusting the angle of attack by the elevator.
We can now make the aircraft climb and descend by the use of the elevator by increasing and decreasing the lift of the tail plane.

Ok we can now make it go up and down what about turning left and right?

The same principles again apply, by adjusting the lift properties of the main wing, by the use of the ailerons that are attached to the trailing edge of the main wing.
The use of the ailerons in the same way as the tail plane elevator combination will raise or lower the main wing around a centre line that runs down the full length of the fuselage called the datum line.

When both wings have the same amount of lift the wings will be balance in the horizontal plane, now by lifting up the right aileron the lift on the right wing will be reduced and at the same time the left wing aileron goes down giving more lift.

The wings are now out of balance with more lift under the left and less on the right the wing they will try and rotate around the datum line and will continue to do so while the wings remain out of balance. The control of this action then must be controlled to allow the aircraft to bank to a given angle and stay there by controlling the amount of aileron movement. This is achieved by centring or bringing the ailerons back to neutral when the desired bank angle is achieved.



Never the less the aircraft is banked to one side but not turning and will continue that course, the application of a small amount of up elevator will cause the tail plane to lose lift and the nose of the aircraft will lift in the direction of the bank and the aircraft will turn to the right.
Adjusting the amount of aileron and elevator the aircraft can be made to turn in a controlled manner.
We have now got the aircraft to go up and down and turn by using the two primary control surfaces of elevator and aileron, what about that rudder thing also at the back? The vertical stabilizer and rudder combination makes the rear of the aircraft move about a point called the centre of gravity, which is around the point of maximum lift under the main wing. This action is referred to as yawing and takes on the appearance of a duck walking when viewed from the rear.

What then does this thing do? We can make the aircraft go up, down left and right so what more do we want? You will find that when banking and turning the aircraft an amount of lift will be lost in the turn, this then causes the nose of the aircraft to drop and if not controlled will put the aircraft into a spin.

In a full size aircraft an instrument called a turn a slip indictor somewhat like a spirit level with a bubble in a glass envelope shows the direction the aircraft is slipping. A term stand on the bubble is in reference to the rudder pedal, which will introduce an amount of rudder in the opposite direction, which will lift the nose of the aircraft, the same principle as the elevator.

All these actions operate around a central point called the Centre of Gravity or C of G, which you will hear, mentioned when checking aircrafts integrity to be allowed to fly. This point is normally located at or around the main spar of the wing; around 25 to 30% of the width of the wing (also referred to as the cord where it attaches to the fuselage measured from the leading edge. This is referred to as the Root Cord of the wing; the end of the wing at the tip is called the Tip Cord of the wing.

The datum line running down the centre of the fuselage and the Centre of Gravity form this balancing point were the aircraft will axis around in all directions.

So there you have the basics that the birds use, just look at the shape of a bird how it as a large chest area to hold those wings near the front of its body and a lightweight tail section set all the way down the back just like an aircraft, they must have copied our design sometime ago and found it works and works well.

Check out the following web sites for that little more information:

W.A.Model Aircraft Sports Centre (Inc) ……W.A.M.A.S.C (Inc)…….. http://www.wamasc.org.au/

Aero modellers W.A. (Inc)…….. http://www.aeromodellerswa.info/index.html

Model Aeronautical Association of Australia .M.A.A.A. http://www.maaa.asn.au/

Perth Weather …… http://www.bom.gov.au/wa/observations/perth.shtml.

Another book is available in this" Getting" series – "Getting tips and ideas for getting the most from your Radio Controlled Model Aircraft".

Getting the most from your Radio Controlled Model Aircraft.
By Malc Nicklin

Thanks to Bill Davies for his help and suggestions.

Thanks to Paul White for his help and suggestions and encouragement.

Thanks to Bob Chitty for the layout of the booklet.

April 18 2011

MAAA FLIGHT PROFICIENCY SCHEME

FLIGHT REQUIREMENTS & TEST CHECK SHEET

FIXED WING POWERED – BRONZE WINGS

This Test is to be assessed by an MAAA Fixed Wing (Power) Instructor.

The requirements specified have been determined by the MAAA and are not to be varied.

Bronze Wings (Power) are awarded when a member demonstrates, in the course of one session, that he/she has the skills to perform the manoeuvres listed in the tasks below, in a competent manner and to the required standard.

This is to certify that ……..…… AUS ……..

of …… …… P/Code ……..

Club …… **Note address on back of form if wings to be sent to Club**

has demonstrated the degree of proficiency in radio controlled flying of model aircraft to be awarded the MAAA Bronze Wings (Power).

……	……	……	……
Signature	MAAA Instructor's Name (BLOCK LETTERS)	AUS No.	Date

At the successful completion of the test this form shall be completed by the Instructor and sent to the **State Association**. **Note: Wings will be sent to Pilot unless Club address in noted on back of this sheet.**

1. **DEXTERITY** ☐
   The pilot must be able to locate all the transmitter controls quickly without fumbling.

2. **THEORY** ☐
   The pilot must be able to name all major components of the aircraft and define functions, including effect of controls, and have a thorough knowledge of safety rules and regulations.

3. **AIRFRAME & PRE-FLIGHT CHECK** ☐
   The pilot checks the engine mounting, plumbing, centre of gravity location, security of under-carriage and signs of structural or covering problems that could affect flight eg. presence of warps which could affect trim. The pilot also checks that controls are neutral and control throws correct, and checks throttle setting, state of battery and performs a range check.

4. **TAKE OFF** ☐
   The pilot demonstrates gradual application of power while keeping the aircraft straight, and using a little elevator to lift off, makes a gentle climb out with wings level until safe altitude is reached.

5. **TRIMMING** ☐
   Pilot shows ability to trim the aircraft in flight. Displacement and re-trimming both the primary roll control and elevator should be demonstrated.

6. **PROCEDURE TURNS** – One in each direction ☐
   The pilot's ability to perform the following steps in the procedure turn will be assessed.
   a. Level flight segments should be straight and level.
   b. Aircraft should pass directly over the landing area.
   c. Turns should be at a constant altitude.
   d. Turns should be completed in order that upwind and downwind tracks are superimposed.

7. **LANDING CIRCUITS** ☐
   Pilot to demonstrate in both directions, as shown in the diagram in the MAAA Pilot Log Book, with all turns of 90 degrees. With high performance aircraft, the power needs to be reduced much sooner than at the turn onto base leg. The upwind and downwind legs are parallel to the landing strip. The first three legs are maintained at a constant height and a gradual approach angle is started at the beginning of the base leg.

8. **APPROACH & LANDING** ☐
   Pilot demonstrates an engine assisted landing, using a suitable power setting that allows the model to descend, controlling nose attitude with elevators (airspeed), and using the throttle to stabilise the rate of descent. The aircraft should be flown over the threshold at an altitude of about 1.5 metres, the throttle closed gradually, and the round-out or flare initiated. The "hold-off" period is then commenced where the aircraft is gradually allowed to sink and settle on the ground in a slightly nose high attitude.

9. **SIMULATED DEAD STICK LANDING** ☐
   At a safe and high position, the pilot will reduce the throttle to idle and perform a descending circuit to show his/her ability to safely glide the model without engine power to a position where a landing approach can be executed.