UP and AWAY

The BMFA Approved Flying Training Manual for R/C Power Flying

by John Long FSMAE

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Learning to fly Radio Controlled Model Aircraft
(A handbook for both beginner and instructor)

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TO THE READER

This handbook has been written for both the instructor and the embryo pilot. By studying the book the instructor will understand the path the student will follow from his first flying lesson and be able to base all his training on the lessons in the book.

The pilot learning to fly can refer to the lesson both before and after the flight and extract the maximum benefit from his time in the air. Not only will he know what is coming but he can go back to the book when the lesson is over and refresh on any points which he may have missed or not fully understood.

In addition, should the student change instructors the new instructor, teaching from this book, will know the point in his training which the student has reached and can carry on exactly where the previous instructor left off.

Good luck to you both!

BRITISH MODEL FLYING ASSOCIATION

The British Model Flying Association which, as the S.M.A.E., was established over eighty years ago is the national body for model flying and is recognised as such by the Civil Aviation Authority, the Sports Council and many other national and international organisations.

Much of the BMFA's time and effort is taken up in liasing with government bodies, local authorities and other organisations in order to safeguard your interests as model flyers. In spite of this, it also finds time to promote and control many other facets of model flying.

The BMFA Chief Executive and our other full and part time staff are based in our permanent office in Leicester and they are there to further the running of the Association.

They can answer most of your queries and can put you in touch with BMFA officers when necessary. Both staff and voluntary officers are always pleased to hear from members and to help where they can.

BRITISH MODEL FLYING ASSOCIATION

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INTRODUCTION

So, you want to fly radio controlled model aircraft? Are you sure?

Think about it for a moment... it is going to be time-consuming, frustrating at times.... and it may be expensive.

On the other side of the coin, it is a most rewarding sport giving tremendous satisfaction and great companionship. Think about it again and if you are still convinced that it is for you --- read on!

This handbook is designed to be your guide and mentor from now (before you invest your hard-earned cash in a model and equipment) until the time when you are a proficient pilot at a 'safe solo' standard. Read it with care: make sure that you understand every paragraph and re-read the appropriate sections again and again whilst you are learning to fly. The time you spend in the air is comparatively brief, so it must be reinforced by reading and re-living every moment of your air time to analyse what you did and appreciate how to do it better next time.

In this book you will find no sections on building aircraft or installing control systems, no complex aerodynamics, no treatise on engine technicalities... there are enough books on these subjects already and expert personal tuition is available at your local model club. What you will find though, are easily understood sections which will take you step-by-step through the process of learning to fly.

But you will need some help and the ear of someone knowledgeable with whom to discuss your problems. The first step you have already taken --- by beginning to read this book. Your next step must be to join your local model flying club ---- your model shop will tell you whom to contact or you can write, check out the website or e-mail the British Model Flying Association (BMFA) who will give you contact details for nearby clubs. Then get up to the flying field and introduce yourself to the members and tell them that you are interested and want to learn to fly. You will find them enthusiastic and will quickly find someone to talk to you and discuss your interests and problems. Tell him all your hopes and fears and --- above all ---**LISTEN**.

No one yet learned how to fly by reading a book and this one can only point you in the right direction and help you to make the most of your instruction so that you learn quickly and easily, getting everything you can out of every lesson.

NOW READ ON.....

CHAPTER 1
YOUR QUESTIONS ANSWERED

WHAT DO I NEED TO START?

Obviously a model aircraft --- and we'll discuss the best one for you a little later on. As well as the airframe, which you can either build or buy, you will need accessories like fuel tank, wheels, propeller, glues and finishing materials which often don't come with the model kit. You will also need a suitable engine and the right radio control equipment.

In addition you must have support equipment -- fuel, starter battery, leads, tools and spares.

Undoubtedly the best way to decide what equipment you need is to look over that used by club members and discuss your needs with them, but we'll guide you towards what is necessary in a subsequent chapter.

HOW MUCH DOES IT COST?

The costs in starting up vary so much that it is impossible to give you an accurate answer to this one but it will probably be several hundred pounds. Your local model shop will be able to give you a clear idea of prices of various items and your local model club can tell you if any good second-hand items are available. You will find that the costs will compare very favourably with those you will incur making a start in any other sport.

HOW LONG WILL IT TAKE TO LEARN TO FLY?

Can't give you a straight answer to this one. It depends upon too many variables. You can learn up to the solo stage in a month or so if you fly frequently. On the other hand, if you only fly at week-ends or occasionally, it can take quite a long time since at each lesson you are really only re-learning the last lesson and not making progress. As an average, given reasonable weather conditions and reasonably frequent flying sessions, let's say six weeks to first solo and perhaps three months to your 'A' Certificate. seems a long time? How long did it take to learn to drive a car? And model flying is much more complicated.

HOW DO I FIND AN INSTRUCTOR?

That's easy! Once you have joined your local model club and made contact with the members, simply ask who teaches newcomers and you will be pointed in the right direction.

It will be likely that several club flyers are BMFA Approved instructors so you will be able to choose the one whom you feel to the most sympathetic. Normally, if you ask an instructor to teach you he will accept immediately unless he is already too heavily committed with others learning to fly.

HOW MUCH WILL IT COST TO LEARN?

Nothing - absolutely nothing! He will teach you for the sheer pleasure of initiating a newcomer into our fascinating sport. But do remember that he wants to fly too, so don't expect him to spend all day with you. On average you can expect to fly three or four times in a flying session. You'll probably find that this is about all the instruction you can absorb in one day!!

WHAT DO I DO BETWEEN FLIGHTS?

You watch others flying. You watch hard and store away the information you acquire. Ask your instructor if you can 'hang on' when others are being taught and try to learn from their flying. Watch other aircraft in the air and imagine that you are doing the flying. Follow the control movements and try to predict the next move. Study aircraft flying at a distance and make sure you know which way they may be turning - and what the appropriate control movement will be to straighten up the turn. Talk to other flyers and **LEARN** all the time. You will undoubtedly find conflicting views - discuss them with your instructor.

REMEMBER

Flying is Fun. If you are not enjoying it, then something is wrong.

It might be YOU, it might be your aircraft, it might even be your instructor.... or any number of things. Discuss it with your instructor and sort out where things are wrong.

CHAPTER 2
THE FIRST STAGE - GETTING STARTED

Are you sitting comfortably? Good, now let's look in detail at all the equipment you will need to get flying.

THE 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. The ideal trainer is a high wing aircraft of around 56 to 60 inches 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 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 should be held on by rubber bands to enhance its crash-proof qualities. The model may be designed for 3 functions (throttle, elevator and rudder) or may have ailerons in addition. You can learn equally well whichever type is selected. Finally, and importantly, it should be inexpensive!

To some extent, your choice depends on whether you wish to build it yourself, complete an 'Almost Ready to Fly' (ARTF) part-built aircraft or simply buy an aircraft already completed. 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 and there is usually a very good range of reasonably priced ARTF trainers available in 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 of the senior club members.

THE ENGINE

Whatever aircraft you buy, make sure that your intended engine will provide adequate power to fly it. There is nothing more disappointing than to present yourself at the flying field with an aircraft upon which you have lavished hours of loving care only to find that it won't get off the ground at full power. 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 commercial training aircraft a range of engine sizes is recommended and it will pay to go for the largest engine size recommended for your aircraft. There is a bonus in choosing a largish engine in that it will be suitable to power more advanced aircraft when the time comes.

Most club flying fields have noise limitations with which your model will have to comply. Take advice from club members and make sure that the silencing arrangements on your model are adequate. Some manufacturers silencers are very good but some are not and you may need to do extra work to meet the club noise levels.

PROPELLER

You will also need a suitable propeller (and some spares). Generally the size you will need will be a 10 x 6 or 11 x 6 for most engines in the range from .30 up to .40 in^3. and the propeller should be of glass-filled nylon for strength and safety. However, noise considerations will almost certainly play a part in your eventual choice as prop noise is a significant part of the overall noise your model makes and you may have to use a slightly different diameter and pitch to meet the required club noise levels. Again, take advice from club members before you commit yourself to buying your stock of propellers.

By the way, when referring to propeller sizes the '10' refers to the diameter of the propeller in inches and '6' is the pitch, or distance it theoretically moves forward in one revolution. When you buy your propellers, clean off the 'flash' on the edges with fine sandpaper and get the propeller balanced - a club member will do this for you. Balancing is essential and you should never fly with an unbalanced propeller.

FUEL

You can sometimes buy your fuel through the club but more often your model shop will meet your requirements. The fuel you need is either 'straight' or '5%'. 'Straight' denotes a mixture of 80% methanol and 20% oil and '5%' denotes that 5% of nitromethane has been added for higher performance and easier starting. The oil content can be either castor oil, a synthetic blend or a mixture of both. Refer to your engine's instruction leaflet for guidance on which to choose and if you don't have it then ask an experienced club member for advice. Under normal circumstances 'straight' fuel is what you will need at present... and it is cheaper than 5%.

RADIO

Now we come to the single most expensive part of your equipment so you need to get it right. The whole success of your operation depends on your radio gear and the range of radio equipment is formidable. Each model shop will fiercely defend the quality and performance of the brand it sells - and rightly so. However, you must have some guidance so we'll try to steer you through the jungle.

First of all, which brand do you buy? Your local club members are usually a reliable guide. Look around in your club and see what the more experienced members use. From a quality point of view there is little to choose between all the sets that are available. Modern R/C equipment is reliable and good value whichever make you choose although in terms of facilities offered by a set you do tend to get what you pay for. By this we mean that the more expensive sets offer increased channels, mixing facilities, computer control etc.

The question then becomes what facilities do you need? Whilst it is quite possible to learn to fly with fewer channels, we would unhesitatingly recommend that, as a minimum, you buy a basic PPM set with a minimum of 5 or 6 channels (to control at least elevator, throttle, rudder and aileron). 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 or 6 channel set will give you more options in the future. You do not really need the complications of a computer controlled (PCM) set to start with and many flyers never buy such equipment. However, costs are coming down and PCM is becoming an option even as a beginners set. Do not buy a cheap 2 or 3 channel set – you will be placing unnecessary restrictions on yourself from the start.

There is a frequency band available solely for model aircraft use at 35 MegaHertz (written 'MHz') and this is the normal band used by model flyers. There are 35 frequencies available, channel numbers 55 through to 90. We would very strongly recommend that your radio be in this band and, in fact, nearly all model flying sets sold are on 35 MHz.

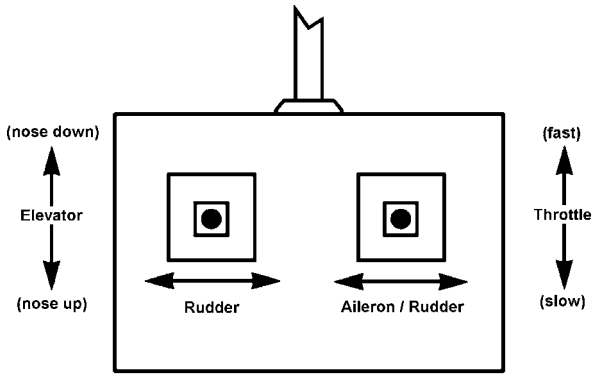
There are other allocated modelling frequency bands of which the 27 MHz band is the best known. Unfortunately it is open to use by CB radio enthusiasts as well as other modellers with cars, boats etc. so you are more likely to experience interference on this band. The 40 MHz band is for the exclusive use of surface modellers and must not, under any circumstances, be used for flying. Beware of 40 MHz transmitters that look like model flying equipment. There are many about and you may be sold one but they are **ILLEGAL** for model flying. There is also a model

aircraft band available in the UHF range, but there are very few sets available and since it is very unlikely to be your first choice, we will not refer to this band in detail.

You may also be offered the choice between a set equipped with rechargeable batteries, either nickel-cadmium (ni-cad) or Nickel Metal Hydride (ni-mh), or ordinary dry cell torch batteries – **always** choose the rechargeable set. Although slightly more expensive initially you will save in the long run since ni-cads and ni-mh batteries can be recharged almost indefinitely whereas dry cell torch batteries have a short and somewhat uncertain life.

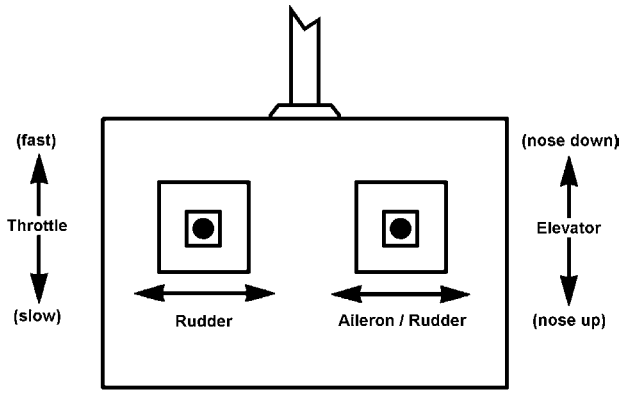
Whatever set you buy, it is very important to make sure that it is set up in the 'mode' used by the majority of flyers in your club. This simply means that the functions controlled by each 'stick' are standardised .

In **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 throttle alone when 3 functions are used). The set-up will look like this:



Mode 1 (Throttle Right)

In **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). The set-up will look like this:



Mode 2 (Throttle Left)

It may surprise you but in any club you care to look at, the flyers are either nearly all mode 1 or nearly all mode 2 with very few clubs having a mixture of the two. Most of them will be very defensive about the mode they fly too.

Whatever the champions of mode 1 or 2 say to you the truth is that there is no 'best mode' and you can learn successfully with either.

The critical thing is that you will need help to learn to fly and it is very useful indeed if the majority of pilots in your new club can fly your model. This is why you should check what mode is mainly used by the club and buy equipment set up on the same mode.

The most used mode at club level is mode 2 (by a factor of about two to one) so we will concentrate on that mode. If your club flies mode 1 then you and your instructor should make the appropriate allowances when reading through the latter chapters.

The important thing when buying a mode 2 set is to ensure that the stick with the ratchet on it (the throttle) is ALWAYS on the left and moves back and forth. You can make the other controls perform any of the other functions by simply swapping round the plugs on the receiver.

The actual operating frequency of your set is determined by the crystals fitted. There are two crystals in your gear - one in the transmitter and one in the receiver and sets are normally sold with crystals fitted and ready to go. If you have not yet bought your radio, discuss with your proposed instructor or other club members which frequency is the best one for you to start on (you don't want to choose a frequency that already has five or six pilots queuing up to fly). You will find that your supplier will usually be willing to deliver your set with crystals of your choice. Again, note that 35 MHz crystals are referred to by channel number between 55 and 90. You can always change frequency (within your operating band) by buying a new pair of crystals.

You **MUST ALWAYS** obey the code of conduct laid down by your club on the control of frequencies, whether it is a pennant on your transmitter aerial, a frequency disc or, most usually, a peg system. **NEVER, NEVER SWITCH ON** your transmitter unless you have the clearance your club requires.

You should talk to club members about this and make sure that you have a full and complete understanding of how the system works and what actions you should take to operate it. This is extremely important as if you make a mistake it won't be your model that will be lost but that of one of your fellow club members with all the implications that might entail.

We cannot stress enough the importance of frequency discipline on the flying field. Careless actions can result in very serious problems for you and your fellow flyers.

SUPPORT EQUIPMENT

This term covers the essential equipment you need to get your aircraft into the air on the flying field. The basics that you will need will include:

(a) Fuel bottle - We have already mentioned fuel - now you need a means to get it from the container into the aircraft's tank. A squeezy bottle will do, with a length of suitable tubing.

(b) A 2-volt rechargeable battery to provide power to operate the engine glow-plug, together with a suitable charger and a glow-plug lead and clip.

(c) Tools - small and medium screwdrivers, plain and cross-point, spanners for the propeller nut and the glow-plug, plus any other small items you think you may need (don't use pliers on the prop nut – it's unsafe and unprofessional).

(d) Spare glow-plugs of the right type for your engine (practically all engines of your type use 'Long Reach' plugs).

(e) Spare propellers - again the right size.

(f) A 'Chicken Finger' (a rubber finger protector to avoid cutting your finger when flick-starting your engine).

(g) Clean rags or kitchen towel roll to wipe down the model after flying. A spray bottle of soapy water will help here too.

(h) The appropriate frequency marker (your club will advise you on this).

You will see flyers on the field using other equipment and you will almost certainly eventually acquire a flight box with a small 12 volt battery, a 'flight panel' (to convert the 12 volts to the 2 volts your glow plug needs) and an electric starter. You may even be able to buy these second hand through club contacts and there is no reason you should not, especially if the price is right.

CHAPTER 3

YOUR ENGINE - RUNNING IN AND SETTING UP

Your engine, provided that it is a new one, will require running in just as a new car requires running in. An engine, carefully run in will not only give a long life, but will deliver more power than one which is flown at high power settings without any running in at all. The running in process will also give you the chance to become familiar with starting and handling your engine.

You can fit your engine into your model and can run it in there or you can make a very simple engine stand: a slab of half-inch plywood with a cut-out to accept the engine bearers at one end, a fuel tank and the necessary fuel lines for filling the tank and connecting to the engine. You will also need some means of operating the throttle which will hold the throttle setting in a fixed position when the engine is running.

The best advice on running in is contained in your engine's instruction leaflet and you are very strongly recommended to read it carefully. If the leaflet is not available then use 'straight' fuel for running in and a standard 10 x 6 propeller.

The three basic designs for model engines of the type we will be using are:

(a) Cast iron piston running in a steel cylinder

(b) Ringed aluminium piston running in a steel cylinder

(c) Plain aluminium piston running in a chrome or nickel plated brass or aluminium cylinder (commonly referred to as ABC or AAC engines)

The running in procedures for types (a) and (b) are similar.

With the engine stand securely fastened down (in the model or on a test stand) fill the tank, open the needle valve about 3 turns from the fully closed position, open the throttle about one-third and squirt a few drops of fuel directly into the carburettor intake. Connect your starter battery to the glow plug and - using your chicken finger - flick the propeller over until the engine fires and runs. Adjust the needle valve until the engine is running roughly (with lots of blue smoke coming from the exhaust) then open the throttle fully, keeping the engine running very rich and 'four stroking'. Remove your starter battery. If you don't understand what 'four stroking' is, just ask one of your

fellow club members to demonstrate the difference between two and four stroking. Run the engine like this for 1 minute, then stop it and let it cool down for a few minutes. Repeat this cycle of start, run, stop, cool down six or eight times. Then do the same thing with another 6 or 8 runs of 2 minutes with a cooling-off period between each run.

Now you can re-start the engine and open up to full throttle again. Then slowly screw in the needle valve until the engine just starts two stroking - still quite rich. If the engine can hold this setting without slowing down or over-heating it is ready for flight. If it shows any signs of distress, shut down and repeat the last 6 rich mixture runs and try again. Only when your engine runs happily in the two stroke mode can you fly it with safety and confidence.

For ABC and AAC engines (type (c)) the running in process is much shorter; usually just a couple of tanks of fuel will do most of the job.

Follow the starting procedures as above but when your engine has started, **don't** let it run rich and 'four stroking' with lots of blue smoke. Screw the needle in a little immediately until the engine just breaks into a clean 'two stroke' and let it run there for a couple of minutes. Stop the engine and let it cool down and then repeat, each time letting the engine run cleanly at a steady 'two stroke' but without leaning the mixture out too much. After several runs it will be possible to safely lean the engine out a little without it overheating at which time it will probably be producing enough power to fly your model safely.

Keep the needle set on the rich side for your first few flights whichever type of engine you have. Full running in will take longer than you think but it is normal to finish it off while flying the model. Just make sure that you don't send the model off with the needle screwed in too much and set too lean – it's a guaranteed engine cut just after take off if you do and that's the last thing you want. Discuss this with your instructor if you have any queries, he is the best person to advise you on this and help you set up your engine and he will tell you how to check for a lean setting by holding the nose of the model high for a short time as part of your pre-flight checks.

ALWAYS treat a rotating propeller with great respect - it can cause serious injury to unwary fingers and hands!!

CHAPTER 4
BATTERY CHARGING

Before you take your aircraft to the flying field you must ensure that your transmitter and receiver batteries are fully charged. Naturally these will be rechargeable cells and not torch batteries!

Your radio gear instruction booklet will give you all the information on connecting up your batteries for charging and you should follow this advice meticulously. The day before you intend to use the radio for the first time, give both batteries a full 18 hours on charge. If, as most people, you only fly at the weekend, give your batteries a full overnight charge (10 to 12 hours) before you fly. As a fairly broad 'rule of thumb', every 20 minutes of 'switch-on' time requires 2 hours of charging time to top up the batteries. So if you have, say, four flights in a day you will need to charge for at least 8 hours before your next day's flying.

Even if you do not fly at all, the batteries will still discharge slowly when not in use. The batteries will require 30 minutes charging time for every day out of use. Therefore, if you do not use your radio gear for a week, it will need a minimum of 30 minutes x 7 days = 31/2 hours of charging time to bring them back to full charge provided that they started the week fully charged. If you had

a flying session before the week of non-use, then you should give the equipment a full overnight charge of 10 to 12 hours.

Ni-cads are very tolerant and will easily withstand a 100% overcharge or more, especially if you are trickle (or 'slow') charging them. Don't ever be afraid to give an overnight charge if you have any doubt at all about the state of your batteries.

If, for any reason, you have dry cell torch batteries in your radio gear you should begin each flying session (say a weekend) with fresh batteries. The main danger with using dry cells is that you never know how much power is left in them and a power failure in the air can only lead to disaster. Our earlier advice could bear repeating – buy rechargeable batteries right from the start.

CHAPTER 5
WHAT THE CONTROLS DO

As you already know, on the transmitter the right-hand stick controls the elevator and the ailerons (rudder in 3 channel mode). Moving the stick towards you will raise the nose of the aircraft in level flight: moving it away from you will lower the nose. Moving the stick to the left or right will cause the aircraft to bank in the same direction - and turn - that way.

These controls are spring loaded so that they always return to the neutral position when released.

This particular stick is the equivalent of the control column in a full-size aircraft and is therefore often referred to as 'the stick'.

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.

Side to side movement on this control operates the rudder in the appropriate sense on 4-channel aircraft. 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.

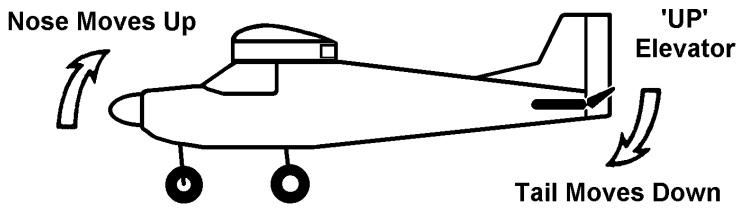
Alongside each of these controls on the transmitter are sliding levers which are the trims for each control. These effectively alter the neutral position of the related control so that by using them when the aircraft is in the air you can cancel out any out-of-balance forces which make the aircraft tend to climb/dive or turn. They work in the same sense as the stick they are associated with. If you pull the elevator trim towards you the nose of the model will rise and vice versa.

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 simply won't be time to look at the transmitter to find out where a particular control is located - and you'll probably be unable to find your aircraft when you look up!

Now, having told you all about the controls on your radio, let us see how these relate to the control surfaces on your aircraft.

Elevator

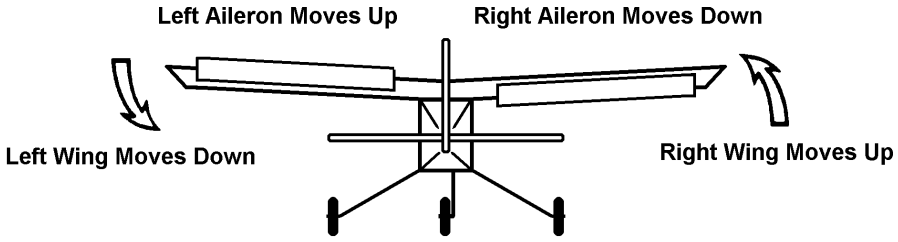
The elevator controls the pitching moment, that is to say it raises and lowers the nose of the aircraft, like this:



'UP' Elevator Given (Stick Back)

Aileron

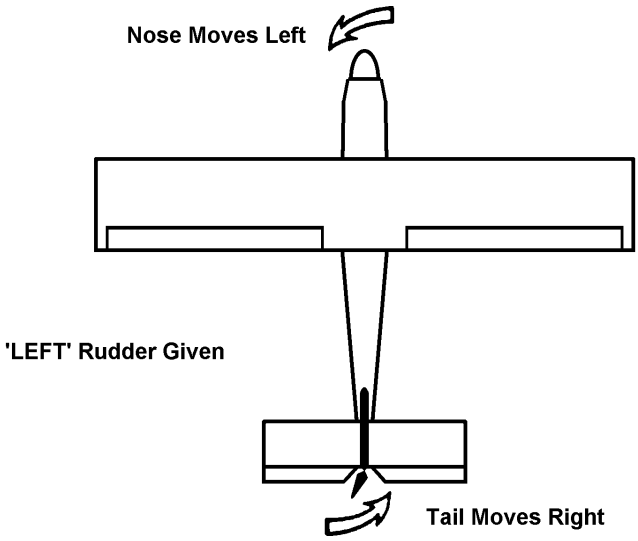
The ailerons give lateral control, banking the wings from side to side, like this:



'LEFT' Aileron Given

Rudder

The rudder moves the nose of the aircraft to the right or the left:



Throttle

The throttle lever controls the power which the engine delivers - fully forward, with the throttle trim also fully forward, gives full power: fully back, with the trim fully forward, gives flight idle (the engine runs at a safe idle speed and will not cut in flight): fully back, with the trim also fully back, will stop the engine running. You will need to set this all up on the ground and you should ask your instructor for help with this.

Let's look at an aircraft in level flight and see how the controls work.

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. An increase in power in level flight will cause the aircraft to climb unless the stick is moved forward to hold the aircraft level, in which case the aircraft will fly faster. Similarly, if power is reduced the aircraft will descend unless the stick is held back, in which case the aircraft will fly more slowly.

If you find that to hold the aircraft level you need a constant pull or push on the stick, you need to use the trim facility. Just move the trim lever in the same direction as the pressure you are using to hold the aircraft level until the aircraft will fly level with the stick in neutral. After trimming you will, of course, still have to make the necessary stick movements to 'fly' the aircraft or hold it level.

Aileron

The aileron control is used to keep the wings level when in level flight. The stick is moved to 'pick up' the wing which is down. You will find that if you can keep the wings level the aircraft will fly in a straight line.

However, if you fly in a straight line for very long the aircraft will soon be out of sight. You must continually make turns and to do so you use the aileron control - whether it is linked to the ailerons in a four channel aircraft or to the rudder in a three channel aircraft. 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 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 bank the aircraft back until the wings are level (relaxing the back pressure on the elevator) and the aircraft is once again in level flight.

If you have a four channel trainer you will have discovered that you do not need to use the rudder at all to turn - it is done entirely by use of the ailerons and the elevator. With three channel aircraft (rudder connected to the 'aileron' control) the control is exactly the same. Stick left and the aircraft will bank and turn left, stick right and the aircraft will turn right.

The reason why these controls are interchangeable is due essentially to the high wing position and the dihedral angle of the wing. Your instructor will explain the 'whys and wherefores' of this to you. But the big advantage of having separate aileron and rudder controls comes when the aircraft is on the ground and it can be steered whilst taxying by use of the rudder which is usually also linked to the nose or tailwheel to give accurate ground manoeuvring. The rudder also has an important function in the air, mainly in aerobatics though.

Throttle

As we have already said, 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, taxying power and, with the trim fully back, 'engine stop' facility. 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 setting for this varies between aircraft, but is normally rather less than half throttle.

CHAPTER 6
YOUR INSTRUCTOR

As we said earlier, each club will probably have several members who are BMFA Approved or Registered instructors and who will willingly teach newcomers to fly, but here we would like to give you one or two words of advice!

Firstly, your instructor's word is law when your aircraft is in the air. If he tells you to do something - do it immediately and without question. By all means discuss it on the ground AFTER the flight if necessary, but obey implicitly in the air.

Secondly, you must not hold your instructor responsible if the aircraft crashes during a test flight or at any other time. No responsible instructor will allow your aircraft to crash if he can possibly avoid it and he will do all he can to prevent the aircraft getting into a situation which could result in an accident. But he is only human and during your training there will be many occasions when you are required to fly near the ground when safety margins are very small (take-off and landing for example) so hard landings and worse are an unavoidable hazard of the sport. Accept these hazards, trust your instructor and have confidence in the robustness of your aircraft.

Thirdly, try to stay with the same instructor throughout your training. Each instructor has his own style and if you switch from one to another you may well get confused and it will certainly take you longer to learn - even though all instructors may be working from this manual.

Some instructors use the 'Buddy Box' system, linking two transmitters together so that the instructor can take over control instantly when necessary. The big advantage of this system is that early flying can be done at a lower altitude safely so that the aircraft can be seen more clearly and mistakes more quickly appreciated. During take-off and landing training, too, the instructor has a greater latitude in taking over when a difficult situation develops. However the system has some disadvantages in that at later stages of training the student can become too dependent on the instructor to take control when things go wrong when really the student should be relying on his own ability to correct errors. In other words, the system can speed up early training but you should beware of becoming too dependant on it as you progress.

In describing what he wants you (or the aircraft) to do, the instructor will say 'left' when he means YOUR left on the transmitter. For example, if he says 'turn left' he will expect you to move the control to the left and consequently the aircraft will turn to its left - although it may not appear so to you at times! 'Up' and 'down' commands require no explanation.

CHAPTER 7
FLIGHT TRAINING AND BRIEFING

FINAL CHECKS

Before you take your aircraft to the flying site there are certain checks which must be carried out.

BALANCE.

Make sure that your aircraft balances at the Centre of Gravity point shown on the plan. 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. At home, switch on the transmitter, then the receiver, and move the sticks to check the controls: stick forward - elevator down: stick left - left aileron comes up, right aileron goes down: rudder left - rudder moves left. If your check is done at the flying field, you must ensure that the frequency control system is complied with **BEFORE** switching on.

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

If you have only 'bench run' your engine, now is the time to test it in the aircraft. 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 correctly.

You are now ready to get to the flying site for your first flying lesson!

FLIGHT PATTERN 1 - THE START & FIRST FLIGHT

Right, now you have the aircraft and the necessary support equipment and are rarin' to go. Your instructor will get the appropriate frequency control sorted out and check your model. 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 bands on each side for banded-on wings)

e. Radio installation, security of all plus and sockets, security of servos, clevises and all hinges.

f. Radio range

g. Correct position of the Centre of Gravity (balance point)

He will then point out any corrections which are necessary. When he is satisfied that everything is in order he will either start the engine himself or ask you to do it. He will ensure that the engine is correctly tuned, slightly on the right side. If a new engine is to be run in on these first flights he will set the mixture very rich to ensure that the engine four-strokes in flight. He will explain to you throughout what he is doing.

With the trims on the transmitter at neutral (throttle trim fully forward) he will check the aircraft's taxying 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 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 at neutral.

The engine will then be re-started and the aircraft put into the air again to check the trimming and, at a safe height (around 200 ft) he will hand the transmitter over to you to have a go.

Hold the transmitter in both hands - your instructor will show you how to use your fingers/thumbs on the sticks. Remember to face the aircraft at all times! At this early stage you will only be using the right-hand stick to fly the aircraft, 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 in 'CONTROLS'..... 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! At low speeds you will require more control movement to effect a response: at higher speeds the controls become very responsive.

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.

Throughout your first flight just try to keep the aircraft on an even keel with the wings level. 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 may use a buddy box to supervise your flying or will stand close by you 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 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 looks! But don’t despair - it will all fall into place quite quickly.

Now, here is your first cardinal rule: **NEVER, BUT NEVER TAKE YOUR EYES OFF THE AIRCRAFT 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.

FLIGHT PATTERN 2 - STRAIGHT AND LEVEL FLIGHT, TURNING

Your second flight pattern 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 introduce you to left and right turns. He will be right with you, as before, 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.

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 ease back gently on the stick 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.

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 were 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 control 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 lead to over controlling.

BRIEFING 1 - PRE-FLIGHT AND POST-FLIGHT CHECKS

Whilst your instructor will have carried out the necessary pre-flight and post-flight checks on your aircraft on its first few flights and explained to you what he was doing, it is now time for you to do these 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 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 is securely mounted and that no screws of bolts have vibrated loose. Check throttle linkage for security. Ensure that the propeller is undamaged and securely bolted on.

e. Obtain your correct frequency peg or clearance, 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 if the radio has been out of use for more than a week or so, or if you have any doubts whatsoever about it (after a crash, for example or 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 retuned if your range is down.

g. Fuel up the aircraft and, after making sure that the model is properly restrained, 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 almost vertically up. 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.

h. With the aircraft held securely on the ground, open up to full power and re-check all flying controls once again.

i. Close down the engine. Switch OFF the receiver, then the transmitter and lower the aerial if you do not intend to fly for a time. Clear your frequency control system. Refuel if necessary.

j. Once the engine has been set for the day, as in (g) 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 a cheap add-on car petrol 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. Your instructor should be able to advise on this one.

With these checks completed your aircraft is ready for its first flight of the day. For subsequent flights you need only perform post-flight checks after every flight. After every flight, your post-flight checks should be:

a. Receiver OFF, transmitter OFF
b. Clear your frequency control system
c. Check propeller, undercarriage and airframe for any damage sustained in flight or on landing
d. Check all fastenings for security (wings firmly attached, engine and silencer secure etc.)
e. Clean down the aircraft
f. Take a deep breath and slow the adrenaline down to a gallop!!!

REMEMBER - NEVER FLY WITH A DAMAGED AIRCRAFT OR A DAMAGED PROPELLER

BRIEFING 2 - TAXYING

After the first few lessons, your instructor will get you to taxy the aircraft to the take-off point from which he will still do the take-off and initial climb.

Taxying is not difficult: just open the throttle slowly until the aircraft begins to move, then reduce power slightly. 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 tailwheel. Control the speed by using the throttle. If you have problems, just close the throttle and let the aircraft come to a halt: then start again.

If you are asked to taxy the aircraft back from where it has landed to where you are standing, ALWAYS bring the aircraft up to you at the end of the taxy 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 take off power than if it had the wind behind it. This is part of safe flying!

A final point to remember - never taxy your aircraft back to the pits. It is very dangerous to attempt to manoeuvre in a crowded area and any radio interference or misjudgement can cause a great deal of damage and possibly injury too.

DON'T DO IT!!

BRIEFING 3 - THE EFFECT OF WIND ON THE AIRCRAFT IN FLIGHT

There is probably more nonsense talked and written on this subject than any other connected with the practical side of flying! In reality, the matter is very simple - it is just that so many people find it hard to accept.

Provided that your flying area is clear of vertical obstructions (houses, trees, hedges, hangers etc.) the wind will blow fairly steadily from a constant direction once the aircraft is above about 50 ft. Below this height, and depending on the surface of your flying site and the proximity of obstructions, there will be some turbulence both vertical and lateral.

Once you understand this principle you will see that a turn from an into wind heading to crosswind will appear to be a fairly sharp turn when seen from the ground and a turn from downwind to crosswind will appear to be slow and elongated. You must accept these visual effects for what they are and remember at all times that if you have not altered your throttle setting and the aircraft is at constant height then your airspeed is constant and the aircraft is in no danger of stalling.

Once the aircraft has climbed out of this turbulent level it is, in effect, flying in a steadily-moving block of air. Thus, with a windspeed of 10 mph the block of air in which your aircraft is flying is moving downwind at a speed of 10 mph. So, your aircraft which flies at a speed of, say 20 mph will appear to be doing only 10 mph when flying into the wind (flying speed less windspeed) and 30 mph when flying downwind (flying speed plus windspeed). In point of fact your aircraft knows nothing about the windspeed at all and is flying at a steady 20 mph all the time!

You will often hear people say that their aircraft tends to climb when turning into wind and dive when turning downwind. What is really happening, of course, is that they are subconsciously trying to compensate for the apparent variation in speed and themselves causing the aircraft to climb and dive.

One major point to remember - don’t try to keep your apparent speed constant or you will find that you will have your aircraft at full throttle when going into wind and stalling when it goes downwind.

If you find all this difficult to visualise, try to imagine yourself piloting a model boat from the bank of a fast-flowing river. In this situation you will find that you can understand the problems outlined above.

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.

FLIGHT PATTERN 3 - CLIMBING AND DESCENDING, TRIMMING

At this point you will have gained confidence in your flying ability and be able to turn the aircraft in either direction in level flight so that you can keep it in clear view at all times. Now that you are proficient in this you will be shown how to make the aircraft climb and descend under full control.

To make the aircraft climb, you have first to increase power. So, from level flight, open the throttle fully and you will find that the aircraft will start to climb automatically. Use the elevator control to maintain a steady angle of climb: not too steep. To return to level flight, simply lower the nose of the aircraft and reduce to cruising power. To descend, just reduce power: the nose will go down automatically and all you have to do is to regulate the descent angle with the elevators. To regain level flight, increase to cruising power and raise the nose of the aircraft.

Turns whilst climbing or descending are quite straightforward, but remember to keep the nose up in a climbing turn and down in a descending turn so that the airspeed remains constant.

One other point which is not always understood: it is the POWER setting which makes the aircraft climb and descend - not the elevators. They control the SPEED of the aircraft only. Try it for yourself – close the throttle leaving the stick where it is and you will find the aircraft will try to maintain its speed by losing height: open up to full power and the aircraft, again, will try to keep its speed constant by climbing. If you try to climb and descend just by using the elevator control you will stall the aircraft in the climb and build up a high speed in the descent.

Now - trimming. The aircraft should be trimmed out to fly straight and level at cruising power. If it tries to climb with the power setting you have selected, move the elevator trim forward a notch or two until the aircraft stays level ‘hands off’ the transmitter. Vice versa if it tends to lose height. If it tends to bank/turn in either direction, correct this by using the rudder/aileron trim. When you have the aircraft trimmed out properly it is more pleasant to fly and its stability improved. Once again - any problems you have should be put to your instructor.

As before, this lesson will be repeated until you can control the aircraft effectively in both climbing and descending at various power settings and in transitions to level flight. Your instructor will also get you to practise trimming the aircraft correctly by handing the aircraft over to you with it out-of-trim so that you can sort it out yourself!

FLIGHT PATTERN 4 - STALLING

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 fall off.

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 elevators 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 nose drop sharply despite the application of full 'up' elevator. One wing may also go down. This is the stall.

Recovery is straightforward. Open the throttle, release the back pressure on the stick and allow the nose to go down and the aircraft to 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:

a. 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.

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

c. 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 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.

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 TO LEVEL FLIGHT.

BRIEFING 4 - ORIENTATION

One thing you will have discovered 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.

Let's give you an illustration:

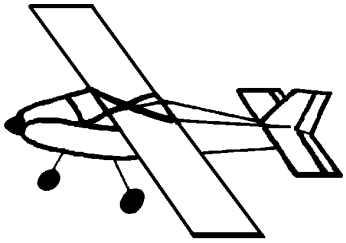


Fig. 1 Model Turning Left

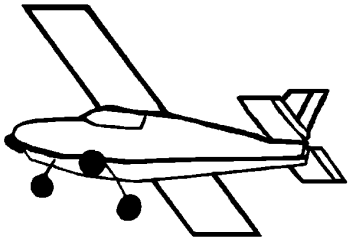


Fig. 2 Model Turning Right

Both Look the Same at a Distance

You can see that if your model was turning to the left (fig 1) and it got into a right-hand turn (fig 2) without you noticing it, you wouldn't realise it and think that the model was still turning to the left. You try to straighten up and, lo and behold, the aircraft steepens its turn and, before you know it, it is in a spiral dive to the right, and panic is about to set in!

The way to avoid this is to keep your eyes on the model at all times and to keep the model within an easy visual distance. 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.

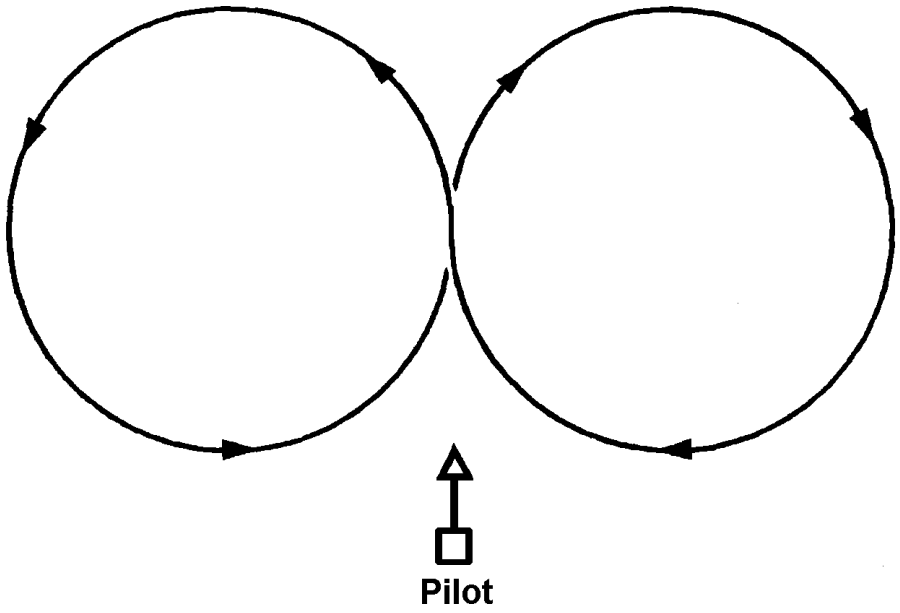
FLIGHT PATTERN 5 - TAKE OFF, CLIMB AND MANOEUVRE

You are now 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!

Begin by taxying the aircraft to the take-off point and stop with it pointing directly into wind. Ensure that all trims are in their correct (neutral) positions - throttle trim fully forward. Check that your take-off path is clear and that no-one is coming in to land.

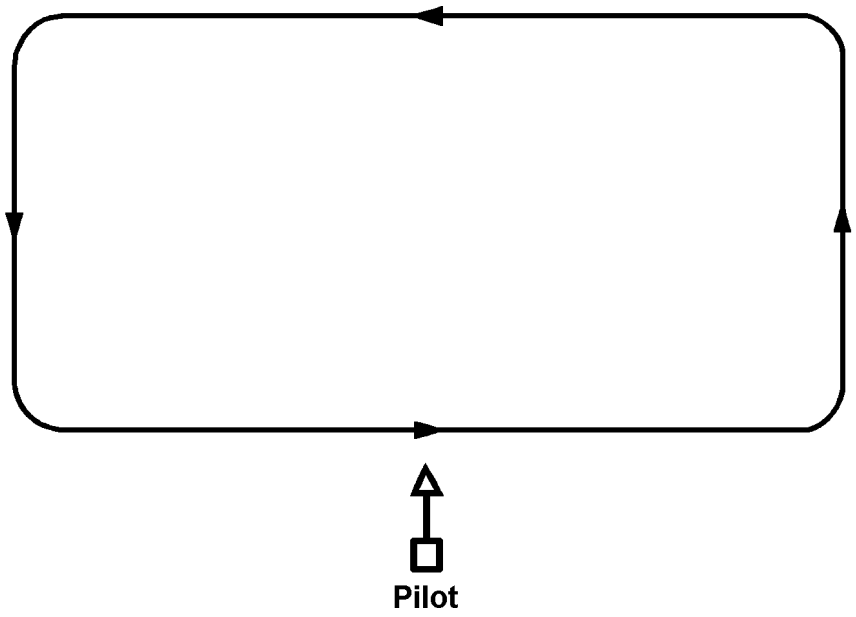
Open throttle smoothly to the fully open position and, as the aircraft gathers speed, keep it on a straight path by use of the rudder. When the aircraft has gained flying speed, a gentle backward pressure on the stick will lift it off the ground and into a climb. Once away from the ground your aircraft will tend to climb steeply - avoid this by using the elevators 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 feet 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!

Now we carry on with the development of your training. Commence to fly a 'figure of eight', which will look like this, with the cross-over point directly in front of you:



The turns should be steady with a constant angle of bank not exceeding 30^{o}. 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 constant. Note that one half of the manoeuvre is a left-hand turn, the other is to the right.

As a variation, you should also fly in a square pattern like this:



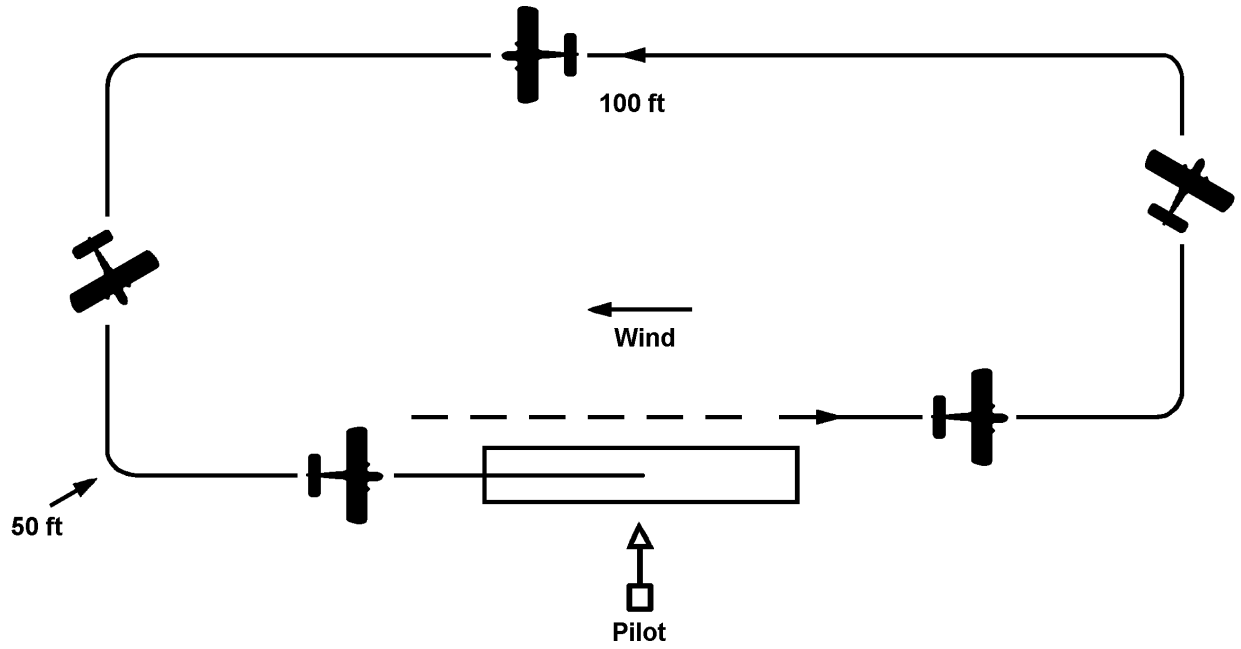
Fly these square patterns with both right and left-hand turns. Don't let the aircraft get too far away and let your instructor know if you have problems. At this time, now that you can handle the aircraft satisfactorily, he will not always be at your elbow, but may be some distance away (but keeping an eye on you!). He will always remain within earshot so that, if you call for help, he can be with you quickly.

After some practise with these patterns, try a modification. From level flight, on the furthest away long leg, climb the aircraft 50 ft. 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.

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

FLIGHT PATTERN 6 - CIRCUIT AND LANDING: FIRST SOLO

It is now time to begin tackling the circuit and landing. The circuit looks like this:



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 left-hand circuit is used to illustrate this lesson, the circuit can be either right or left-hand.

After settling your aircraft at the correct height and positioning it correctly into wind, fly about 100 metres 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 50 metres out.

Once established on the downwind leg, reduce power by 2 or 3 notches and feed in about 2 notches of ‘up’ trim. 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 20 metres, or so, turn onto the final crosswind 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 to line up with the landing path at a height of about 50 ft at the end of this leg. Don’t forget that this is a descending turn and the nose of the aircraft will be noticeably down to maintain speed.

The aircraft should now be heading straight for the landing point, 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: if too high, close the throttle completely. In other words, regulate the descent by means of the throttle.

When the aircraft reaches a height of about 3 ft, 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.

This is the whole landing sequence but your instructor will probably start you off by getting you to fly the 'square' 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 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 being 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! A few more runs like this and your instructor will get you to do the whole sequence on your own:

a. Take-off

b. Climb to circuit height

c. Fly the square circuit

d. Approach and land

You have now gone solo - although you may not have fully realised it at the time –

CONGRATULATIONS!

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

NOTE: Although we have shown a 'square' circuit pattern since it follows our teaching pattern, some instructors will prefer to round out the crosswind legs to make a 'race-track' pattern.

BRIEFING 5 - ENGINE FAILURE IN FLIGHT

Up to this point any problems caused by an engine failure in flight will have been handled by your instructor. Now that you have gone 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: 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, just lower the nose of the aircraft to maintain flying 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 slipstream from the propeller the flying controls will be less positive, particularly the elevator, so keep the speed up at all times. Your circuit should be planned so that the aircraft is at about twice normal circuit height halfway down the downwind leg (Key Position 1) and still about twice the normal turn-in height as the final turn to line up with the runway is begun, (Key Position 2). 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.

FLIGHT PATTERN 7 - FORCED LANDINGS

For safety reasons, your instructor will begin this exercise by teaching forced landings with the engine throttled back. 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.

Your instructor will get you to climb the aircraft to a fair height upwind of the landing area and then throttle right back. At this point, put the aircraft into a normal nose-down glide and your instructor will take over control and 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 cross-wind. The point at which this turn is made will depend on the height of the aircraft and the windspeed. A low height or a brisk wind will require an early turn and too much height or a calm day will require a later turn. Your instructor will demonstrate this to you.

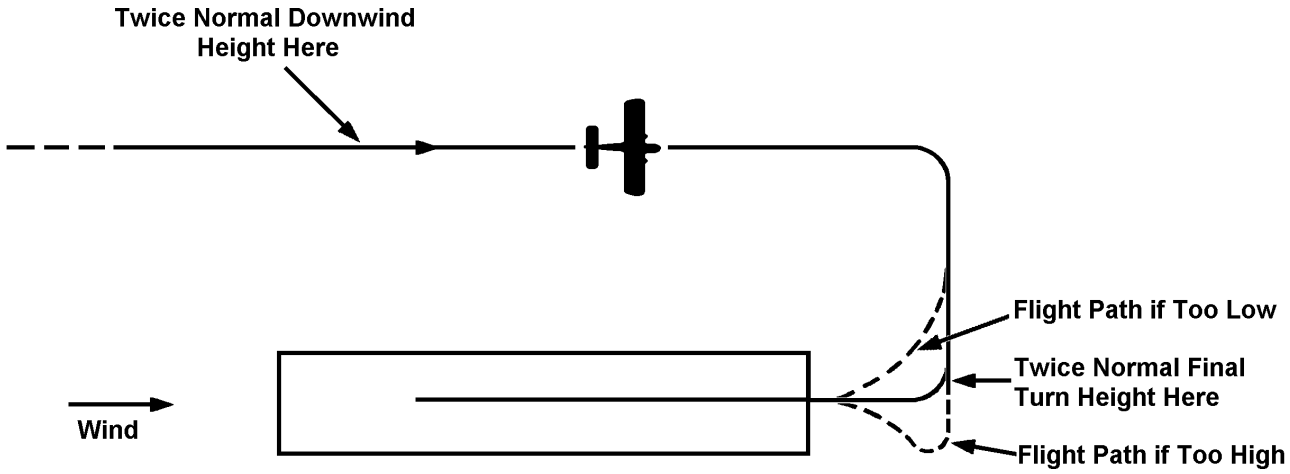
The second 'key' position is the point where the final turn onto the approach path is made. Your instructor will show you the correct height but will also demonstrate that this will vary with the wind conditions. He will also show you that a lot of height is lost in this final turn to line up with the 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, although your instructor will perform an overshoot to save time on repeating the exercise. 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 your instructor will 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. 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.

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. Your instructor will then extend your skills by closing the throttle on you at different points in the air 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.



REMEMBER - ALWAYS CALL 'DEADSTICK' LOUDLY WHEN YOUR ENGINE STOPS SO THAT OTHER FLYERS ARE AWARE OF YOUR EMERGENCY AND KEEP CLEAR OF THE CIRCUIT

FLIGHT PATTERN 8 - CONTINUATION TRAINING AND THE BMFA 'A' CERTIFICATE

Your next few flights should continue to cover all that you have learned so far. Each flight should consist of:

a. Take-off and climb to safe height

b. Turns, figures of eight, squares and general flying

c. Square circuits and overshoots (both right and left-hand circuits)

d. Landings - including some forced landings

Study also the Safety Code in your BMFA Members' Handbook and make sure that you not only understand the rules and the reasons for them but follow them! Make sure that you are also familiar with your club rules in the same way

When you (and your instructor) are confident with your performance in the air and your knowledge on the ground, you will be ready to take your 'A' Certificate of the Achievement Scheme. This test is carried out by a Registered Examiner and your club should have at least two such Examiners. The test is very straightforward and consists of:

a) Carry out pre-flight safety checks as required by the BMFA Safety Codes, starting the engine when appropriate

b) Take off and complete a left (or right) hand circuit and overfly the take-off area

c) Fly a 'figure of eight' course with the cross-over point in front of the pilot, height to be constant

d) Fly a rectangular circuit and approach with appropriate use of the throttle and perform a landing on the designated landing area.

e) If the engine stops during the landing the model may be retrieved and the engine restarted to enable the remaining parts of the test to be completed.

f) Take off and complete a left (or right) hand circuit and overfly the take-off area

g) Fly a rectangular circuit at a constant height in the opposite direction to the landing circuit flown in (d).

h) Perform a simulated deadstick landing with the engine at idle, beginning at a safe height (approx. 200 ft) heading into wind over the take-off area, the landing to be made in a safe manner on the designated landing area.

i) Remove model and equipment from take-off/landing area.

j) Complete post-flight checks required by the BMFA Safety Codes.

k) Answer correctly a minimum of five questions on safety matters, based on the BMFA Safety Code for General Flying and local flying rules.

All manoeuvres must be carried out in front of the pilot.

Hand launching is not allowed unless your examiner is satisfied that the flying field surface is not useable for a take off so be sure you have practised Section 5 thoroughly.

The Certificate is official recognition of the fact that you have achieved 'safe solo' standard and your club may now allow you to fly unsupervised. Remember that, whilst the gaining of this

Certificate is an important milestone, it is a long way from being the end of the road and a licence to fly as you please! Your aim now should be to polish your flying and begin to explore the world of aerobatics. You should try to become fully confident in handling your aircraft in the air and able to perform accurately all the manoeuvres you have learned. You should only be satisfied with a perfect landing every time!

Now that you have got your 'A' Certificate, don't forget that your instructor is still there! He will be able to help you iron out any minor (or major!) problems and give you invaluable advice and help when you need it.

ONE THING TO REMEMBER ABOVE ALL

FLY SAFELY

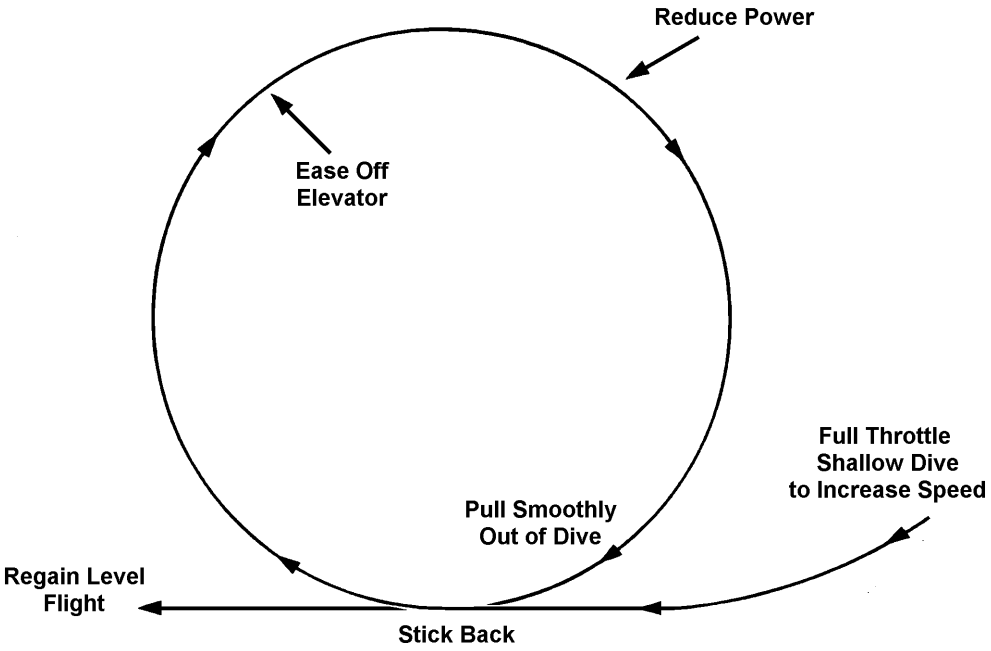
FLIGHT PATTERN 9 - BASIC AEROBATICS

Once you have mastered the basic flying technique you can start experimenting with mild aerobatics. 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. 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 and begin to throttle back to avoid picking up too much speed. Now recover to level flight. You may not succeed in getting right round the loop at the first attempt, but keep trying and remember to pull back harder as the aircraft reaches the vertical.

LOOP

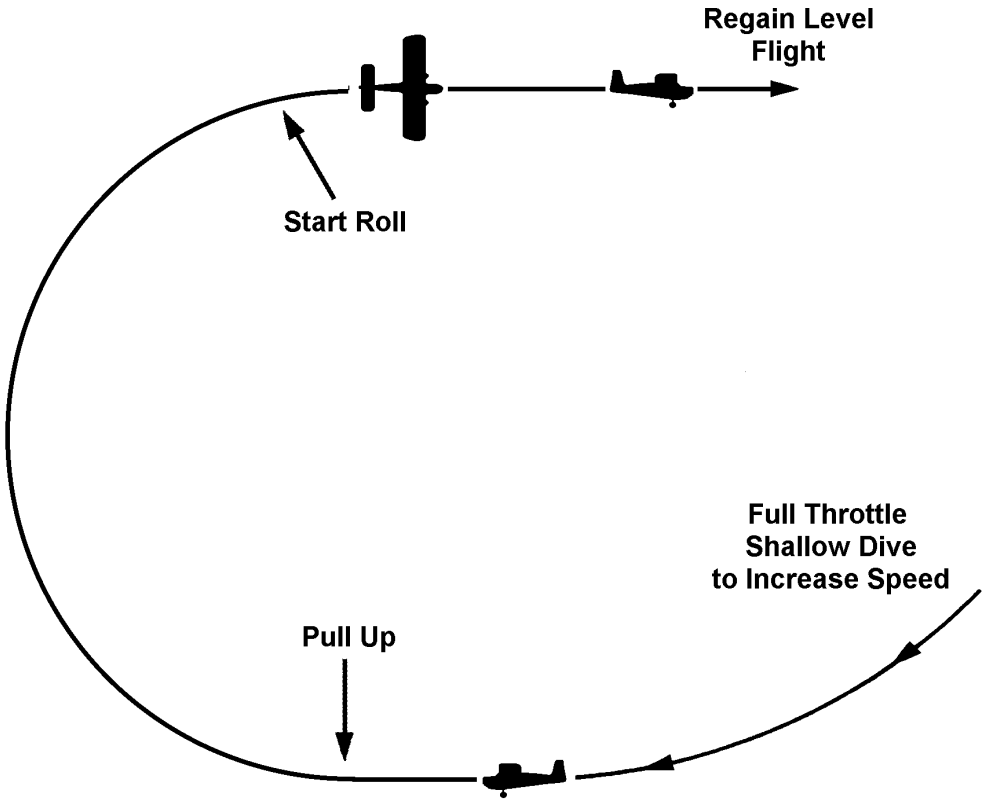


ROLL

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 ungainly manoeuvre. Start by flying level, then raise the nose slightly and apply full aileron in the direction you with 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 'down' elevator when the aircraft is inverted, but this will come with practise.

ROLL OFF THE TOP

This consists of a half loop with the aircraft being rolled out level at the top of the loop. You will need a fair amount of speed to perform this manoeuvre and, of course, full power. Don't start to roll out until the aircraft is well on top of the loop. The illustration will help you to understand how this manoeuvre is performed.



Roll Off The Top

CHAPTER 8
NEXT STEPS

Now that you can fly your basic training aircraft competently you should continue to fly it for several months longer. Try out every possible manoeuvre with it; fly it inverted (if it will) and generally explore the limits of its performance. You will certainly get into difficulties from time to time. With plenty of height you will be able to sort out the proper recovery technique for any unusual situation you may create. If you crash, understand why, repair the aircraft and go on exploring.

Eventually the time will come when you will recognise that you have 'grown out of' the basic trainer and you are ready for the next step.

Your next aircraft should be an advanced trainer with a low or shoulder-wing with a semi-symmetrical airfoil section and, of course, ailerons. If you powered your basic trainer with a .40 cu in engine, this motor will be quite suitable for your advanced trainer.

You may need some help in checking your new model over and giving it its first test flight. Don't hesitate to ask your instructor to assist at any time when you need help.

Your advanced trainer will have the capability to perform virtually everything in the book - and a lot more besides! However, always remember to keep to a safe height: you will make mistakes from time to time and when you do, that bit of extra height will make all the difference between a sigh of relief and a yelp of anguish!

Again, fly your model as much and as often as you can. Never fly aimlessly around. Try to set yourself targets - a perfect loop, a really good slow roll or practise the perfect landing. You should aim to take the 'B' Certificate of proficiency when you are able. Take a pride in following the rules: fly safely at all times and try to set a good example to your fellow club members, both in the air and on the ground. Beware of becoming over-confident.... it is only too easy to believe that you know it all! The result is always a bent aircraft.

FLIGHT CHECK RECORD

STUDENT ……..

DATE	LESSON / FLIGHT RECORD	PASS / REPEAT	INSTRUCTOR

The sample flight check record on the previous page can be copied and used by both student and instructors. Photocopy the page onto a record card or generate your own similar pages and paste them into a notebook. You will find such information especially helpful if more than one instructor is involved in your training but keeping a record of your progress will always be worthwhile even if you have one instructor throughout.

Your first page might look like this.

FLIGHT CHECK RECORD

STUDENT ***N. E. W. FLIER*** **……..**

DATE	LESSON / FLIGHT RECORD	PASS / REPEAT	INSTRUCTOR
6/5/99	*Start and first flight. Check trims and rates*	*PASS*	*Fred Jones*
6/5/99	*Straight and level - turns*	*R*	*FJ*
6/5/99	*Straight and level - turns*	*R*	*FJ*
14/5/99	*Straight and level - turns*	*R*	*Fred Jones*
14/5/99	*Straight and level - turns*	*R*	*FJ*
14/5/99	*Effects of wind – Climbing and glide*	*R*	*FJ*
26/5/99	*Climbing and descending – use of power*	*R*	*Fred Jones*
26/5/99	*Trimming*	*R*	*FJ*
4/6/99	Straight and level - turns	R	Alec Smith
4/6/99	Trimming	PASS	Alec Smith
4/6/99	Stalling	R	Alec Smith
15/6/99	*Straight and level – turns*	*R*	*Fred Jones*
15/6/99	*Straight and level – turns - stalling*	*R*	*FJ*
15/6/99	*Orientation – Use of Power*	*R*	*FJ*

NOTES FOR INSTRUCTORS

Advice to instructors can be of great benefit to both instructors and their pupils as both then know exactly why things are being done as they are.

The notes published here are quite basic and interested instructors and pupils should contact the BMFA Leicester office for copies of the new 'Guidance Notes for Instructors' booklet. This contains detailed advice on many matters involved in instructing and will be invaluable, especially to the new instructor just starting out.

An instructor with problems of any kind is encouraged to seek the advice of the local Chief Instructor or to contact the Controller of the Instructor Scheme via the BMFA Leicester Office.: his name is **Peter Spurway** and he can be e-mailed at peter.spurway@bmfa.org.

The Controller will also welcome any constructive comments on any aspect of the Scheme.

THE INSTRUCTOR'S TASK

Instruction is the art of imparting knowledge and it goes without saying that any instructor must know the subject he is going to teach. In order to teach a novice to fly an instructor must be able to fly the aircraft competently without showing off, be able to communicate effectively with the student and have sufficient background knowledge to answer the student's questions adequately.

COMMUNICATION.

Whilst we may know what we mean it is not always easy to put that precise meaning into words. The good instructor uses simple terms which the student can understand and avoids jargon. He will give his full attention to the subject in hand and not be easily sidetracked or allow diversions. He will always question the student on what he has just been taught to be sure that he has understood the lesson.

FLYING ABILITY.

The need for an instructor to be able to fly well is obvious - what may not be so obvious is the need for his own flying to be accurate and totally safe. The instructor who crashes his aircraft frequently is unlikely to inspire confidence in his student! Accurate and safe flying by an instructor is essential at all times - not just when actually instructing.

KNOWLEDGE.

A sound basic knowledge of how and why an aircraft flies is essential if the student's inevitable questions are to be answered. The student is entitled to expect his instructor to have all the answers and the instructor must be as well prepared as he can to be respond. If the Instructor does not know the answer (and he may not always) he should say so and be prepared either to find out the answer later or to refer the question to someone who does know. Nothing could be worse than trying to bluff the way through an answer - this is a very quick way to forfeit the student's confidence.

A knowledge of simple aerodynamics is essential – for example, why does the nose of the aircraft drop when entering a turn? The good instructor should be able to answer this and other similar questions straight away with a simple diagram if necessary. If your particular knowledge is not up to this there are plenty of books on the market which will help.

The instructor does not have to be a brilliant flyer nor an aerodynamicist - he does have to be competent, knowledgeable, patient, experienced and have a quiet authority.

An important part of the instructor's task is the preparation of the lesson. He should have practised the lesson himself and know exactly what he is going to teach and how he is going to teach it. Before

the flight the instructor will have briefed the student on the lesson to be tackled and the problems which may be encountered..... and how to deal with them. After the flight he should question the student to be sure that the lesson has been understood.

In the air he will adopt the system of:

DEMONSTRATION IMITATION RECAPITULATION

DEMONSTRATION

The instructor demonstrates what he wants the student to do.

IMITATION

The student tries to copy what the instructor has shown him.

RECAPITULATION

The demonstration and imitation is repeated until the student has got it right.

The instructor should always bear in mind the fact that the student is concentrating so much on flying the model that much of what is said whilst he is flying will go over his head. Hence the need to go over the flight when the aircraft is safely back in the pits.

The instructor should aim to fly with his student regularly and give 3 to 4 lessons in a flying day. Lessons should not be much longer than 10 minutes and the instructor should not expect the student to concentrate for any more than five minutes at a time. Give the student a 2 or 3 minute break by taking control every 5 minutes or so.

Safety is a vital aspect of model flying and should be emphasised at every opportunity. The good instructor always practices sound safety procedures and instils them into his student. Follow the Safety Codes and abide by the Club rules and ensure that the student does too.

The Safety Code for General Flying is the most important one at this stage and the instructor should go through this with the student.

The use of progress cards or booklet is recommended and a basic sample is provided in this Up-and Away manual. The pupil may use this or the instructor could make up the cards or booklets himself to the same pattern.

The third column should be used to indicate when the student is ready for the next exercise. ‘Repeat’ means that he needs further practice. Detailed comments are not desirable.

The card or booklet should be retained by the student so that if another instructor takes the student he can see immediately the progress the student has made and what the next lesson should be.

The ‘Guidance Notes of Instructors’ booklet has a much more detailed version which you may find even more useful.

NOTES ON THE FLIGHT PATTERNS

First of all, read the book right through - this will give you a feel for both the background and what is to come. Start with your student by checking that he has read and understood Chapters 1 to 6. Question him, particularly on Chapter 5.

The important part of the book for you starts at Chapter 6. Note what your student has been told and appreciate the areas in which he will look to you for advice.

FLIGHT PATTERN 1.

When you are checking his aircraft, TELL him what you are doing - and why. Follow the line of instruction in the lesson and reinforce what he has read by teaching exactly as planned.

- **ALWAYS** discuss with your student before the flight what you are going to do and ALWAYS discuss after the flight how it all went and what he needs to concentrate on next time.
- **ALWAYS** be encouraging in your comments. Spur him to better efforts and never criticise to the point of eroding his confidence.
- But **DON'T** let him get away with any deliberately unsafe flying. Over-confidence is worse than under-confidence.

FLIGHT PATTERN 2

The major student tendency in this lesson is over-banking. The student applies bank to get into the turn then forgets to neutralise the stick to hold a steady angle of bank. Teach him to be aware of this tendency and to hold a steady angle of bank once into the turn.

BRIEFINGS

Briefings are intended to reinforce your instruction - not to replace it! The briefings are there so that he can have the information to hand to read over at any time. If you do not fully understand any of the points made, refer either to your local Chief Instructor or to the Controller.

FLIGHT PATTERN 4

This has been included as a separate exercise to emphasise the point that low speed can lead to sudden problems. Take the opportunity to explore slow flight in parallel with this exercise.

FLIGHT PATTERN 6

The teaching in the manual is based on the ‘square’ circuit since this is a requirement for the ‘A’ Certificate test and because of the fact that a ‘square’ circuit is good training in control of the aircraft. However, it is recognised that many clubs require a ‘racetrack’ circuit and it is quite permissible for this to be taught up to the solo stage, after which the square pattern should be practised for the ‘A’ test.

You will note the use of a small amount of ‘UP’ trim on the downwind leg. This does make the approach and landing much easier and it should be taught as a standard procedure.

Once on the approach path it is most important to teach the student to keep the wings level. If this is done the aircraft does not deviate from the approach path and the chances of a good landing are much enhanced.

Overshooting **MUST** be taught at **FULL POWER**. Anything less will cause trouble at some time or other.

FLIGHT PATTERN 7

Coping with a dead engine in flight must be taught in a positive manner. It must be approached calmly with the aim of getting the aircraft to the correct ‘first key’ position. It may help if the student can accept that when the engine stops he has simply transferred from a `Power Model' to a ‘Glider’! In any event, once he can recognise the two correct key’ positions he is halfway towards getting his aircraft down at the right place on the landing strip. Let him try out the sloppiness of the controls ‘power off’ by cutting the engine very high and so give plenty of time on the glide.

Once the student has got the hang of coping with engine failure from an upwind position, gradually give him more difficult positions from which to make a forced landing. Regular practice will dispel all fears he might have and enable him to get his aircraft down safely under almost all circumstances.

FLIGHT PATTERN 8

When the student has gone solo you should aim him at the ‘A’ Certificate. Concentrate on polishing his limited flying ability so that he can perform the test accurately every time. Don't forget to take him through the BMFA Safety Code on General Flying as well..... and don't forget to ensure that he is familiar with the Club Rules!

FLIGHT PATTERN 9

When he has obtained his ‘A’ Certificate it may be as well to let him fly on his own for a while to gain confidence in his ability and to make mistakes and recover them successfully. He will still need help from time to time, sometimes urgently, and you should be available if needed. Be ready to take him onto aerobatics when he is ready for them.

GENERAL

This whole training system is not intended to be a rigid one. It is fully accepted that different instructors may approach a lesson in a slightly different way. However, it is vital that the basic principles of the system are followed so that a properly standardised flying training system is achieved throughout. It may, for example, be necessary to leave out ‘Taxying’ if the student's aircraft is not steerable on the ground. Similarly, Flight Pattern 4, ‘Stalling’ may be left until later in training or combined with another exercise.

Do instil into your student that **HEIGHT IS SAFETY** and watch his flying whenever possible after he has qualified to ensure that he does not develop any bad habits.

AND FINALLY

When you take on the role of instructor you are taking on a rewarding and responsible position within your club. Good instruction is never wasted and the results of your efforts to instil good flying habits in the people you teach will always make a difference in the long term. Not only will the general standard of flying within your club improve as properly taught pilots begin to show their paces on the field but the person you teach today might very well be your club’s ace pilot or a club examiner or instructor in a few years time.

Good luck to you all - and safe flying.

ABOUT THE AUTHOR...

JOHN LONG writes with some authority: a model flyer since the 1930's, he flew Spitfires and Hurricanes during the war then spent 30 years as a flying instructor holding the highest possible qualifications. A holder of A.1. category at the RAF's Central Flying School (which means he instructed the instructors). John commanded the CFS Examining Wing and before retiring from the service was Director of Flying Training at the Ministry of Defence. For his work in flying training he was awarded the Queen's Commendation and the Air Force Cross.

His work for the B.M.F.A. has included the posts of Chairman of the R/C Power Technical Committee and Vice-Chairman of the Society. In recent years he has been a consultant teaching overseas armed forces personnel to fly R/C target drones (RPV's). He is a fellow of the S.M.A.E. and holds the Royal Aero Club's Silver Medal.

"Up and Away" thus incorporates professional advice and instructional expertise from a highly qualified instructor. We believe that this will guide you into enjoyable and safe R/C power flying. We Hope that you enjoy both this manual and your sport. Safe flying.

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