

MODEL AERONAUTICAL  
ASSOCIATION OF AUSTRALIA



**HELICOPTER**

**Flight Instructor**

**Manual**

# MAAA INC. Flight Instructor Manual

*The following represents both a curriculum and a guide to Helicopter Instructors which, if followed, should produce competent pilots in minimum time and with minimum effort. While individual instructors may find variations useful, most will find it advantageous to try the methods listed. The order listed is also important as one area or exercise is designed to lead the student logically to the next.*

## **AIM**

To improve the expertise of instructors and the standardisation of flight instruction to assist beginners and to advance the sport of flying radio controlled model helicopters.

## **INTRODUCTION**

A Fixed Wing Flight Instructor's Manual was initially developed in the 1980s by the then RCAS of NSW as a means of standardising the instructional methods used for flight training members of the MAAA. The contribution of RCAS is recognised here and some of the wording used in this document is derived from that source.

The instruction process introduced by this manual has advantages for both instructor and student. When an instructor is unable to be at the club, another instructor can carry on teaching so the student can progress through the critical stages of early learning. Having another instructor stand in or assist, who will have a slightly different personal approach, may help to communicate slightly different perspectives to the student. This may also help when a student is not responding well to a particular instructor.

The instructor should make it clear from the beginning that windy, turbulent conditions will make useful instruction very difficult, if not impossible and may result in the student suffering a loss of confidence.

It is most important to clearly establish the amount of commitment expected from the student prior to commencing initial training. Once this has been agreed, the instructor should then also be committed to continuous and regular teaching sessions. It takes the average newcomer between five and ten hours actual flying time to reach competent unassisted control approaching the Bronze Wings standard. Obviously this varies with age, regularity of sessions and serviceability of equipment. The time required to be spent on the actual helicopter can be considerably shortened by effective use of a simulator.

This document is prepared for instructors using Mode 1, 2, 3 or 4. If basic flight instruction is using Mode 1 or 4 then a 'Buddy Box', if available, is strongly recommended or the student should have the model tethered. The instructor should also be prepared to assist their student to learn to fly on the simulator. It is important that the instructor is able to maintain safety and be able to control either the cyclic or the power/tail while the student learns the other two controls (power/tail or cyclic respectively). These sets of controls are primary and enable the instructor to maintain flight safety and protect the model from student errors.

A set of simple practice techniques has been included for the Mode 1 or 4 student without a buddy box or tether.

### **1. ATTENTION SPAN AND OVERLOADING**

To be effective the instructor must continually be aware of, and monitor, both the attention span and overloading of the student.

The attention span for most beginner helicopter pilots is as little as four to five minutes but at best, less than ten minutes. This equates to about the time of a single flight. During a single training session the attention span will reduce with each consecutive flight.

Overloading may be reduced by the use of the 'Buddy Box' where the student has only to use one or two controls simultaneously or with Mode 2 by only having the student take control of one "stick".

The instructor must continually be sensitive to when overloading occurs. It usually shows in the student becoming a little more erratic with the controls and the model frequently moving away from the central helipad after earlier being able to keep the model on station.

A student should never be asked to perform a new manoeuvre towards the end of a session.

An instructor should never shout at a student, as by upsetting the student, the concentration and attention span is destroyed, making it impossible to carry out meaningful instruction. The student needs to be coaxed along, not terrorised!

Similarly, an instructor who talks too much can destroy the student's application to learning. The instructor should explain to the student what is to be done, show what to do if necessary and very soon let the student do it without interruption. By the conclusion of a few flights the instructor should only occasionally need to provide verbal commands. When the same mistake is made several times, it should be pointed out, as concisely as possible, how to correct the situation.

## **2. BEHAVIOUR OF THE INSTRUCTOR**

When taking on a new student it is useful to determine the student's knowledge and experience with model helicopters. You can decide from this how much terminology you need to explain. After a short period of time it will become a new language for the student. The instructor should use just enough terminology to get the message across.

The behaviour of the instructor is crucial to the whole process of learning. The information must be presented in a palatable, attractive form. It must be remembered that a student flying any R/C aircraft is, in most cases, apprehensive of looking foolish and has a fear of damaging the aircraft. There is also a good deal of apprehension about being taught by someone for whom flying is easy. Therefore, a gentle, smooth, considerate approach, recognising the concern of the student, is essential. The necessary information must be supplied by the instructor, clearly and precisely, without unnecessary verbosity, and the student allowed to get on with it.

A helicopter instructor will not have time to take the transmitter from the student while flying. This is why a 'Buddy Box' can be an important tool for teaching on Mode 1. In other words, do not allow an emergency situation to develop. Achieve this by careful prior instruction so that the student will be properly prepared.

A good instructor will spend very little time flying the helicopter. Conversely, the instructor who does fly the helicopter much of the time is a bad instructor, irrespective of other attributes. Demonstrate the manoeuvre, explain the stick movements necessary and return control to the student.

Most instruction will be carried out in a "club" type of situation where there will be other people flying, standing about, etc. It will sometimes be necessary for the instructor to protect the student from others who will try to talk to the student while flying, often doing untold harm. These people need to be made aware of the consequences of starting a conversation while the student is concentrating on flying.

With all the best intentions in the world, do not neglect your own flying skills and take steps to make sure that you retain your own expertise by setting aside flying time without the burden of anxious students awaiting further instruction.

## **3. THE CURRICULUM**

### **3.1 General**

From the outset it should be understood that the ultimate aim of any instructor, training people to operate R/C Helicopters, is to turn out pupils who are capable of flying safely, and who can fit into a busy club or contest scene with a minimum of discomfort to themselves and other club members.

In the past there has been a tendency to accept a pupil as trained on reaching a level where they can keep the model airborne and are able to put it down upright.

Too often, these fliers, when faced with the additional workload found on busy flying fields, go into overload and the result is what appears to be unsafe or dangerous flying. In fact they simply are not able to cope with different surroundings e.g. sun or pits in a different location, noise and presence of other helicopters, and so on. It is desirable that the instructor exposes the student to a variety of flight line and environmental conditions prior to considering the student as trained.

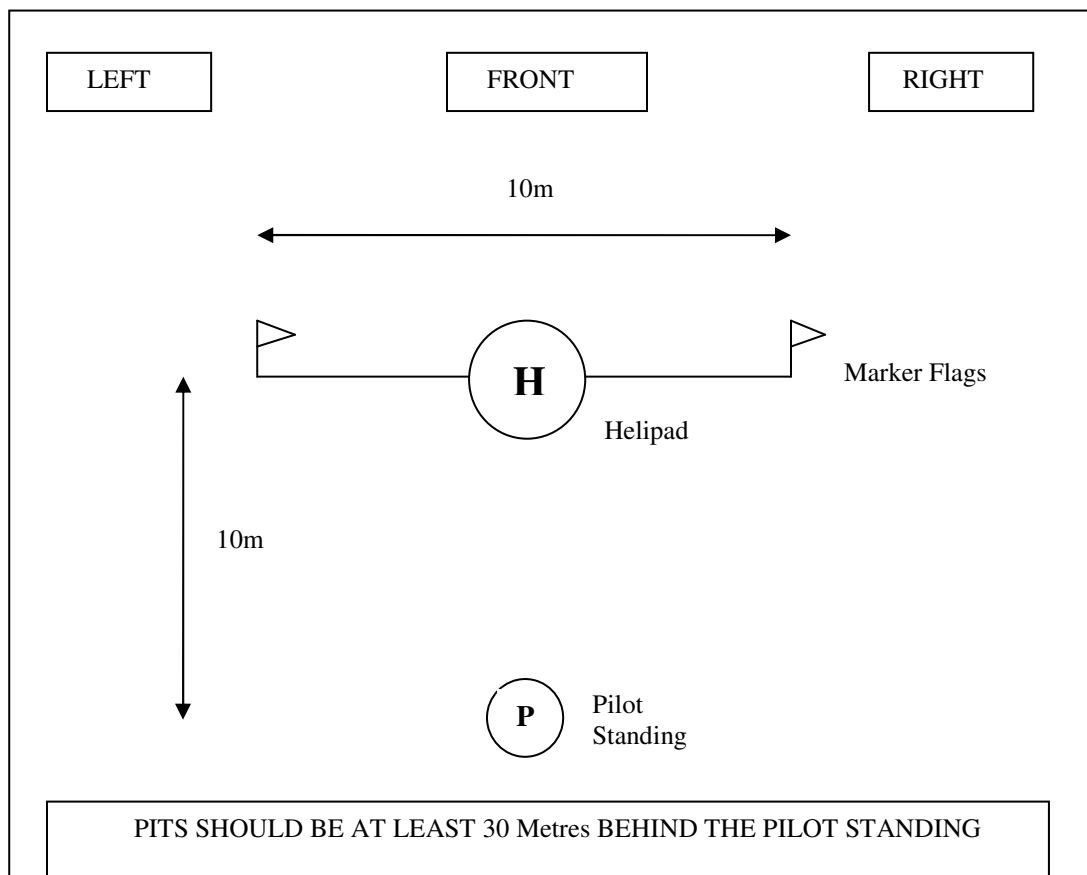
Obviously then, it is up to the training system to prepare students adequately for real-life situations, and this must be done from the beginning, before inappropriate or restrictive habits start to form.

Consequently, it is important to vary the student's training so that all manoeuvres are attempted in various positions or directions, e.g. left side and right side hovering, right and left hand pirouettes. This is absolutely vital during training, for any R/C pilot who has learned only one direction or position for a manoeuvre can relate just how difficult it is to attempt the opposite hand manoeuvre in emergency situations.

Keeping in mind then, that care must be exercised to avoid student overload, the required discipline must be introduced from the beginning and in readily absorbed portions. It should be pointed out to the student at the outset, that a sensitive light touch is necessary to hover the helicopter and maintain position over the helipad. Once able to hover, then it is important to work in defined areas of the sky at all times, both during training and when skilled. This becomes particularly important when one realises that the average student will be experiencing "Tunnel Vision". This is due to the stress the student feels when learning, causing the peripheral vision to contract, and so the student sees the model but is unable to recognise the whole area.

During the entire training period, continual emphasis should be placed on the student's ability to guide and maintain the helicopter into an increasingly smaller spot over the helipad while the student stress levels reduce with practice; which in turn reduces "Tunnel Vision" and allows an expanding peripheral vision, until the student is able to recognise the whole flying area. This should be followed by being able to keep the helipad in sight while moving the helicopter away from the pad.

The approach to adopt in teaching an awareness of location, is to define the flight area as illustrated in Figure 1. It must be understood by the student that each excursion from the helipad regardless of height or direction, should be made with reference to the helipad position so that the student develops location awareness. The pilot should stand 10 metres behind the central Helipad at the "Pilot Standing" position shown in Figure 1 and the flags or at least markers should be used early in training as a guide to assist students with position awareness and control. 10 metres is necessary to provide a safe distance in the event of pilot error or model failure. For example, a rotor blade or mounting failure can result in the blade travelling up to thirty metres at high speed.



**Figure 1**

*Note: Each individual club flying site will naturally have its own unique restrictions and limitations, because of the local layout. Consequently the left, right and front areas might have to be modified to accommodate any local limitations, BUT the minimum distance behind the Pilot Standing to the Pits should NEVER be less than 15 metres and 30 metres is desirable.*

*Always use these area names in order to improve the accuracy of communication between instructor and student.*

We now have a typical situation with the Flying Areas in Front, Left and Right, and also the Pits or 'no fly' areas. Training can proceed with simple exercises to be carried out over the helipad. The instructor can now very easily ascertain the pupil's ability to hold the helicopter in the designated area and the pupil knows exactly what is required in advance of the training session. As the pupil becomes increasingly aware of the location and surroundings, this position should be expanded until, at the final stages of the early training, the student should be able to move between and above the marker flags.

Do not take risks! Ensure that the helicopter is safe before flight. Be diplomatic with the student if the helicopter cannot be safely flown without modification. If this is the case, if possible give the new pilot a short flight session on your model or a borrowed model to maintain their interest and establish a good relationship.

Time, effort and care spent in the initial training will pay handsome dividends when the first flights are attempted. What is generally accepted as the most gruelling time during R/C helicopter flight training should be reasonably simple to a well prepared student. The consequence will be a reduction in repair times and a corresponding increase in confidence and enjoyment.

### **3.2 USING THE SIMULATOR**

The simulator is an excellent method for training. Whilst it does not replace the real model completely, it provides a very reliable way of learning the control techniques. Where possible, the instructor should sit with the student, with the simulator running, select an appropriate model and if necessary modify the model and simulator functions or adjust the student's transmitter to replicate the "feel" of the student's model. Where this is not possible or acceptable, the instructor should give some guidance to the student on how to set up the simulator to best effect.

The instructor should demonstrate the style and type of manoeuvres that the student should practise and recommend to the student that as much time as practicable be spent in practice. The Bronze Wings manoeuvres are a good place to start. It should be pointed out that at least five to six hours will be required to give the student adequate coordination to translate comfortably to the real model. If the simulator approach is possible, when the student can perform the recommended manoeuvres and never crash the simulator, then and only then will they be properly prepared to fly the live model.

### **3.3 AIRFRAME CHECKOUT**

The purpose of this document is not to give direction on how to set up the model, but it is important that the instructor is confident to check the "set up" of the student's model and where necessary make corrections to suit the type of flying that will be required in the early stages of learning. Do the final check yourself, particularly of control throws, sense and neutrals, as these, and a knowledge of any build errors present, will give some idea of what to expect in the air. The instructor must perform these checks prior to test flying and conducting training on the student's model.

### **3.4 DEXTERITY TRAINING**

Dexterity training is useful prior to the first flight. This is best done by use of the simulator, which has already been covered, however, if this has not been done then the student should be instructed in the use of the controls before the flight commences. It is useful to have the student practise the controls by restricting their view of the transmitter and watching their action while giving normal flight commands. It is then possible to help them recognise which control to use and the amount of input required.

### **3.5 TEST FLIGHT**

Fly safely! An instructor should never damage a student's helicopter (excluding system failures). Check engine idle setting, check flight characteristics at hover and in forward flight, and check the control throws set during the airframe check, not for your enjoyment but for the student. Check and correct the trim and tail gyro gain before passing controls to the student. Remember, a beginner does not want a "touchy" helicopter, but rather one which has smooth and progressive responses allowing the development of a "feel" for how much control input is required. You are not setting the helicopter up for you to go hot-dogging, you are setting it for a beginner. In general, most people use too much control sensitivity. If there is excessive vibration caused by rotor blade imbalance or tracking then correct the tracking, but if the blades are out of balance then it may not be possible to correct this at the field. It should then be explained to the student that the model should not be flown until the blade balance has been corrected.

### **3.6 TETHERED FLIGHT**

Using a tether to restrain the model in the early part of training is almost fool proof, particularly when the student wishes to practise without an instructor to help. The model is set up and test flown by the instructor. The model is then tethered by attaching a string for

small models or a strong cord for larger models, directly under the main shaft or as close as possible to the Centre of Gravity (CoG). With the training legs attached, the string is attached to a ground peg (or floor or carpet if a small electric model) and the length set to allow the model to rise above the ground to a height of about half of one rotor blade length, or about half of one training leg.

Inform the student that the model will “bounce” around quite violently initially but will not normally do any damage as the training legs absorb the energy and avoid toppling.

Once the student can hold the model in flight above the peg, then the tether is lengthened to about the length of one rotor blade and once again the student learns to control and balance the model at the end of the string.

Once this is mastered, then the student practises keeping the string loose. Once the string can be kept loose, then full control has been attained and the string can be removed.

This technique can also be used for “nose in” flight training.

### **3.7 NON TETHERED FLIGHT WITHOUT BUDDY BOX**

The technique described here applies to students or learners who wish to fly on their own or do not wish to adopt the training techniques recommended in this document. This way of learning is NOT recommended but has been practised around the world when persons are required to learn unaided. The techniques are also useful for instructors who have no other aids available and are using Mode 1 or fly a different Mode to the student.

To be successful and prevent damage to the model, it must be fitted with the now well recognised crossed training legs.

An area is either marked out or a suitable helipad is defined. The area should be about two metres square or round. The model is placed nose out in the centre of the helipad.

The student then proceeds to raise the power slowly until the model floats on the training legs. The model must be mechanically set on the legs so that it leans slightly to the right for clockwise rotating blades and to the left for counterclockwise rotating blades.

The model is then “balanced” by gentle cyclic and tail control inputs until the student can stop the model from “travelling” away from the helipad. Once this is mastered, the power is then used to achieve short “hops” to a few centimetres above the helipad. Initially each “hop” must only be for a few seconds, extending in time as the skill level increases. This is practised until the model hovers continually, never leaving the area of the helipad.

Once the model can be reliably hovered within the area of the pad then the height of each “hop” should be raised until a reliable hover at eye level is achieved.

From this point the sequence of the training is the same, whatever technique is being used.

### **3.8 USING BUDDY BOX**

There are four flight control Modes: Mode1, 2, 3 and 4, with Mode 1 and 2 the most popular. If the instructor does not fly the same Mode as the student or the student is using Mode 1 or 4, then it is strongly recommended that instruction is conducted using the ‘Buddy Box’ dual control system. As stated above, training on Mode 2 or 3 can be performed without a ‘Buddy Box’ if the instructor flies the same Mode.

It is very important to establish proper communication protocol prior to flight. The instructor must always say, “HANDING OVER” and “YOU HAVE IT” and continue to fly the helicopter until the student responds with “I’VE GOT IT”. When taking control back, the instructor should announce, “TAKING OVER” and/or “I’VE GOT IT”. This may seem obvious but relieves the stress of seeing the model performing manoeuvres that the student does not seem to be controlling.

It is all too easy to finish up with no-one flying the helicopter if this course is not taken. In some emergency situations the instructor may have to take over without first saying, "Taking over", but this should not be the norm.

### **3.9 EARLY FLIGHTS**

The same basic principle of teaching each function separately should be used for any of the four Modes as far as possible. With Mode 1 and 4 or when the student uses a different Mode to the instructor, the 'Buddy Box' is the only tool that allows a single control function to be passed to the student.

The pilot should be facing the centre of the helipad. The correct position for a pilot to stand on the flight-line, whether a student or not, is at right angles to what would be a runway direction for fixed wing aircraft. The helicopter should ALWAYS be flown in front of the pilot, not overhead or around behind the flight-line.

While it is necessary to ensure that the student has a proper grounding on each control, do not dwell longer than necessary on each section. Keep it interesting and the student will remain receptive.

The student should firstly be given the throttle/pitch control (with tail if Mode 2). The instructor should take the cyclic. Once the student has a good feel for the altitude control, then they can be given the tail as well (for Mode 2 the student will already have the tail). Once the student has reasonable control of these, then the student is given the cyclic while the instructor takes the pitch/throttle and tail. The instructor can then keep the model straight and low while the student masters the cyclic controls. When the model moves away from centre, the instructor lands the model well before the model reaches a situation of risk.

Maintain full guidance, call each control input required, i.e. "Forward", "Back", "Left", "Right", "Nose left", "Nose Right", "More Power", "Less Power", "Kill Power". This is the whole set of instructions required in the early phase of instruction.

As the student begins to understand which control to apply, give the commands later and later until they are not required, allowing time for the student to interpret what to do next.

### **3.10 ON STICK TRAINING**

This term refers to the instructor physically controlling one or both "sticks" on the radio simultaneously with the student. This is a practical and very effective method for Mode 2 control systems.

The instructor explains to the student what is about to take place.

The instructor commences by test flying the model. Then the student holds the transmitter comfortably as if about to fly. The student then moves the right hand thumb to the side of the transmitter and the instructor places their hand so that they can comfortably control the right stick. When the student takes control of the cyclic their left thumb is placed to the side of the radio so that the instructor can control the throttle and tail.

Once the student is comfortable with the cyclic, then the student takes both sticks and the instructor places their fingers low but not touching the right stick, just to protect the student from executing any over-control of cyclic. From this position the instructor can take full control of the cyclic instantly if required.

This technique can be used until the student can hover reliably over the helipad. Following this, the 'Buddy Box' may be introduced.

Sharing of the transmitter must not be attempted for Mode 1 helicopter training. The reason is that the helicopter is close to the ground and there is a split of the primary controls where the instructor cannot immediately take care of both primary cyclic controls.

### 3.11 TRIMMING

As soon as the student can hover reliably, the instructor should provide training on trimming an "out of trim helicopter" because students are likely to want to practise hovering on their own somewhere and need to be able to recognise when the model is out of trim and know how to correct it. With a helicopter, the student will be able to learn this required skill quickly, as it can mostly be performed without risk to the model at the point of lift off.

The student needs to check the trim on each helicopter flight to ensure that trim controls have not been bumped. With a new model, trimming is essential and a student will need to be able to do this on their own fairly early in their training.

Bring the model to the hover point and confirm that the model is balanced. If it feels balanced then it will be close enough to lift off. After lift off, the pilot will tend to fly the model and will not always recognise that the model is out of trim. The pilot needs to release the tail control and check that the model stays trimmed. As a student, they should be instructed to land the model if any out of trim condition exists, adjust the trim if the error is small, then fly the model again until the student can feel that they are not applying any corrective control. If the yaw is severe then mechanical and/or transmitter adjustment may be needed.

For cyclic trimming, again the model is brought to the hover point and then just into hover. If an out of balance is sensed, then the power should be reduced and either the trim adjusted on the transmitter or, if severe, then a mechanical adjustment should be made. The model should then be brought to the hover point again and then just into hover and the balance checked. If the model feels balanced, then lift off should be performed. Once again the pilot will need to consciously relax the cyclic control to identify whether the flight balance/trim is correct. If the model is still not balanced, a student should land, make the fine trim changes and test fly again until a balance is achieved.

### 3.12 Ongoing Basic Training

A good sequence of practice for the new student is the Bronze Wings manoeuvres, using the flight line layout with flags and with the pilot standing 10 metres behind the central helipad. Mastering the Bronze Wings manoeuvres should be the primary aim of the new student. Although a student may be safe to practise these manoeuvres one by one under the guidance of an instructor, the attainment of Bronze Wings would normally be required to indicate to other club members or to another Club that the student is safe to be allowed to fly without an instructor.

**The use of the 'Buddy Box' is recommended for all transmitter Modes when full forward flight is first attempted and when learning to fly circuits. The student may also wish to use the 'Buddy Box' when trying to learn a new flight manoeuvre.**

### 3.13 Advanced Training

Once the student has attained Bronze Wings, then the instructor should be encouraged to assist the student to advance through to full circuit flight and onto aerobatics if desired.

Two manoeuvres that are required for student advancement and safe recovery are Nose-in flight and Autorotation.

Nose-in flight should be taught as the next manoeuvre following on from attaining their Bronze Wings to enable safe circuit flight and forward flight landings.

Once the student can confidently fly circuits or high level forward flight, then the instructor should teach the Autorotation manoeuvre, as every helicopter pilot will sooner or later be forced to execute this manoeuvre, whether a full F3C, 3D, scale or sport pilot.

A safe method for Autorotation training is described here. This procedure applies to electric and piston powered models.

Firstly, the Throttle Hold setting should be adjusted to a speed just below that required to sustain hover. With electric models where throttle hold is often used as a safety measure, the changed throttle setting should be used very cautiously and probably reset at the end of the training session. The instructor then brings the model into hover at about 1 metre altitude and demonstrates the Autorotation from that height. The student then brings the model to a hover at waist height and the instructor engages the Throttle Hold switch and the student lands the helicopter. The same process is then followed with the student activating the Hold switch.

With the model flying in “Stunt” mode with a low pitch setting of approximately  $-6^{\circ}$ , and a matching throttle curve or with the governor operating, the student is progressed through increasingly rapid decent manoeuvres under power from approximately 20 metres to a smooth landing. Once this can be done confidently, the student then practises full landing with the Hold switch activated. Since the throttle is set to just below hover point, the model will perform in a very similar way to the “Stunt” mode practice just completed.

Next the throttle value in Throttle Hold is reduced progressively as the student becomes comfortable with each reduction in throttle until the engine has totally disengaged when in the Hold position. This process would normally only require two or three reductions of throttle setting during the course of the training.

#### **4. GENERAL OBSERVATIONS**

It is most important to emphasise to the student on reaching Bronze Wings standard, that they are now at the basic minimum standard required. Avoiding accidents due to pilot error requires practice until all responses and reflexes become automatic. The instructor should emphasise that it is important to progress slowly but consistently. Lots of *‘courage but little ambition’* is the key to success.

The instructor should stress to the student that pilots should fly within their own limitations. If it is too windy, wait for another day. If the student wishes to experiment with something new, then teach them the fundamentals of performing the new manoeuvre at a safe height, and, importantly, have them talk through the new manoeuvre prior to the attempt. Especially have them consider how they intend to recover from the new manoeuvre should they foul it up! This should be done even if as recommended here, the student is on a ‘Buddy Box’ to try new manoeuvres. Many students will want to try new manoeuvres without the ‘Buddy Box’ however, and the instructor will not always be present when the student wants to try something new.

Instructors should make themselves available to assist other pilots at any time with new manoeuvres or improving the manoeuvres they can already do.