A Training Guide

for

R/C Model Airplane Flying

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Introduction:

It is the intention of this text to teach experienced fliers how to teach RC flying and to provide the student RC pilot some insight as to what this sport is all about. While it will be most useful to beginning instructors, even fliers who have been teaching for some time should find many of these points helpful, or at the very least, as a helpful reminder. Students will benefit because it will provide them with an outline as to what comes next in their training syllabus.

Outline To Text:

What about dead sticks?
Are they ready to fly by themselves?

VII. Other Important Things A Beginner Must Know
Safety! Safety! Safety!
The basics of engine tuning

Instructors: Do You Have What It Takes?

As you were learning to fly, you probably noticed that the instructors at your flying field were very busy, especially during evening and weekend flying. There probably never seemed to be an abundance of instructors, even during designated instruction times. For this reason, many newly proficient fliers should consider becoming instructors.

In this text, we intend to present to you some information that can help you become an RC flight instructor or can help veteran instructors hone up on their skills. While there are many ways you can give back to your club, instructing for a flying season is one of the most rewarding ways.

The goal of this instruction program will be to get the student to the point where they can fly by themselves. While you may also wish to assist your students with learning aerobatics as well, this text will only address basic flight. When using these teaching methods, there are four steps (or progression levels) a student must achieve to get to the point where they can begin flying on their own. This makes it very easy to teach, since you can organize every technique needed for flying into four basic steps. It also helps you limit the number of things a beginner must master as they learn how to fly. This is a guide. Although you can decide to eventually mix and match certain techniques described during each step to match your own teaching preferences, it is recommend that you thoroughly understand the entire process before you begin changing anything. Then, once you feel that you can improve this guide, please feel free to do so. If you do, please document your improvement or changes and let the Training Coordinator know what you did and how it worked out. Again, the goal is to help get the student to the point where he or she can fly by themselves.

This text will stress the teaching of flying skills. You should be able to relate the basics of aerodynamics and flight, control surfaces, and in general, what makes an airplane fly. While this text does offer some assistance for helping the beginner pick their first airplane, understand flying safety, and start & maintain engines, there will be many things you need to relate before flight training can begin.

Special notes for beginning instructors:

> **1) Use Trainer Systems.** While experienced instructors may be able to teach without a trainer system, as you begin instructing, you will be amazed at how many precarious attitudes a beginner will get their airplane into. Depending on your flying skills, some of these attitudes will not be comfortable to you. It is difficult enough to right a wandering airplane with the trainer system. Doing so after a transmitter is passed can be much more difficult, especially when the plane is close to the ground, as it is when taking off and landing.
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> If the student does not have the trainer system capability (maybe they have a basic radio that came with an RTF model, for instance), you can easily help them with the early stages of learning how to fly (steps one and two). Without a training system, as long as you keep the airplane high enough, the plane will never be in danger, though you have to be much more attentive. As a qualified instructor, you should be confident enough in your flying ability to do so. However, as the student begins taking off and landing, make it very clear that there will be little you can do to save the plane when it gets close to the

ground. Without a training system, it is more than likely that the plane will be dumped (and damaged) several times before take-offs and landings are mastered. As long as the student understands this, work with them. However, if they show any signals (during steps one and two) that they may blame me for the plane's damage, don't help them learn how to take off & land!

One more point about passing the transmitter as opposed to the trainer system. With the trainer system, you have total control of when you retake control. When you pass transmitters, the beginner must give you the transmitter before you can retake control. As the beginner progresses, they may protest when you ask to retake control. They may (incorrectly) feel they are still in total control even though you know better. By the time they finally acknowledge that they are in trouble, it may be too late for you to save the airplane. Make it very clear at the start that if the student protests when you ask to retake control, you will stop helping them, that is, the training stops there. Your AMA insurance coverage is very specific about how it will deal with damage caused by the model. Irresponsible flight activities are not covered and should will not be allowed.

2) You control the pace. Beginners tend to get a little anxious. You will eventually develop a feel for when a student has progressed enough to move on to each new step. Until then, take it slow. If in doubt about whether a student is ready to move on, keep on the current step until you are absolutely sure.

3) Be assertive with your control of the master transmitter. Especially when first starting, be ready to take control of the plane at the first sign of mistakes. While this may frustrate beginners to some extent, you must be totally comfortable with the control of the airplane. There may be times, for example, when a student is coming close to the flight line. They may be flying just fine, but you will have to take control of the plane to avoid the flight line boundary.

4) Patience is the key. Beginners will have difficulty with things you (now) find easy. This can be frustrating. If you show your frustration, beginners will soon lose confidence. You must constantly encourage beginners, stressing positive accomplishments to build on.

5) Be on the lookout for new ways to do things. Believe it or not, the best way to thoroughly learn something is to teach it! You will be amazed at how many things you learn from a beginner's questions. They really force you to think through many things you may now take for granted. And in order to explain anything, you really have to thoroughly understand it. For questions you can't answer, look for an another experienced instructor in your club to help.

6) Be sure you can fly out of trim airplanes. If you have never taken a new plane off by yourself, you shouldn't take a beginner's plane up for the first time. To get ready to fly a plane for the first time, practice this. Get your plane in the air and have an instructor intentionally throw off one or more of your planes trims. Practice getting the trims back to normal.

7). Know how to handle an emergency. Practice dead-stick landings even though you are an experienced pilot. You will have to demonstrate this to a student, hopefully

intentionally, so perhaps if you freshen up on the process, you will make it look like you really do know what you are doing.

8) Be sure the beginner has an AMA membership card. Beginners must understand that flying can be dangerous and accidents happen. They need insurance when flying model airplanes every bit as much as when driving a car. (Some of my clubs "hot dogs" require it more!). The AMA and SFA provide insurance to their membership. Remember that the AMA will allow you to register up to three instructors as those designated to help non-AMA members for a period of up to thirty days. These designated instructors and their students will be insured as long as they follow the rules of the AMA.

9) Keep their left hand on the stick. Through the first two steps to learning how to fly, beginners will be predominantly using only their right hand. You will eventually notice that they will tend to let their left hand stray away from the left stick. Urge them to keep both hands on the sticks. As they begin taking off (in step three), their left hand will be needed, and it will be easier if they are comfortable with their left hand on the stick.

10) Be flexible. As you begin teaching any subject, you will be amazed at the number of ideas your students come up with. Most beginner ideas tend to be a little naive. They simply do not understand enough of the big picture to draw correct conclusions. However, sometimes excellent ideas come from naiveté. Do not be too quick to judge a student's idea as being bad. They may surprise you! We have a natural tendency as human beings to expect people to do things our own way. Yet if we open our minds to other possibilities, we may learn something ourselves.

11) Watch for the student's saturation point. We all have a limit to how much new information we can absorb in a given period of time. Student's to RC flying are no exception. Keep in mind that your student will be concentrating very hard during practice sessions (especially on their first few flights). There will come a point when they simply cannot take any more without a break. One common symptom of this will be that the student has been doing just fine for about eight to ten minutes of flying. But all of the sudden, the student starts making mistakes (usually silly mistakes) not normally made. The student may not even understand why they are doing so poorly and begin to get frustrated. As the instructor, you must be able to recognize when the student has had enough. Tell the student they need a break and land the plane.

12) Two steps forward, one step back. You must remember that your students will have problems along the way to learning how to fly. At times, things you thought your students understood will seem to be difficult again (especially after long non-flying periods). This can be frustrating for instructors so you'll have to show your patience when faced with this problem. One way to minimize the problem is to do a review of what the student currently knows at the beginning of each flying session. You can review on the ground, reinforcing the students knowledge as well as begin the practice flying by having the student do seemingly simple maneuvers they already know. This also helps you begin a more complicated (and new) topic on a positive note. However, even with reviews, you must be on the lookout for times when the student needs to take the one step back before they can move forward.

OUR APPROACH:

In section one, we offer several discussions aimed at helping the student. This chapter includes the most commonly asked RC questions, a presentation on what makes the best trainer airplane, a discussion of safety, and the basics of engine tuning. While these presentations are, for the most part, directed to the beginner, we urge you to read them to help with your ability to relate these important topics to beginners at the field. You can also copy this information and give it directly to beginners.

When it comes to actually teaching, we break teaching RC flying into four basic steps. In any form of teaching it is good to limit the number of things a student must learn - and RC flying is no exception.

1. Teaching how to master turns and level flight
2. Teaching how to set and hold headings
3. Teaching how to master take-offs
4. Teaching how to land
5. The Solo flight.

While this may sound overly simplistic, think about it. To get to the point where you are flying by yourself, every technique you master fits into one of these four steps!

ASSUME NOTHING!:

Before taking a beginner up for the first time, ask questions. Do not assume that the student knows, for example, the basics of aerodynamics and flight, or that he or she knows the stick controls on the transmitter (ailerons, elevator, throttle, and rudder) and knows the function of each control. And, of course, do not assume the student's airplane has been checked out by a pre-flight instructor or that it has had at least one trim flight. When in doubt, check It out. It is always better to be sure than to apologize for a crash that could have been avoided with a few simple questions or checks prior to flight. During the check flight, ask questions about what you are doing and explain what the controls on the transmitter do. Show the student what a coordinated left or right turn is, what climbing means, or how to accomplish it. Do some basic aerobatic maneuvers with the trainer aircraft to show the student the capabilities of that aircraft. You will be surprised how much enthusiasm can be gained when a student sees what his or her nice new trainer is actually capable of doing other than flying straight and level and recovering from some error in input.

FLYING PREFERENCES:

Instructors tend to teach what they know in the same fashion they know it. There are several alternatives to almost every important function of flying. Good instructors recognize that their own ways are not only (and in some cases not the best ways) of doing everything.

FINGERS OR THUMBS?

As you teach a new person to fly, I would suggest you start them off right from the beginning using their fingers rather than their thumbs. The further a person progresses, and the more precisely they wish to fly (when pattern flying for example), the more important it is that they be able to fly with their fingers. It is very difficult to switch to flying with fingers once you have learned to fly with your thumbs.

HOW DO YOU HANDLE THE LEFT/RIGHT PROBLEM?

Beginners have a common problem when it comes to mastering turning. After entering a turn, they tend to forget which way they are turning and give the wrong aileron to exit the turn (sending the plane deeper into the turn). There are several ways you can help the beginner with this problem. One way is to ask them to turn their body to face the plane's heading. If their looking in the same direction as the plane is flying, it will help them remember which way the plane is turning. Another is to get them to keep repeating (out loud) from the beginning of the turn which way they are turning. With either method, the beginner will eventually become comfortable turning and not need the crutch. My suggestion would be to get them to stand in a stationary position when flying (this is especially important if you're not using the trainer system) and get them to keep saying out loud the direction they are turning. However, if you have a system that works, then stick with it.

WHAT THROTTLE SETTING DO YOU USE?

When you first begin training, try to keep the throttle setting just high enough to keep the plane in the air. This ensures smooth docile performance and minimizes the beginner's natural tendency to overcontrol. It also helps them make level turns. However, It is possible to have beginners that catch on quicker when the engine is running faster. For some people, a responsiveness airplane is easier to master than a docile one. Either way, keep in mind that you will eventually need to have the beginner practice at all throttle settings from idle through full throttle.

HOW MUCH CONTROL SURFACE MOTION DO YOU WANT?

Again, instructors tend to disagree on this point. Since beginners have a natural tendency to overcontrol, many instructors like to set up trainers to be very docile, minimizing control surface motion (possibly with dual rates). This means the beginner must move the sticks quite a bit to cause a reaction from the plane. However, my feeling is that it is better to keep the plane rather responsive for three reasons. First, the beginner must eventually learn the precise control motions needed with sensitive control surfaces (on this airplane or their next one). Second, on windy days minimal control may not be enough to cause any response from the airplane in certain attitudes. Third, as the instructor, you need the plane to be responsive enough to get out of precarious attitudes. You may wish, for example, to use dual rates in such a manner as to use high rates while flying then switch to low rates for landing (remember the capabilities of the trainer system may not be able to do this, check with the manufacturer if in doubt). This is up to you and to the capabilities of the student.

WHEN DO YOU TEACH RUDDER COORDINATED TURNS?

Generally, teach people to fly without them ever having them touch the rudder stick (except for steering on the ground). Most RC airplanes, and especially trainer planes, turn quite nicely with only a combination of aileron and elevator. Admittedly, rudder coordinated turns make for nicer

looking turns, and rudder is helpful when landing in a crosswind, try to keep turning as simple for beginners to master as possible. However, if you feel strongly that the beginner should learn rudder coordinated turns from the beginning, by all means, teach them in this manner. Again, it's up to you and your concept of the capabilities of the student.

FINAL APPROACH, ONE TURN OR TWO?

If teaching realistic flying, the RC pilot will make two turns during the final approach. One turn will bring them ninety degrees to the runway and the other will bring them right on the middle of the runway. To simplify this, I have beginners making one (180 degree) sweeping turn during final approach.

WHAT IS THE WIND LIMITATION?

Most beginners can learn more easily on calm days. But I live in the Chicago area. If we waited for perfectly calm days, we'd never fly! However, there comes a point when the wind is blowing so hard that it will be impossible for the beginner to control the plane. For the beginners first ten flights or so, I recommend limiting your instruction to when the wind is blowing under 5-8 miles per hour. As the beginner progresses, let them fly on windier days. Remember, your student has not truly mastered flying until they can fly with winds around 10 mph.

II. BEFORE THE FLIGHT INSTRUCTION

OBJECTIVE:

The objective of this section is to try to deal with the most common questions and problems a beginner has. Though as an experienced pilot you already know much of what is presented in this section, this presentation should help you with your ability to relate what you know to beginners. Also, much of this section can be simply copied and given to beginners with questions.

Instructors tend to get the brunt of questions from people just thinking about getting into the hobby. Once someone has begun learning to fly, instructors are bombarded with questions related to all facets of this hobby. Even once a beginner has learned to fly, if they have questions (especially about aerobatics), they ask an instructor.

In this section, some brand names and actual models are mentioned, but keep in mind this is done for the sole purpose of offering comparisons. It is in no way intended as endorsing nor criticizing any of the products mentioned. There are numerous radios, airplane kits, ARFs, RTF's, engines, and flying accessories of excellent quality. In fact, you really have to go out of your way to find a poor product in this hobby. Don't get me wrong, they are out there, but as an instructor, you will probably be asked to recommend a product. Please do so with the understanding that not every student has the resources necessary to buy that Ready-to-Fly super gizmo with all the bells and whistles. Keep it "down to earth" so that the tools of the sport do not become an item of property settlement at the divorce hearing.

COMMON RC QUESTIONS:

Based on experience, most instructors will find that most beginners to the hobby tend to have the same set of questions as they enter into the RC airplane hobby. So let's begin by giving a summary of these questions and supply some brief answers.

How does the radio control system work?

As with any kind of radio, a transmitter (held by the flyer) is used to send signals to the receiver (in the airplane). Both are powered by (usually rechargeable) batteries. The radio system can have several channels. Each channel is used to control one airplane function. Servos (one for each channel) are used to cause the actual motion within the airplane to make control surfaces move.

A good beginner's radio configuration has four channels. These channels control ailerons, elevator, rudder, and throttle. Two sticks (like computer game joysticks) on the transmitter give the flier control of these four controls. With the most common radio setup mode, the right stick is used to control aileron (left/right) and elevator (up/down). The left stick is used to control rudder (left/right) and throttle (idle through full throttle). Like a computer game joystick, the aileron, elevator, and rudder sticks are spring loaded. When you let go, these sticks spring back to the middle of the control. The throttle stick stays where you place it, from idle to full throttle.

Keep in mind that some radio control systems have more than four channels. Other controls for these channels include retractable landing gear, flaps, and even smoke systems. For now, you

should concentrate on the four basic controls. Leave the fancy stuff for when the student has mastered the hobby.

Within the airplane, servos receive signals from the radio's receiver whenever either of the transmitter sticks is moved. The servos respond according to the motions of the transmitter sticks and cause the control surfaces of the airplane to move in sync with stick movements (through mechanical linkages). Instructors: If an interested person at the flying field has questions about radio systems, be sure to show them on your own airplane.

Other radio terminology:

Trim controls - It is not possible to perfectly set each servo and control surface. Say for example, the plane tends to climb in a hands off condition. The elevator trim control will give the flyer the ability to trim in some down elevator without affecting the joystick for the elevator. In essence, trim controls allow the flyer to set the radio so that the plane will fly straight and level with hands off the radio. ALL radios come with trim controls for the four basic channels.

By the way, this is another reason that beginners should seek help. It is highly unlikely that a new airplane will behave perfectly with regard to trim settings. A plane that is not trimmed properly can be very difficult to fly (even for an experienced flier). For a beginner, it will be impossible to fly. During your new plane's first flight, the instructor will trim your airplane, causing the centered or neutral position of each channel to be centrally positioned.

Servo reversing - It is sometimes inconvenient (if not impossible) to mount the servos in a way to properly control the control surface. In many cases, the servo will come out backwards (left aileron comes out to be right aileron, for example). The feature servo reversing allows you to mount the servos in the most convenient manner, and if one or another comes out backwards, the servo reversing switch for that servo (in the transmitter) can be turned on. Servo reversing is a standard feature on almost all radios sold today.

Dual rates - Though not included on every radio, this feature allows you to change the responsiveness of your airplane's control surfaces (usually this feature only applies to ailerons and elevator). On high rates, your servos will move full travel and the plane will be quite responsive. On low rates, your servos may only move about 40-60 percent of their total travels. This is a nice feature for beginners, since you can reduce the responsiveness of your airplane, making it easier to fly.

Mixing - This feature allows you to have one control automatically invoke another. For example, as you give left aileron, the radio can be adjusted to automatically give some right rudder (to make for a smoother turn). While this is a nice for feature experienced flyers, it doesn't help beginners learn to fly. Don't go out of your way to find a radio with this feature for your first radio.

Radio styles - AM versus FM versus PCM - Generally speaking, the most reliable (and most expensive) radio style is PCM (stands for pulse coded modulation). Next in reliability and price comes FM (frequency modulation). Finally comes AM (amplitude modulation). Though almost all of these radio styles are highly reliable, we recommend that beginners purchase an FM radio.

Trainer system - This feature allows the safest manner of flight instruction. We devote an entire discussion later in this set of questions to the trainer system. Please refer to this information. For now, just remember a beginner should not buy a radio without the trainer system!

How many airplanes can fly at a time?

The FCC has allotted over 40 frequencies to model aviation. These frequencies are given numbers, ranging from about 16 to 58. In theory, this means that over forty planes could be flying a the same time! However, the likelihood of forty flyers showing up at the same flying field without duplicating frequencies is low. Also, when more than six or seven planes are in the air at the same time, it can be quite distracting to the flyers (mid-air collisions do happen). For this reason, CCRCC limits the number of planes that can be in the air at the same time to 4 airplanes. Note that if one flyer turns their transmitter on when another on the same frequency is flying, the pilot of the plane in the air will loose control of the plane. This is why most clubs use some form of frequency control. Instructors: be sure your students understand the rules of your frequency control.

How long can they fly?

Depending on the size of the engine and the size of the fuel tank, the range of flight time can be from about 10 minutes to well over 20 minutes. One common recommendation for a .40 sized engine is about a six once fuel tank. This will allow about a 10-12 minute flight.

What happens if the engine quits?

Most planes designed for beginners will glide quite well. In the hands of an experienced flier, a plane can be safely landed even if the engine quits. Of course the altitude and attitude of the airplane at the time of the engine failure has a lot to do with how difficult it is to safely land the airplane. The higher the plane, the more time the flier will have to plan the landing. (Landings without power are called dead-stick landings.)

How far away can the airplane fly?

The rule of thumb is: if you can see it you have control of it! Generally speaking, your radio will have control of the airplane for up to distances of more than a mile. The higher the plane, the greater the range.

How fast do they go?

This depends on the style of airplane as well as the size of the engine. Trainers will fly at speeds of about 20-40 miles per hour, depending on the maneuver. More aerobatic sport planes can reach speeds of well over 90 MPH. Pylon racers designed for speed can go as fast as 150 MPH.

How high can they go?

As high as you can see them. Again, if you can see it, you have control of it! However, flying fields that are located in close proximity to airports usually have some height limitations. Instructors: be sure to relate any rules related to height and position flying.

Is flying an RC airplane like flying a real (full scale) airplane?

In essence, yes. You'll have the same basic controls a full scale pilot has of a real airplane. However, full scale pilots that have learned to fly RC airplanes tell me that there is quite a difference in actual flying technique. They say an RC airplane responds much faster than a real airplane. They also say that learning to fly RC can be awkward, since there is no feel for the planes maneuvers. RC flying requires much more hand/eye coordination since you must respond to what you see.

Is it hard to learn to fly?

This is a tough question to answer. Everyone has a different aptitude level for learning RC. This much is certain. RC flying is hard enough to learn that you will not want to try to learn by yourself. In over 30 years of flying experience, I have never seen anyone learn by themselves that did not go through several airplanes (or at least several crashes) in the process! Fixing airplanes is not nearly as much fun as flying. If you want to learn to fly with the least amount of problems, join the club and work with one of our instructors. He'll flight test and trim your plane, take off and land for you, give you pointers, and stand close by, ready to take control if you get into trouble in the air. While we can't promise your instructor will never crash, you will have a much better chance of keeping your plane in one piece with an instructor than without one.

How long does it take to learn to fly?

Like the previous question, this is tough to answer. It depends upon the student's aptitude. It also depends on how often you practice. The more often you practice, the shorter the time it will take to master. You know the saying, "If you don't use it, you lose it!" It truly applies to RC flying. If you only fly once a week, it may take quite a long time. You'll be struggling to remember what was learned in the last session. We have seen people solo (fly by themselves for an entire flight) in as little as two weeks of practice (every day for several flights). Others make take the whole flying season to learn to fly. Yet others may take more than one flying season. With a good instructor, even the learning stage is fun and rewarding. So this period should seem to go quite quickly, regardless of how long it takes.

What's the hardest part of flying?

Landing. Your instructor will first teach you how to keep the plane in the air, making simple turns. Then you'll progress to flying figure eight patterns. Once you can keep the plane in the air by yourself without any problems, you'll learn to take-off. Finally, once you have mastered all other phases of flying, you'll learn how to land.

How much wind can there be?

Experienced flyers can fly (sport planes) in winds well over 20 MPH. However, the more wind, the harder (and less enjoyable) it is to fly. Beginners won't want to fly in winds much over 5 MPH until they have mastered the first step of learning how to fly.

What is the best size for learning?

Generally speaking, the smaller the airplane, the less expensive it will be. Unfortunately, the smaller the airplane, the less stable it is and the worse it handles in the wind. Keep in mind that

all size RC airplanes perform nicely on calm days. I recommend starting with an airplane large enough to handle the wind you get.

Here are the approximate engine sizes as well as the approximate wingspan and weight of several standard classes of RC airplane.

Engine	Wingspan	Weight
.049 (1/2-A)	35-40"	1-2 lbs.
.20	40-45"	2-3 lbs.
.40	50-55"	4-5 lbs.
.60	60-65"	6-8 lbs.
.90	70-75"	9-10 lbs.
.120	80-85"	10-12 lbs.

I recommend starting with a plane in the .40 engine size class. It will be large enough to easily get off the ground and fly nicely in some wind. If cost is prohibitive, .20 size is good too, but wind will be more of a problem.

How much do they cost?

This is also a tough question to answer based on the size of the airplane and how many extras you want to buy. For a .40 sized airplane, here are some basic guidelines for costs. Note that this configuration assumes that you wish to keep the cost down

ARF (almost ready to fly) plane:	$110.00
.40 sized engine (medium class):	$80.00
4 Channel FM radio (with cord):	$160.00
Flight box accessories (fuel, etc.):	$70.00
Approximate startup cost:	**$420.00**

While this may sound expensive, this is a one time cost. Your radio, engine, and flight box can be used over and over for other airplanes. Don’t Forget that you need to join the AMA at a cost of $48 per year, and pay your PRC dues and initiation fee if you're just getting started.

There are also RTF’s or Ready to Fly kits that come pretty much that way. Assembly usually consists of putting the wings together and connecting the linkage, assembling the tail section and connecting the linkage, and installing the landing gear. The kit comes complete with an engine, installed radio system, and some offer a training video or flight simulator computer

programs that help in getting started. One such kit is the Hobbico NexSTAR which costs about $400.00 but does not include the flight box and accessories mentioned above but does have the Great Planes RealFlight NexSTAR Select Simulator for the PC. The simulator uses the transmitter that comes with the RTF kit. Assembly of the RTF usually takes about an hour or so depending on the skills of the person assembling the kit. If your club does not have a Futaba Trainer box with the ***square*** connector, you may wish to buy one. Total cost of the trainer box and the cable is approximately $50.00.

What makes a good trainer plane?

Here are some qualities that contribute to making a good trainer plane:

High wing design - You'll notice that all trainer recommendations we give are high wing airplanes. This is the most stable design (even for full scale airplanes). Since the body of the fuselage is below the wing, the plane will nave a natural tendency to right itself after a turn.

Flat bottom or semi-symmetrical wing - Flat bottom wings are best for stability, which is helpful when learning. However, planes with flat bottom wings are not very maneuverable. Once you do learn to fly, you will eventually want to learn how to do some aerobatics. Flat bottom wing designs perform poorly when it comes to aerobatics. Semi-symmetrical wings have a slight curvature to the bottom of the wing. They are not quite as stable as flat bottom wings, but they do allow moderate aerobatics.

Rugged design - Its almost a guarantee that your first plane will get knocked around quite a bit. You'll want to be sure that it can take some minor bumps and bruises. But be careful here! When a plane is designed to be rugged, it usually sacrifices some of its flying characteristics.

There are a number of planes on the market that claim to be almost indestructible, and they almost are, but they sacrifice good flying characteristics to be able to make this claim.

Should I build a plane from a kit or buy an ARF (almost ready to fly)? - This is totally up to you. If you enjoy working with your hands, by all means, build your own airplane. You can save a little money (but not much) and you'll have the satisfaction of flying something you built yourself. Also, you'll have the plans to the airplane in case you have to do some repairs after a crash.

On the other hand, if you don't enjoy building, or you wish to get in the air as quickly as possible, there are several excellent flying ARF airplanes on the market (some of which we highly recommend). Keep in mind that, even with an ARF, there is still some work to do. While the wing halves, fuselage, and tail section are complete, you do have to final assemble, mount the engine, and mount the radio. Most ARFs come with excellent instructions (since they assume beginners are purchasing them), and you can be in the air in about 10-12 hours of building time.

Another nice thing about ARF airplanes is that most come with almost everything you need to complete the plane (except radio and engine). Hardware like clevises, engine mounting screws, wheels, fuel tank, wheel retainers, control horns, nose cone spinner, and sometimes even glue are included right in the box. While the quality of these components may not match those you buy separately, at least you won't have to make a lot of trips to the hobby shop!

What is the trainer system or Buddy box? (this is IMPORTANT!!)

Imagine you've just built your airplane and you bring it out to the field for the first time. You get together with an instructor and he test flies your airplane and trims it out. Now it is going to be your turn. Your instructor takes off again and gets the plane up to a safe altitude and hands you the transmitter. If you are like most beginners, you'll have the plane on its back almost immediately (beginners have the tendency to over-control the plane). Your instructor quickly grabs the transmitter back from you and rights the plane. Then he gives you back the transmitter. You get about 3 more seconds of practice before he has to grab the transmitter again.

This passing back and forth of the transmitter is very cumbersome, error prone, and downright scary. In the beginning, when your just trying to keep the plane in the air, passing the transmitter will suffice. But as you get better, and you begin to do maneuvers closer to the ground (like take- offs and landings), you'll want a more fail-safe method of instructor control.

Sometimes called a buddy box, the trainer system allows you to connect a slave transmitter with the master transmitter with a cable. Once set up properly, the instructor will take the master transmitter and give you the slave transmitter. He'll get the plane in the air and when ready, he'll simply press a button or hold a spring loaded toggle switch and you'll have control. If you get into trouble, he usually says, “I have the airplane” releases the button or the spring loaded switch and he has control again. No more passing transmitters. Once the trainee is ready, he says, “Ok, you have the airplane” and presses the button or holds the spring loaded switch and off you go, controlling the airplane again. This type of trainer system will dramatically improve your odds of learning how to fly without crashing even once (especially as you begin taking off and landing).

Unfortunately, you have to have both a master and a slave transmitter. Most beginners do not want to buy a second complete radio system just to get the slave transmitter. And most pilots will not let you borrow their transmitters to be used as a slave (the servo reversing switches may have to be changed which can cause major problems when they go back to flying their own airplane). Fortunately, there are trainer boxes available for several different types of radio systems, including the Airtronics and Futaba systems. Tower Hobbies of Champaign IL is such a company. The cost is about $45.00 for both the cable and buddy box trainer. You can also order the buddy box and cable from your favorite hobby store.

Note that the trainer system connector port is not equipped with all radios. Most AM style radios, for example, do NOT come with this port. You'll probably have to buy an FM or PCM to get this feature, meaning you'll have to spend a little more. But this is money very well spent! Many clubs, ours included, have buddy boxes available for most popular radio systems.

What Makes The Best Trainer Airplane?

There is a lot of controversy related to what truly makes a good trainer. As you talk to people at the field and read ads & articles in model magazines, everyone seems to have a different idea as to what makes the best trainer. Of course, the companies trying to sell trainers will always slant their sales information in a way that sounds right for everyone. In this presentation, I intend to discuss the three most important attributes for trainer type airplanes.

Wing configuration - The most popular trainers are of high wing design. The high wing gives the most stability for flying. Since the major portion of the airplane's weight is below the wing, high wing airplanes have excellent self correcting characteristics.

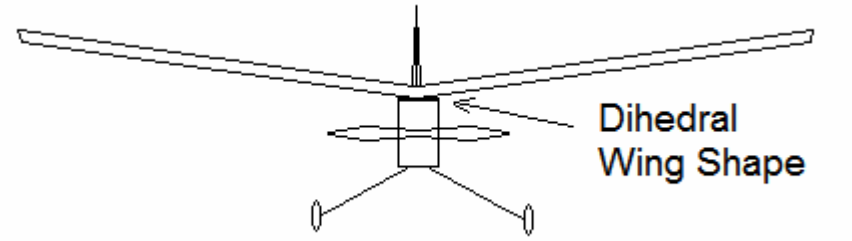
There are three types of wings used for trainers, the flat bottom wing (as is used on Hobbico Flightstar 40, Great Planes PT-40, and Midwest Aerostar, Hobbico NexSTAR Select), the semi-symmetrical wing (as is used on the Hobbico Avistar), and the fully symmetrical wing (used on the Great Planes Trainer 40). The wing configuration has a great deal to do with ease of flying, wind penetration, and aerobatic capabilities.

Generally speaking, planes with flat bottom wings are easiest to fly. With even a small amount of dihedral (the amount of angle in the middle of the wing), they tend to be very self-correcting. However, on windy days, difficulty of flying increases due to the fact that they do not penetrate the wind very well. You will also notice a great deal of ballooning (the tendency for a plane to gain altitude when speed is increased) with flat bottom wings. Also, planes with flat bottom wings tend to have limited aerobatic capabilities.

Planes with semi-symmetrical wings, while they sacrifice some in the way of self correcting characteristics, remain amazingly stable. With them you gain in wind penetration characteristics, reduce the tendency for ballooning, and increase your potential for aerobatics once you have learned the basics of flight. (This is my wing style of choice for trainers).

High wing planes with fully symmetrical wings tend to be much more aerobatic. As long as you limit the movement of control surfaces, they can also make excellent trainers. The Great Planes Trainer 40, for example, makes a great trainer. And in the hands of an experienced pilot, can perform almost every maneuver in the book! The *dihedral* also has a great deal to do with the plane's stability and self-correcting characteristics. Dihedral is the upward or downward

inclination of an aircraft wing from true horizontal. If you look at the wing from the front of the aircraft, the wings are angled upward to the right and left side from the center as shown below.



Generally speaking, the more the dihedral, the more tendency the plane will have to self-correct. However, the windier the day, excess dihedral will keep the plane from penetrating the wind nicely. It is difficult to fly planes with excess dihedral directly into the wind. The plane will have the constant tendency to turn in the direction the wind is blowing (with the wind).

Weight versus rugged design - Of course your first airplane will have to take quite a bit of abuse. Especially when you start landing on your own, you'll need a plane that can withstand the bumps and bruises associated with your first few attempts. Some of the balsa ARFs (almost ready to fly airplanes), while they are very light and have excellent flight characteristics, are a little on the weak side. For example Avistar and Flightstar are great fliers but tend to be a little weak in the nose area and may require some beefing up as you begin learning how to land. At the very least, you'll probably have to modify the nose wheel connectors which tend to bend or break after a few hard landings.

Some model manufacturers take rugged design to extreme. The Aircores and Duraplanes for example, while they are VERY rugged, tend to sacrifice desirable flight characteristics for the sake of keeping the plane from breaking. These planes tend to be quite heavy and do not respond well when it comes to slow flight characteristics. Difficulty of flying also increases as weight increases. In some cases, the excess weight may actually cause a mishap that would not have occurred with a lighter design.

Two of the best kit planes in this regard are the Great Planes PT-40 and the Midwest Aerostar. The nose area of these planes is well supported and will allow many hard landings, yet they remain amazingly light. Unfortunately, as mentioned, these are both kits you have to build yourself. I do not know of an ARF that has excellent flying characteristics and extremely rugged design (though they may exist). Note: The Hobbico Superstar 40 and 60 seems to meet both these characteristics and is available as both ARF and ARC (almost ready to cover). As mentioned above, there is an RTF kit by Hobbico, the NexSTAR that does very well. The NexSTAR Select is a larger sized aircraft and is well built and will take a lot of abuse. This particular plane has a built in Automatic Flight Stabilizer, removable wing tip spoilers, and a removable speed brake. These all aid in smoothing out flight which really helps the novice learn the sport without having to wrestle with control all the time. This kit weighs in at about 6 1/8th pounds, has a four channel entry level radio system and the reliable OS .46 FX engine. The radio and engine are pre-installed. The engine also is shock mounted which helps reduce vibration. This plane is larger than the PT-40 and the Aerostar which makes it a bit easier to fly.

Good advice:. avoid the heavy weight airplanes that sacrifice desirable flight characteristics. If you purchase an ARF, look for balsa construction to keep the weight down. However, be ready to reinforce the nose area as you begin learning how to land.

Plane and engine size - 40 size trainers offer the best compromise in stable flight and economy. While you can go smaller to keep costs down, the 20 size airplanes tend to be a little unstable (especially in wind). If cost is not a concern, 60 size trainers tend to be substantially more stable than 40 size trainers (especially in higher winds).

When it comes to engines, my first recommendation is to buy something with a proven track record of reliability. Talk to experienced flyers at your field to get recommendations. OS Max engines tend to have the best reputation in this regard. While you can get more power for the money with other engines, you don't want to be spending your precious flying time fine tuning your temperamental engine. Also, as you begin learning how to land, you will want a good reliable response from idle to midrange (for practice approaches).

As far as power, I recommend if anything, that you keep the plane slightly on the overpowered side. As you begin taking off, a good strong engine makes the procedure much easier. If your plane barely has the power to get off the ground, taking off can be quite a challenge. This extra power is also very handy when practicing approaches and for gaining altitude fast. Additionally, once you have learned to fly, a good strong engine will be needed for your next (sport) airplane. Besides, even during training, having a strong engine allows you to play. All work and no play… you know... do rolls, spins… you know, play.

HOW ABOUT NEW ENGINE BREAK IN?

All internal combustion engines benefit from extra care when they are run for the first few times. This is called the engine break-in period. This allows the working parts to mate together under load conditions and at an operating temperature that is more typical to those encountered during normal engine operation.

It is vitally important to complete the break-in before allowing the engine to run continuously at high speeds and before finalizing carburetor adjustments.

Most quality engines are precision instruments. Their parts fit together with precise tolerances and will generally be ‘tight’. For the most part, these engines will require a short simple running-in procedure and can be done with the engine installed on the aircraft. This does not mean that you cannot break-in the engine on a test stand, however, this is not necessary.

The following is a procedure recommended by OS Engines for their most popular RC Aircraft engines for beginners and advanced pilots.

1. Install the engine with the propeller intended for the model.
2. Insure that the linkage is correctly connected and operates from the radio in the proper direction, that is, close the throttle on the transmitter should close the throttle on the engine carburetor. Make sure it is not reversed. This is especially important with engines that are inside a cowel because the carburetor is not easily seen.
3. Open the needle valve to the advised starting setting and start the engine. If the engine stops when the glow starter is removed, open the needle valve to the point where the engine does not stop when removing the glow starter.
4. Run the engine at full throttle and adjust the needle valve to a very rich setting which can be noted by the engine switching from two cycle to four cycle operation and run the engine this way for one minute.

5. Lean out the setting until the engine switches to two cycle operation and run the engine for 10 seconds, again at full throttle.
6. Return the engine to rich operation, again to four cycle, and run it for a minute.
7. Follow steps 5 and 6 for about 5 minutes then shut down the engine.
8. Allow the engine to cool down for at least 10 minutes.
9. Restart the engine and repeat steps 3 to 8 until the fuel is expended.
10. Continue this process through three tanks of fuel. With each tank, increase the time at two cycle operation at full throttle by 5 seconds.
11. At this point, it is safe to operate the engine in flight, however, try to avoid any inverted or excessive nose-up flight for another two tank fulls.
12. After about 10 or 15 flights, the engine should run continuously in any configuration.

Once the engine is ready, the following will help you insure the engine is truly ready for all situations in flight:

13. Insure that the aircraft is held securely by some means so that it will operate at full throttle and not endanger you or the people around you in the pits. STAND BEHIND the aircraft when performing any carburetor needle valve adjustments.
14. Run the engine up to full throttle. The engine should run up to full throttle cleanly and without hesitation.
15. Run the engine down to idle. The engine should not shut down when going to idle operation.
16. Return the operation to full throttle.
17. Quickly pinch the fuel line leading to the carburetor and release it. The engine should immediately accelerate then return to normal full throttle operation. This is normal. If it does not, then you must
18. make minor adjustments to the high speed needle until it does. If it runs poorly at idle, adjustment of the idle setting needle valve is needed.
19. Perform steps 14 and 15 again. . If it shuts down when returning to idle, readjust as shown in step 17 until it runs properly. The engine runs properly when it goes to full throttle and back to idle without hesitation and without shutting down. Now it should be ready to fly with

Minor adjustments will probably be required on different flight days and may be required on each flight depending on weather conditions ie. changes in temperature, humidity, barometric pressure, and so on.

Many people think that it is harmful to run the engine at full throttle. You should be breaking in the engine the way you intend to fly it. Consider this: you will use full throttle and probably need full throttle many times during normal flight. You want full performance when you need it, ie. take off, and idle throttle when on approach to landing. These are not times that you want your engine to fail. Breaking the engine at low RPM's will not allow proper seating of parts and may actually cause problems because the internal parts were never allowed to seat properly. Full throttle will not hurt the engine if it is done properly, that is, initially run very rich and for short periods of time at leaner settings. This actually will extend the life of the modern RC Engine. Running it at low throttles will harm the engines and will shorten the life. In extreme cases, shorten it by having to dig it out of the ground after failing at a critical point in the flight.

In extreme situations, with ringed engines, the rings could actually crack due to connecting rod stretching in full throttle operation if you do not break the engine in properly. It will never run properly, and will never give full performance if not properly broken in. It will run erratically and

never accelerate properly and may shut down during a critical landing. Proper break in will give you full performance and a long engine life.

PRE-FLIGHT INSPECTIONS

Beginners to RC flying vary dramatically when it comes to building skills. Some are building their very first flying model and find it quite challenging while others may have built other types of flying models and find it rather easy. The kind of airplane has a lot to do with how difficult it is to get into flying condition. ARF's tend to be rather easy, requiring little more than final assembly while kits can be much more challenging. Additionally, correctly mounting radios and engines can be somewhat difficult, even for ARF airplanes. RTF's have that problem solved. Again, the engine and radio are already installed and, for the most part, already to go with minor trim adjustments.

For these reasons, we urge beginners to have their planes checked for air-worthiness by either their instructor or by a very qualified club member. Instructors will check for problems that need to be corrected. Common mistakes that must be corrected before the plane can be flown include having servos activate control surfaces in the incorrect directions (easily fixed by using servo reversing), not placing foam rubber around the receiver for padding, securing the battery to keep it from wandering around in flight, not properly gluing wing halves (on ARFs), not correctly gluing hinges, and improper center of gravity point. Keep in mind that these are but a few of the many things that can cause an airplane to crash, and the instructor must be on the lookout for many more.

Additionally, there may be things an instructor finds that may not cause the airplane to fail (yet) but should be repaired or adjusted in the near future. For example, certain control surface hardware (clevises, control horns, and linkages) works better than others. An instructor may be willing to help a beginner today, but ask that some things be changed before further help will be given. Don't forget to use some sort of securing mechanism on all clevis connections. Put a small (1/8th inch) piece of fuel tubing over the clevis to keep it closed. An aircraft that loses control of the elevator because the clevis disconnected from vibration or stress is not a pretty sight.

III. STEP ONE: TEACHING HOW TO MASTER TURNS & LEVEL FLIGHT

OBJECTIVE:

The objective of this section is to get the student to a point where they can keep the airplane in the air with no help from you. Though the plane may still be "flying the student" to some extent at the end of this step, at least they should be to the point that you are not constantly fearing for the airplane as they fly.

We assume at this point that the training airplane has had a trim flight and any necessary control surface adjustments have been made. We also assume that the beginner understands the basics of aerodynamics and flight, including a knowledge of the influence each control surface has on the airplane. Finally, we assume that the beginner understands the rules (especially the safety related rules) of your particular flying field.

The time it takes the student to master this step varies dramatically. Believe it or not, I have had students do so on their very first flight. But it usually takes longer. Regardless of how long it takes, students should not get the feeling that they are in a race to see how long it takes to master any step to flying.

Let me digress a moment. When it comes to time, beginners tend to think they should master flying their very first time out. When they don't, or whenever they think their not progressing fast enough, they tend to get down on themselves, especially if another beginner seems to be progressing faster. Part of the job as an instructor, will be to keep them from getting discouraged. Make it clear that everyone picks up the hobby at a different pace. Relate the problems you had when you learned to fly. Be sure their having fun. (If it's fun, who cares how long it takes?) Tell them if they push too hard, the problems they're having only get worse.

Begin on the ground by explaining the basics of turning. Explain that turning is basically a three step procedure:

bank with the ailerons,
maintain the turn with up elevator
level out with the opposite aileron.

Demonstrate turning with hand movements as well as on the stick of the transmitter. One instructor had a small plane mounted on a stick that he used to demonstrate the attitude of the aircraft during flight.

Explain that even trainer planes tend to be quite responsive and that only a little motion of stick will be sufficient to maneuver the plane. While the student cannot really get a feel for flying while on the ground, you must prepare them for what to expect in the air. By the way, we're assuming here that the student understands the basics of aerodynamics and flight. This, of course, includes an understanding of what effect each control surface has on the airplane! What about the rudder? - If the plane has ailerons, I'd recommend having the beginner ignore the rudder when turning for a while. RC airplanes, and especially trainers, turn quite nicely with a simple combination of aileron and elevator. While you may eventually wish to teach the beginner rudder coordinated turns, I find that this tends to substantially complicate the learning process, especially early on. If you intend to teach rudder coordinated turns, I'd recommend

waiting until the student is well along in step two before you introduce this more complicated turning method.

THE FIRST FLIGHT.

On the student's first flight, begin by demonstrating a turn. Try to get the plane in an attitude where the student can see both the plane and the transmitter to see the small amount of control you are giving (hold up the transmitter to show them). After entering the turn, stress how important it is to maintain the turn with up elevator. Also demonstrate how a trainer airplane tends to self correct, meaning minor aileron corrections may be required to hold the bank angle. Finally demonstrate exiting a turn with opposite aileron control. You may want to demonstrate this in both directions, stressing the three step nature of turning

- Bank with aileron
- Hold the turn with up elevator
- Straighten with opposite aileron.

THE BEGINNER'S FIRST FEW ATTEMPTS

You're using the trainer system, right? The plane is in the correct trim for straight and level flight.

Begin by getting the plane into a perfect turning position. You'll need to make it as simple as possible for the beginner's first few tries. I like to begin at a safe altitude by aiming the plane toward one of the near corners of the field (left or right). This way, soon after the student takes control (by your holding the trainer button on the master transmitter), he or she will immediately begin the turn. Always have them turn the plane in a direction away from the pits (turning right on your left side and turning left on your right side).

It is quite likely that the beginner will immediately roll the plane over on its back, so be ready for anything as you give them control! Again, you control when to take over. For the beginner's first few attempts, you will probably have to retake control soon after you push the trainer button. Don't be afraid of hurting feelings by retaking control! As soon as the student is in trouble and you retake control, right the problem and set the plane up again for another turn attempt. Alternate corners of the field. This forces them to practice left and right turns equally. Don’t forget, you are stressing safety all the time, either implied or explicit.

[As the instructor, you set the rules for when you retake control. Early on, tell beginners that there will be times when they may be in control of the airplane, yet you will still retake control. The first time has to do with the flight line. If it even appears that the student might eventually cross it and fly over the pits, retake control. While it is possible that the student may have been able to continue flying without crossing the flight line, don't take any chances where safety is concerned, especially on the beginner's first few flights. Second, set an altitude limitation. While learning how to turn, beginners tend to lose altitude in each turn they make. When the plane descends past a certain altitude, retake control, even though they may be doing rather well (this also gives them the goal of keeping the airplane above the established cut-off point). Third, set a distance limitation. If the plane gets so far away that it becomes difficult to see, retake control. If the club has these sort of restrictions already, then make sure you inform the student. If not, you may want to set a similar rule based on your own comfort level. Tell the student that if they get the plane into an attitude you don't feel comfortable with, you'll retake control. This may not

be caused by a problem or mistake on their part; you simply don't want the plane to get into an attitude from which you cannot recover!]

Though you have explained the three steps to turning on the ground and the student may have seemed to understand quite well, when in the air, the student will probably have problems remembering these three seemingly simple steps. Also, they will not be able to give the correct amount of aileron and elevator to make good turns. For these reasons, you will probably have to talk them through their first few turns.

Don't be afraid to talk to the student while they fly (though be careful to stick to the point so as not to get them confused). Here is an example conversation (though very one-sided) I would have with a student on their first few turning attempts. It truly typifies the kind of talking you will be doing to your own students. At this point, you have just set the plane up for the student to make a gradual left turn when you push the trainer button to give the student control of the plane. A dialog may be:

> *"OK. I've set you up to make a nice gentle left turn. Give a little left aileron to get the turn started and be ready to bring in up elevator. See that left wingtip drop. That's it. Not to much now or you'll have to give some right. That's it. You'll need some up elevator now. Waited just a little too long to bring in the up. See that nose drop a bit. Hold the turn with the up. Nose is still dropping. You need more up. That's it. Hold the turn until your heading back toward those trees. Good. Remember, you're turning left. Be ready to straighten with right. OK. Begin to straighten. Not too much now or you'll over-control. Good. Now let's try a right turn..."*

Be careful with how much talking you do. Stick to the main points of the step. In this case, bank with aileron, hold the turn with up, and straighten with opposite aileron. You may notice the student doing something or another that may be causing problems for something coming down the road and you have trouble resisting the urge to talk about it while the student is flying. Save any discussions that are not directly related to the subject at hand for until the plane is on the ground.

POSITIVE REINFORCEMENT.

VERY IMPORTANT: After each flight, be sure to review the flight with the student. Stress those areas where progress has been made and be sure to offer praise. For those things the student is having problems with, you now have the student's full attention and can offer advice and constructive criticisms.

One more point about talking to students as they fly. While it's good to talk to help them get comfortable with a new flying technique, you'll want to be sure that the student is not just mimicking your instructions and confirm that the student truly understands the maneuver you are teaching. Once they are following your instructions and turning quite well, keep your mouth shut for a while and just watch them fly. If they continue to do well, they truly understand the maneuver you have been teaching.

STEP BY STEP

If the student is having problems making turns (as most will), concentrate on each step independently. Begin by making sure they can give the correct amount of aileron control to get the desired bank angle. Beginners have the tendency to give too much control, rolling the plane to a very severe bank angle. You'll probably have to keep stressing how little stick control they need to give. Make sure they understand the relationship of bank angle to the plane's tendency to lose altitude. The more bank angle, the more the tendency to lose altitude quickly.

Once they can set the correct bank angle, concentrate on having them maintain the turn with the elevator. Make sure they are making gradual, level turns, neither gaining nor losing altitude (though gaining is always better than losing). Stress the relationship of bank angle to elevator. The more severe the bank angle, the more up elevator required to hold altitude (and the tighter the turn). Also stress that it is important to begin giving up elevator as soon as they see the wingtip begin to drop to the desired bank angle.

Beginners tend to wait too long, and the plane loses altitude before entering the turn. This is somewhat difficult to master, because if they pull in up too early, the plane simply climb (eventually stalling). I call this problem wishing the plane around with the up. Beginners also have the tendency of forgetting which way is up. The elevator stick may seem backwards to a person who has never been exposed to any form of flying. Stress that it's just like a full scale aircraft. Pulling back on the stick makes the plane go up. If they hold the transmitter more horizontally, it may help them remember this.

As they progress further in this step, stress the importance of maintaining the bank angle with aileron control throughout the turn, especially if they're flying a very self correcting trainer plane with a flat bottom wing and a lot of dihedral. Have them practice this by making full 360 degree turns. Have them fly the plane in a full gradual circle. Even a plane that is not very self correcting will require minor adjustments of aileron to maintain the correct bank angle. Once they master the 360 turn in one direction, have them practice it in the other. Also, once they can perform one 360 degree turn, have them continue the turn several times, making several 360 degree turns consecutively. This practice forces the beginner to maintain a gradual coordinated turn for a long period of time.

Finally, have them concentrate on exiting the turn by applying opposite aileron until the plane is flying level again. The most common problem here is that the beginner forgets which way the plane is turning and they attempt to straighten by applying the wrong aileron direction to exit. This, of course, sends the plane into an even sharper turn. As the instructor, you must be prepared for this mistake every time the beginner ends a turn! The lower to the ground the airplane is, the more important it is that you be ready.

There are several things you can do to help the student with this problem. One way (that many experienced fliers do not like) is to have the student physically turn with the plane. If they are facing the same direction as the airplane, it will be easier to determine which way to exit the turn. Another way is to have the student keep saying (out loud) which way they are turning throughout the turn. They will then know which way to exit the turn. Another common problem for beginners exiting turns is they continue to hold the up elevator too long. This of course, will make the airplane climb at the end of the turn, and possibly cause a stall. They must practice until they can exit the turn at the same vertical attitude as entered.

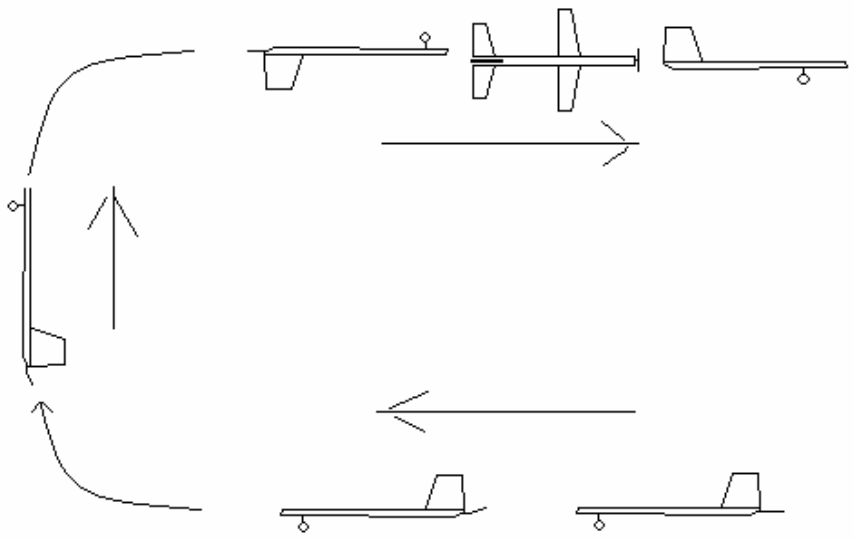
TWO MORE THINGS TO WATCH FOR:

First, since you are teaching turns in a step-by-step manner, you must be sure the beginner is not simply mimicking the stick movements you ask for. They must truly understand the turning process. By forcing them to make turns in both directions and in several different positions in the sky, and by keeping quiet and making them turn by themselves (after you think they understand), you should be able to confirm whether the beginner truly understands turning.

Second, beginners tend to turn much to severely. They bank hard, pull in a lot of up, and level out quickly. While their turns may look rather well, you must force them to turn gradually. When they turn so radically, it will be difficult (if not impossible) for them to come out of the turn on a predictable heading, which will be very important in step two to flying. If the beginner is having problems, it doesn't hurt to point out that turning gradually is the most difficult way to turn. Though they must master gradual turns, once they do, they can look forward to learning the Immelmann and Split-S turns, which are basic aerobatic maneuvers.

Definition Immelmann Turn:

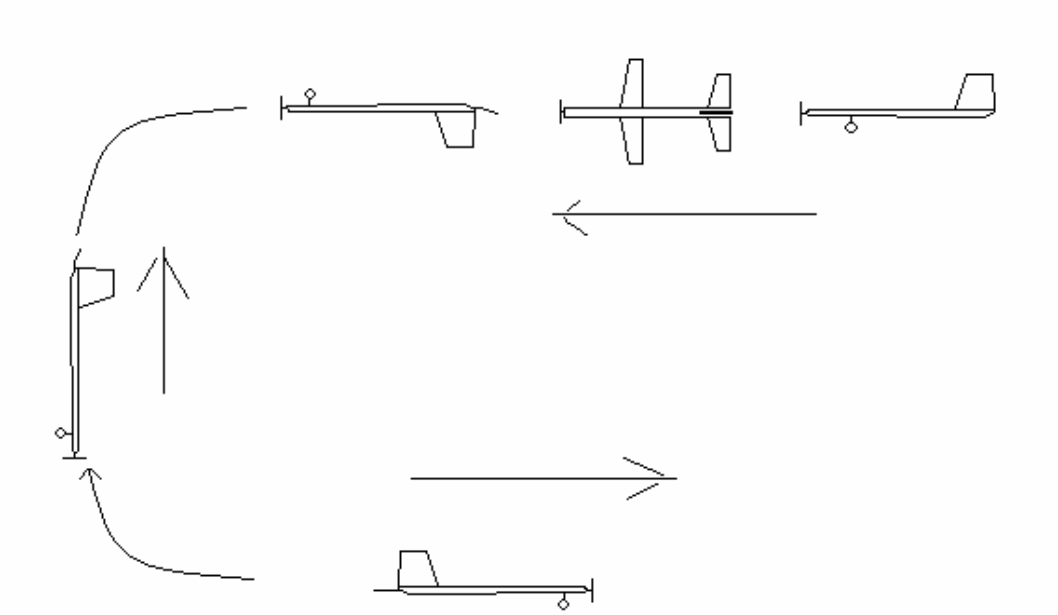
The aircraft flies in a strait line at full speed. Up elevator is added to do ½ inside loop. At the top of this half loop, up elevator is released and the aircraft is half-rolled to the upright and level flight in the opposite direction as was the entry. This maneuver was perfected by Maxx Immelmann as a combat turn early in the First World War.



Immelmann Turn

Definition Split S:

The Split S is just the opposite of the Immelmann. The aircraft flies in a straight line at half speed at a high altitude. The aircraft is rolled to inverted, the elevator is now pulled for a half loop, released once the aircraft is back to straight and level flight and is right side up headed in the opposite direction.



Spllit S Turn

RIGHT AND LEFT FROM THE VERY START

Be sure that the student practices left and right turns equally. With no intervention from you, most students will fall into the habit of making turns in only one direction. It has been my experience that beginners tend to favor left turns. Force them to practice turns in both directions.

Most beginners find it more difficult to make right turns. They may complain that the wingtip drops more quickly and more severely (along with the nose of the plane) when making right turns. They also complain that the plane tends to fall further into the turn while holding the turn with up elevator. This is related to how much engine thrust the plane has (possibly too much right thrust). Though some of this tendency can be removed by removing some right thrust, it also makes an excellent time to stress how small corrections must be made with ailerons during each turn. It also makes a good time to have them practice full 360 degree turns in both directions.

WHAT ABOUT PLANES THAT DON'T HAVE AILERONS?

Though you don't see them as much any more, there are trainer planes that have only rudder, elevator, and throttle. Believe it or not, these planes fly quite similarly to planes with ailerons. As you apply rudder, the wingtip will still drop. You still hold the turn with up elevator. And you still exit by applying the opposite rudder. You will notice, however, that the nose of rudder controlled airplanes tends to drop more severely in turns. Be sure you've practiced flying a rudder controlled airplane before you try to help someone for the first time. It takes some getting used to.

THROTTLE SETTING:

Most model airplanes are overpowered, including trainers. This means you usually won't need full throttle to keep the plane in the air. As you know, planes tend to be much more responsive at full throttle. For most of our practice flying, keep the throttle at a setting that ensures docile performance. As the beginner progresses, be sure they can handle the airplane at any throttle setting.

WIND AND TURNING:

Ideally, the wind will be calm during the beginners first few flights. However, do not consider the beginner competent with this first step until they have flown in wind of at least five miles per hour. They will find that wind presents its own problems to turning smoothly. It will appear that the plane will be sluggish when turning into the wind, while quite responsive when turning in a direction with the wind. This of course, means that different stick control amounts will be necessary with every turn. The best advice you can give is to tell beginners to fly what they see. If they give a little aileron control and the plane does not respond, they simply have to give more. Getting the student used to this idea early is very helpful. As we start slowing the airplane down for landing practice, this tendency for response to become sluggish will be compounded.

BALLOONING TENDENCIES:

Most trainers have the tendency to climb with speed, especially trainers with flat bottom wing design. The faster they go, the more they want to climb. While some of this tendency can be overcome with engine down-thrust, engine speed is only one factor that influences the plane's speed. As a beginner makes their first few turns, it is likely that the plane will lose altitude. As it loses altitude it picks up speed. When the beginner exits the turn, the plane will have the natural tendency to climb, due to the increased speed. This tendency is called ballooning, since the plane resembles a hot air balloon as it rises for no apparent reason. Be ready to explain this tendency. To avoid it, the beginner must make level turns. If the plane does not lose altitude in a turn, it will not pick up speed, and it will not climb at the completion of the turn.

The beginner will also notice a tendency for ballooning whenever the airplane is turned into a high wind. To the airplane, it is just as if airspeed increased by the wind speed. The plane will tend to rise. This can be corrected (to some extent) by applying down elevator as the plane comes into the wind.

Try not to let the student get too bogged down with trying to overcome ballooning. Though it may seem like the plane is doing something wrong, it is just a natural tendency for trainer planes. Students (and instructors) can waste entire flying sessions adding down--thrust to the engine and shims under the back of the wing in attempts to keep the plane from ballooning. While some marginal improvements may be made, in the end, the plane will still balloon when it picks up speed. It is much more important that the student concentrate on practicing to make level turns. Try to have them accept the fact that trainers tend to balloon. Tell them that their next airplane (probably a sportier plane) will either have less tendency to balloon or will not have this tendency at all. Demonstrate this on your own sport airplane.

YOU KNOW THEY'RE GETTING CLOSE WHEN...

One signal that the beginner is getting close to the completion of this step is that they begin to complain that the airplane always seems to climb. Be sure to praise them at this point! They have overcome their tendency to lose altitude in every turn. Now it will be a relatively simple

matter of flattening out their turns. They can bank slightly more severely with the aileron or not give quite as much up elevator to hold the turn.

When the plane gets too high, I simply have them cut the throttle a few notches and continue flying. Eventually the plane will descend. Once a comfortable altitude is reached, I have them increase the throttle a little and concentrate on making more level turns. By the way, I like to have beginners control the decent of the plane by themselves (instead of retaking control) since it makes an excellent time for the beginner to start manipulating the throttle.

WHEN ARE THEY FINISHED WITH THIS STEP?

Generally speaking, when the student can keep the airplane in the air for a whole flight with no coaching from you, they have mastered this step. Be sure, however, the beginner can turn left and right equally well. It is quite common that a beginner becomes much more comfortable with one way or the other, and ends up constantly setting up the plane to turn in the comfortable direction. Force them to practice turning in the direction they feel least comfortable with!

IV. STEP TWO: TEACHING HOW TO SET AND HOLD HEADINGS

THE OBJECTIVE:

The objective of this section is to get the student to the point where they can fly the plane under complete control at all times (in the air).

If the student truly mastered the first step to flying, this step should be relatively easy to master. You can begin stressing the importance of being able to set and hold headings even during step one. As they begin to make level turns (even after their first successful attempt), stress how important it is to come out of the turn in a predictable direction. This will be very important during the setup and final approach for landing!

SETTING HEADINGS:

By setting a heading, we mean the student must be able to exit each turn in a predictable manner. By holding a heading, we mean the student must be able to keep the plane flying in the headed direction (without wandering) for as long a period as required. Again, at the completion of step one, the beginner may be able to keep the plane in the air, but the plane may be flying the pilot to some extent. The beginner may still be reacting to the airplane instead of making the airplane react to stick movements.

Explain that the key to setting precise headings is knowing when to begin exiting the turn with the opposite aileron. The smoother and more gradual the turn the easier this will be. At what point opposite aileron must be applied depends on the severity of the turn. The more gradual the turn, the sooner the (equally gradual) opposite aileron is applied, and the easier it is to smoothly exit the turn on the desired heading. As mentioned in part one, beginners tend to turn much too severely, making it very difficult to exit turns precisely.

To practice, begin by making the student fly figure eights. Since it is easier to make turns in a direction away (so the plane never points to the pilot), have them start by making left turns on our right side and right turns on our left side. Stress the importance of flying much more precisely. Since you are flying on a rectangular shaped flying field, use each corner of the field as the target heading for each turn. Tell the student to told to maintain each turn until the desired heading is reached and come out of the turn pointing directly toward the opposite corner, and then hold the heading for a short period of time. While the first few attempts will not be perfect, this practice forces the beginner to think about exiting the turn very early in the turning process. The first goal will be to exit each turn with the plane pointing directly into a corner.

Once they master this (turning left on the right side and right on the left side), I have them reverse the direction of the figure eight. This forces them to make more difficult turns (turning right on the right side and left on the left side. Since the student must keep from flying over the pits, turns must be made in a timely manner. This tends to put a little more pressure on the student.

Figure eights are excellent for heading setting practice because you (the instructor) can easily monitor the beginner's progress. You will be able to tell if the student is catching on or still having problems. As long as the student has truly mastered step one and can consistently make smooth level turns, the two most common problems a beginner has at this stage is one,

exiting too early, or two, exiting too late. If exiting too early, the student must turn again to eventually get the heading they want. If exiting too late, the student will overshoot the desired heading and have to turn back. Both of these problems lead to over controlling the airplane. Talking the student through the first few turns can help with each of these problems.

If they have either of these two problems, stress the importance of being able to begin exiting the turn slightly before the desired heading is reached. The more gradual the turn, the easier exiting should be. By the way, this is the reason we said during step one that you should keep the student from turning too radically. While radical (very severe) turns may be easy for the student to master, when it comes to setting headings, radical turns are very difficult to exit in a predictable manner and lead to over-controlling.

Once the student has mastered figure eights (in both directions), have them practice free form turns. Based on the position of the airplane at a given time, call the turn you wish them to make. For example, if you say "45 degrees right", you should expect the student to veer off to the right on a new heading 45 degrees from the start. If you say "180 degrees left", I expect a complete turn to the left. This practice forces the beginner to fly the plane in new and different attitudes, and commonly turns up trouble spots (attitudes and positions in the sky with which the student is not yet comfortable). We all had trouble spots as we began flying (even some experienced fliers still have some trouble spots). For those areas the beginner has trouble with, give more practice. But at the completion of this practice, the beginner should be able to control the plane in almost any position in the sky!

HOW ABOUT A BIT OF A DISCUSSION ON TRIM.

This is about the point in the training when you should force the student to think about trim settings. They have pretty much mastered the ability to keep the plane in the air when the plane is perfectly trimmed. You should reinforce this by having the student get some practice with an out of trim airplane. On their slave transmitter, you can reach over and throw the aileron or elevator trim slightly off center. The beginner will be forced to determine what is wrong and correct the trim problem. Once you've started doing this with a beginner, you can repeat trim setting practice on the first flight of each practice session. Again, trim changes with airspeed. Have the student increase speed slightly, say five clicks or so, then re-trim for level flight. By the time the student solo's, he or she should be able to trim the aircraft. For the beginner, the entire first flight of the day may be spent trimming the aircraft. Then once done, minor adjustments in trim will be made during subsequent flights.

HOLDING HEADINGS AND FLYING WITH PRECISION:

Once the student has mastered figure eights and free form turns, you must stress the importance of being able to hold a heading. Even the most stable airplanes tend to wander from set headings based on wind direction and velocity. The student must be able to keep the plane going in a given direction. This must be mastered before they will be able to land. (During the final approach, the beginner must be able to hold the plane right on the **MIDDLE** of the runway all the way to the ground!) Using the figure below, notice how symmetrical the left and right sides are and how the turns at the left and right sides are squared off, that is, the aircraft straightens out and flies straight after the turn then starts the next turn then flies straight before the next turn.

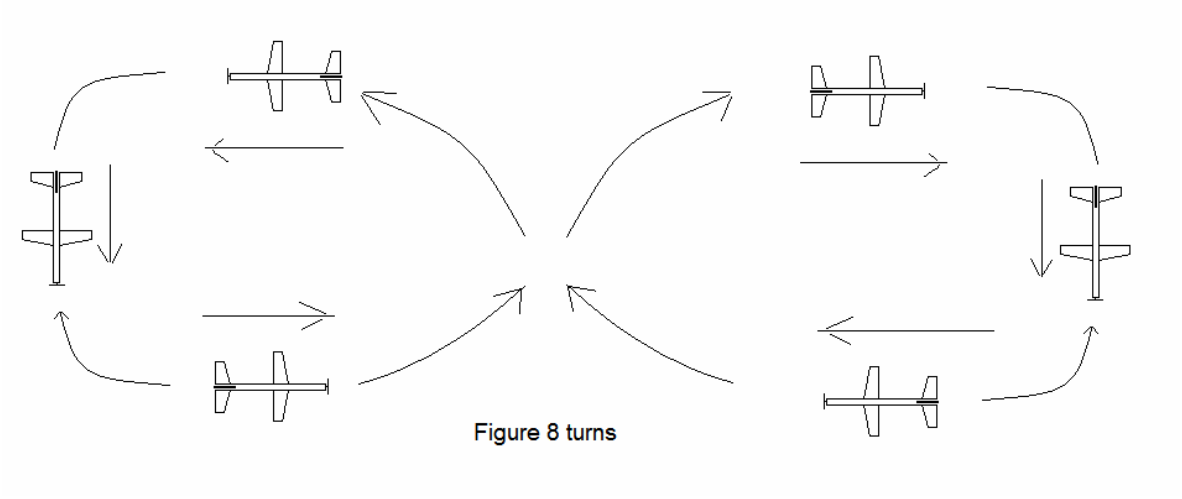
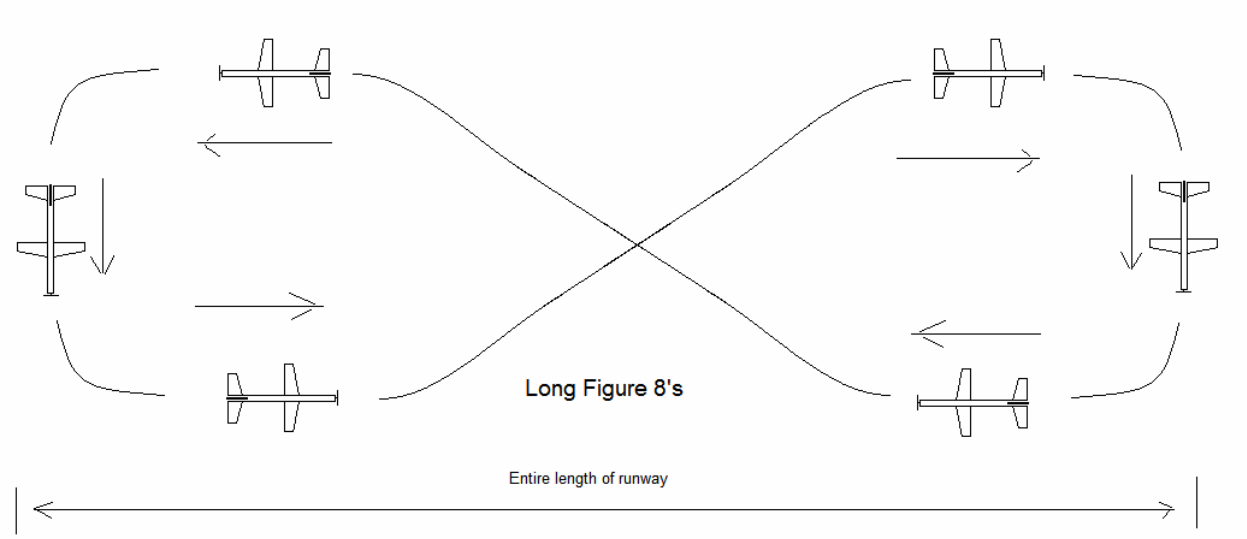


Figure 8 turns

For practice, once again you can begin with the figure eight. But this time, have the student extend the straight legs of the figure eight, forcing them to hold the heading for at least 100 ft at the completion of each turn. At the crossing point in the center, the flight should be straight and at about a 45º angle and for about 100 feet, straight and level. They must practice making minor corrections as the plane tends to wander from its desired heading. You should stress that the direction and amount of wandering will vary almost every time, based on wind speed, wind direction, and the planes attitude at the completion of the previous turn. They must always be ready to apply these minor corrections in order to hold headings. The eventual goal of this practice is to make perfectly shaped figure eights with the crossover right in the middle of the flying field. Once mastered, the student can truly fly the airplane with a great deal of precision.



Once they master the extended or long figure eights (in both directions), have them fly a pattern that takes them right down the middle of the runway (still quite high of course). One way to do this is have them fly a long oval shape with the near side of the oval right on the middle of the runway. Have them practice holding the heading on the runway for the entire length of the flying field. Be sure to reverse the direction of the oval in order to have them practice equally between left and right patterns.

WHAT ABOUT THROTTLE SETTINGS?

Most of the practice to this point has been at one throttle setting. As stated during step one, most students find it easier to fly with a throttle setting that is just strong enough to keep the plane in the air, making for a docile flying airplane. However, before progressing to step three, have them fly the plane at different throttle settings. When they decrease the throttle, the plane will become less responsive, simulating how a slightly under-powered plane will respond just after take off. As the throttle is increased, the plane becomes more responsive, simulating how an over-powered plane will behave during take off. Again, make note to the student that changes in throttle will definitely affect the trim.

IT'S TIME FOR AN EMERGENCY DRILL.

Now that the student has pretty much mastered the precise movements involved in making right and left turns as demonstrated in the figure 8 maneuvers, it's time that the student learns what to do in the event of an emergency. The most common of these is the 'Dead Stick' or the loss of the engine power. All the time that the student is flying, there should be something going through their minds… what to do in case the engine quits. Most of us do this rather automatically. We know where we will go, or should know where to go. During the training, the instructor should never allow the student to fly so far away that recovery to the runway is impossible. Stress that distance is not a friend of the RC pilot.

In the event of an engine failure, the student should quickly evaluate the location of the runway with respect to their flying position, attitude, and altitude. Demonstrate this by taking control and cutting the throttle to idle and bring the aircraft to a point where it can land and, if you want to, land it. Then get back in the air and hand the control over to the student. Have him or her climb to a good height, out in front of them, and cut the throttle to idle. Have the student bring the plane around to the point where the aircraft on a high altitude final, then add throttle. Continue this from different points in the sky until the student is comfortable with the drill. Then continue on with the training.

Doing at least one emergency drill like this on every flight will prepare the student for the inevitable. The dreaded dead-stick landing. It is not if, but when. It will happen and the student should be prepared for it, and be ready to make a good landing without power.

A NOTE ABOUT RUDDER COORDINATED TURNS:

If you wish to teach rudder coordinated turns, this would make an excellent time to do so. Use hand motions to help explain that the rudder can be used to help keep the nose up in a turn. As the plane banks in one direction (with aileron), the rudder can be used as a kind of elevator. The steeper the bank, the more influence the rudder will have.

[It may help to demonstrate this by performing a knife-edge maneuver with your sport airplane. In the knife edge, while the plane is banked ninety degrees, the rudder control does affect the plane as the elevator normally does.]

As the beginner gives aileron and the plane banks, opposite rudder can be given to counteract the natural tendency for the nose of the plane to drop. Keep in mind that most trainers will turn quite nicely without rudder control. In fact, the influence of rudder may make it quite difficult for the beginner to master turning. They may not even notice any difference if the rudder control

surface is small. For this reason, you may wish to omit rudder coordinated turns from basic flight training and save it for after the student solo's.

WHEN ARE THEY FINISHED WITH THIS STEP?

When the beginner has mastered the ability to fly the plane under complete control at all times, when they can fly the airplane in virtually any attitude, altitude, and speed, when they have gotten all of the left/right, up/down mistakes out of their system - and when they can set and hold headings, flying with precision - then their ready to progress to step three, making takeoffs.

V. STEP THREE: TEACHING HOW TO TAKE OFF

THE OBJECTIVE:

The objective of this section is to get the student to the point where they can taxi and take off.

The student may ask why is it that learning to take off is later on in the syllabus. Well, the answer to that is simple. The first part of any training of this sort should involve flying the airplane. Getting it up there is relatively easy compared to other aspects of flying, but not as easy as learning to land. So, once the student pilot can reasonable fly the airplane, the next step will logically be taking off, followed by, you guessed it, landing! The taking off process is short and quick. Usually one or two take off's will get the idea planted as to how it is done. Once that happens, it is easy to follow up on.

Another reason is that up until this point, it is relatively easy (though sometimes nerve-wracking) to train students without the trainer system. As long as you keep the plane relatively high, you can easily grab the transmitter out of the hands of a beginner when they get into trouble and still have time to right the airplane. However, as the student begins practicing takeoffs and landings, the plane will be very close to the ground, and there will be nothing you can do to save the plane if they get into trouble. You should make it very clear at this point (to beginners who do not have trainer systems) that in order to proceed it will be at their own risk. By this time, you have grown to know the student quite well. If they have shown the slightest tendencies that they may blame you for an accident which causes damage to their airplane, **DO NOT HELP THEM ANY FURTHER** until they have the trainer system. Additionally, I am sure you know of instructors who just flat out refuse to help students past this point without the trainer system. If you are a beginning instructor, my advise is not to continue training without the trainer system regardless of how persuasive the student may be.

SETTING THE PLANE'S GROUND TRACKING:

Experienced pilots can taxi and take off even if the plane is not perfectly tracking on the ground. In fact, if you've had a hard landing or two during training, it is likely that you may not have realigned the plane's ground tracking for the sake of saving some time. You may have simply held in some corrective rudder (coupled with nose or tail wheel) during the taxi run. However, beginners will not be able to handle a plane on the ground that does not track straight.

Before you turn the plane over to a beginner to take off, be sure the plane is tracking straight, and after every hard landing from this point on, be sure to check the tracking before the next takeoff. This cannot be stressed enough. In the hands of an inexperienced pilot, a plane that is not ground tracking properly can be very dangerous indeed (especially if the plane veers toward the pits).

One way for the beginner to set tracking (at home) is to let the plane role down a shallow grade (with the radio on). Many suburban drive-ways are perfectly graded for this. With the rudder stick neutral, let the plane roll down the grade and watch for left/right tendencies. Be sure to tell the beginner not to adjust for tracking with the rudder's trim (this will, of course, affect flight trim). Adjustments must be made mechanically, within the airplane.

THE TAXI.

Your flying field's particular taxi surface (asphalt, cement, grass, etc.) has a great deal to do with how hard it is to taxi. Personally, hard surfaces are usually more difficult since it is easier to get the plane moving too fast. A grass taxiway tends to slow the plane down quicker and requires more power. Unfortunately, you probably don't have control of your runway surface, meaning your students will have to get used to whatever you have.

Taxiing and making the takeoff run can be quite difficult to master, especially if your field has restrictions about takeoff directions. At some fields, for instance, pilots are only supposed to takeoff and land in an East or West direction. If the wind is out of the North or South, pilots must takeoff and land in a crosswind condition. As a general rule, you are not allowed to walk out on the runway to make a take off, meaning all pilots must stand at designated pilot stations. If your field has such restrictions, it will take your student longer to fully master takeoffs.

Depending upon the size of your flying field, practice taxiing may be frowned upon. At most (crowded) fields, no one can take off and land while a student practices taxiing. This means the beginner may have to practice at odd hours (early in the morning or right at dusk) when there is no one else around. Fortunately, once you give the beginner a few pointers, they should be able to practice ground taxiing by themselves.

First of all, if they have a four channel system with rudder attached to steering on the left stick, they will probably find it awkward to precisely use their left hand. They will also find it difficult to control throttle and rudder independently. Begin by making them get comfortable with the left stick without the engine running. Before they start, however, check how much nose-wheel movement the airplane has. If it is excessive, have the student remove some of the movement until the nose-wheel movement is only enough to turn in long sweeping turns rather than short circles. This will assist in over-steering which can possibly tip over of the airplane.

Once they can move one control without the other, explain the plane's ground handling characteristics. You have been doing a lot of taxing with their airplane up to this point, and while different airplanes can have dramatically different ground handling characteristics (tail dragger Vs tricycle gear, for example), you should be able to help them understand how responsive their plane will be on the ground.

Be sure to explain the plane's natural tendency to accelerate quickly as soon as it begins moving. You may often see many beginners (on a grass field) who slowly increase the throttle to the point where the plane begins moving and don't realize the plane will continue accelerating until the throttle is reduced. Teach beginners to quickly burst the throttle to about half way and back to idle using short quick bursts. This way they can get the plane moving slowly and stop any time the plane gets moving too quickly. As they develop a feel for what it takes to get the plane moving, they will make the plane move smoother. But first and foremost, be sure they keep the plane moving slowly - be sure to be ready to retake control as soon as the plane gets moving too quickly. As for steering with left and right, it may take quite a bit of practice, since it must be done with the left hand. Also, the same left/right problem they had in the air when the plane is coming toward them may recur.

TAKE OFF PRACTICE:

Once they can handle the plane well on the ground, have them head the plane into the wind practice some high speed takeoff runs. Don't let them take off quite yet. As soon as the plane builds up speed, have them cut the throttle. Force them to see how little rudder it takes to make

the plane respond at high ground speeds. Beginners have a tendency to over-control with rudder their first few times, so be ready to retake control at all times (keeping your master transmitter set to idle).

ACTUALLY TAKING OFF:

By this point, the beginner should be quite comfortable with handling the plane on the ground. But you'll still want to make it as easy as possible for their first few takeoffs. Explain that taking off is just a matter of building up flying speed while heading into the wind. Once flying speed is reached (they should know when flying speed is reached by having watched you do it many times), they must apply just a small amount of up elevator (though some well trimmed planes may actually lift off by themselves). Once the plane comes off the ground, the nose will be pointed up slightly and they can release the up elevator. If the plane is properly trimmed, the plane will continue its gradual climb at full throttle until it reaches a comfortable altitude and can be turned. As the plane rises, they must be ready to make minor corrections to hold the plane's heading directly into the wind (with aileron) and to maintain a gradual ascent (with elevator). **ALWAYS HAVE THEM MAKE THEIR FIRST TURN AWAY FROM THE PIT AREA!** Once the plane has reached a safe altitude, the throttle can be cut. Beginners tend to be so nervous after their first few takeoffs that they forget to cut throttle. Of course, you should demonstrate taking off prior to having them do it.

As they increase throttle for takeoff be sure you match your master transmitter's throttle setting to theirs in the event you must retake control.

BEGINNERS HAVE PROBLEMS IN THREE AREAS.

First, they have problems holding the plane in the proper heading with the rudder while the plane is on the ground. This can be very dangerous if the plane wanders off in the direction of the pits. Be sure to let them know that just because they started the takeoff roll does not mean they have to take off. If anything looks wrong or they feel panic for any reason, have them cut the throttle! By the way, this is why the high speed practice runs are so very important. During these runs, the beginner does not expect to take off and will be cutting the throttle every time. With this experience, they will be much more likely to cut the throttle at the first signs of problems during actual takeoff runs.

Second, when taking off in winds over about 2-3 mph and especially with a cross wind, beginners have trouble holding the wingtips level after the plane lifts off. Since the plane is not moving very fast at this point, it may respond rather sluggishly. The beginner must be ready with firm, accurate aileron control. When taking off in any kind of cross wind, be sure to make them predict which way the wind will tend to blow the plane as it lifts off the ground. This way, they will be ready to apply the opposite aileron.

Third, beginners tend to apply too much up elevator to get the plane off the ground. Or they hold the elevator in too long. Either way, the plane will have the tendency to stall soon after liftoff.

PRACTICE, PRACTICE, PRACTICE

Most beginners think they have mastered takeoffs with their first successful one, regardless of how scary it was. You must stress that each takeoff will be different, and it will take many

takeoffs to become fully proficient. Wind direction, wind speed, and rudder sensitivity will make for a few nerve-wracking moments. As soon as the beginner has successfully taken off, retake control, land the plane, and make them do it again - and again - and again. If all practice is done on a nice calm day, be sure you are with them the first few times they takeoff on windy days.

WHEN HAVE THEY COMPLETED THIS STEP?

When you are confident that they are in complete control on the ground, when you have seen them make a mistake and know enough to cut the throttle (they recognize when to abort takeoffs), when they can repeat the takeoff roll time and time again regardless of wind conditions, when they can maintain the takeoff heading in a nice gradual climb over and over again - then they're ready to go on to the fourth and final step - landing.

VI. STEP FOUR: TEACHING HOW TO LAND

THE OBJECTIVE:

To get the student to the point where they can make consistent approaches from both direction and land.

A NOTE ABOUT ENGINE RELIABILITY

This step requires a great deal of throttle changing. Before starting this step, it would be wise to confirm that your student's engine will maintain idle, go from idle to full, and in general, perform without stopping or stuttering at all throttle settings. In section II of this manual, we discussed engine break in. This is where proper engine break in becomes a serious issue. You should always follow the instructions provided by your manufacturer on engine break in. The guidelines shown above in Section II are guidelines based on what all manufacturers and very experienced pilots recommend. Following these instructions will insure that your engine is ready for all situations in flight and especially in landing, and will give you long engine life.

IS THE STUDENT PILOT READY TO LAND?

If all steps to this point have been truly mastered, landing will simply be an extension of what the student already knows. However, if they are having problems with this step, it should be taken as a signal that further practice (especially with step two) is needed.

TEACHING SLOW FLIGHT CHARACTERISTICS

Before the beginner can begin learning how to land, they must understand how the plane responds at slower speeds. With the plane rather high, have them reduce the throttle to just above idle and have them try to fly the figure eight pattern. Have them take note of how the ailerons respond more sluggishly. Also have them note how, at idle, it is impossible to keep the plane from losing altitude (especially in the turns). Most importantly, have them note how if they try to maintain altitude by pulling back further with up elevator, the plane will eventually stall. This is as good a time as any to again bring up trim. Normal flight trim sets the ailerons, elevators, and probably the rudder trim for a straight and level flight at a specific throttle setting. What happens when you land? What is the process? Well, first of all, we are on our downwind leg and reduce throttle to half. The airplane slows down. What just happened to the trim? Is the airplane now trimmed for straight and level flight? No, it is not! From this point on, you will be holding or adjusting “trim” as you go through the turn to base then final. When you make that turn to final, your are at minimum (idle) throttle setting. The airplane will descend slowly and as it does, it will be losing airspeed. Let’s continue with the discussion.

As they continue to lose altitude in their figure eight pattern, eventually have them kick the throttle back up to regain altitude. Have them repeat this several times. Be sure they can still maintain control even at slow speeds (especially holding a heading into the wind). Be sure they know at what point the plane will stall. And be sure they know what tends to happen during a stall. Fortunately, most trainers are very stable in a stall and no radical controls will be required to recover (though you may wish to explain that more aeorbatic airplanes may not be so forgiving when they stall).

In step two, we had the beginner flying with precision. We had them flying right down the middle of the runway (in an oval pattern). The goal was to hold the heading all the way from one end of the field to the other. Now have them repeat this practice (still up high), but this time have them reduce the throttle for each pass down the middle of the runway. Again, that throttle setting has been reduced. Trim is necessary, but, you cannot "just adjust the trim knobs", you must adjust the elevator for trim and hold it in. Again, be sure they can hold the heading for the length of the field at idle. Have them increase the throttle at the end of each pass and go around. Be sure to make them practice this from each direction.

[Note: Even though the wind will be blowing from only one direction on a given day, and of course the actual landing must be done into the wind, have the beginner practice approaches equally from both directions (from the left and from the right). This will prepare them for days when the wind is blowing from the other direction.]

PRACTICING APPROACHES.

Do this over and over again. During the actual approach, of course the beginner must begin letting the plane come closer to the ground. But first have them practice the approach pattern up high. Teach the student pilot a symmetrical approach pattern, that is, the same basic pattern can be used from either side of the field (left or right). This also makes it quite easy to practice from both directions.

One approach is to use a modified figure eight pattern for teaching approaches. Starting with the plane flying right down the middle of the field from right to left, have the student veer off to the right (at about 45 degrees) shortly after the plane passes by. Have them hold this heading until the plane has made sufficient room to make a left final approach turn. The student will then begin a long sweeping left turn with the goal being to end the turn with the plane perfectly aligned with the middle of the runway.

At this point they cut the throttle to just above idle and hold the heading just until the plane passes by. The student then increases the throttle. Note to the student that he or she should keep the aircraft in a straight line as it gains speed and altitude. Then have the student veer to the left (at about 45 degrees) telling him or her that this is called going around. Use this term over and over again. The heading is held until enough room is made for a right approach turn. The student will then begin the long sweeping right turn to line up with the middle of the runway.

This is repeated over and over again. As the student gains proficiency, the throttle is cut earlier and the plane is allowed to come closer and closer to the ground. While all of this may sound a little difficult, if the student has truly mastered setting and holding headings, believe it or not, this is actually rather easy! All we are really adding at this stage is the increase and decrease of the throttle.

THE FINAL APPROACH TURN

Though this is rather difficult to explain to students, the student must understand that the nose of the plane must maintain a slightly downward attitude throughout the final approach turn (especially if the throttle is cut). This is how we cause the plane to maintain airspeed as it comes to the ground. The more wind there is, the more important this point becomes (and the more severe the downward attitude). While some pilots try to counteract the wind with higher throttle settings, the descent of the airplane allows much finer control of airspeed than throttle. If the

nose of the plane balloons up at the end of the final approach turn, the plane will eventually stall. It will be impossible to maintain airspeed, and if very close to the ground, could result in disaster. As the student is practicing approaches up high, have them pay particular attention to the nose of the airplane. A great rule of thumb is if you can see the bottom of the aircraft, your nose is to high. But, don't drop the nose to much, you want it to come in as straight and level as possible with a SLIGHT nose down attitude. This will maintain a good approach speed reduction as the aircraft loses altitude to the point where the next step will "just happen". Remember to hold that trim!

ACTUALLY LANDING

Once the student has progressed to the point where they can consistently align the plane with the runway and bring the plane to within twenty to thirty feet from the ground, they are finally ready to land. Once again, remember that beginners tend to rush this. You must determine when their ready. If anything, a little more practice than necessary won't hurt. Also, remember to be aligning your master transmitter throttle setting to their transmitter, so you'll be ready to take over at any moment! Take a look at these suggestions made by another instructor pilot concerning the approach and landing.

Landing Errors

1. LANDING EVERY TIME.

Don't tell yourself to touch down every time you make a landing approach. Force yourself to go around if the approach isn't a good one. A bad approach results in a bad landing 99% of the time. You should actually be practicing approaches, not landings. When you make a bad approach, go around, set up, and try it again. When you make a really good approach, then throttle back all the way to idle and land. Unless you are an expert, the approach determines the landing. When you have a good approach the landing will just about do itself.

2. TOUCHING DOWN BEFORE YOU PASS IN FRONT OF YOURSELF.

Have you ever done this? You become nervous to land because of wind or maybe it's just not one of your "good" days. To hopefully make the landing easier, you make a big pattern, dragging it out. You end up touching down way before you get back in front of yourself. Is this how the landing went? BAM, the main gear spreads out. BAM, the nose gear bends. BAM, the prop breaks.

Sound familiar? It's a very common landing error. Let's analyze the touch down location. There are three places you can touch down, before yourself, right in front and past yourself. Right out in front is best. You have the best view of fuselage angle and the descent rate. Past yourself is okay until you get way past. The airplane is directional—right is right and left is left. The further away you get, the harder it is to tell the descent rate, but you can still set the airplane up slightly nose high and let it touch.

Now, let's look at landing before you get to yourself. The airplane is coming toward you so steering appears to be reversed. Actually, right is still right, that is right movement on the aileron causes the aircraft to go right, but being tense makes this appear to happen and being a student makes it worse. From a nose-on position, it's hard to tell the fuselage angle

and the descent rate. This is the worst case for making a good landing. Even experts can't consistently make good landings far away from a nose-on position.

As an instructor, give your student an even chance. You should work on having the student judge the wind, speed, distance, and altitude of the aircraft. Have the student turn at the right time.. not to early and not to late. Set up that approach so that the landing is in the right location. This should have already happened in previous approach practice sessions so he or she should already know when to turn. It is better to have the student turn early, than late but ideal to have them turn at the right time. You can see everything better and judge the touchdown better when the aircraft is right in front of you at touchdown time.

3. SEEING THE BOTTOM OF THE AIRPLANE.

We mentioned this earlier, but it is a good point that should be stressed. If you can see the bottom of the airplane during a landing approach, the nose is too high and the aircraft will eventually stall. The higher it is, the sooner it will stall. You need to either add power and go around or use the elevator stick to lower the nose. If you are set up on a final approach, the nose of the airplane should be down in a glide position. Even after you solo, stand with a couple of good fliers and watch the airplane on landing. You won't see the bottom of the airplane. Try this: Climb to a comfortable altitude. Make it higher than that. Now, go to the end of the upwind side of the runway and turn into the wind. Reduce the throttle to idle. Watch the airplane drop. Try to keep the nose up and level. Raise the nose ever so slightly, a bit at a time. Watch the airplane as it slows down to the point where it loses airspeed. It will stall. Add throttle and recover and try it again. Do this over and over again until you are comfortable with the understanding as to what airspeed it will stall and remember this for your approaches.

4. UNDERSHOOTING THE RUNWAY.

When you make a landing approach, you normally set up parallel to the runway on a downwind leg, throttle back, and turn to final approach. You can either make one big, sweeping base-to-final turn or you can square the pattern off with a base leg, then turn to final. Most beginners set up wide like they are going to make a square off pattern, then turn too tightly and angle in to the runway.

There are three ways to line up for final approach.

1. One, the right one, is exactly in line with the center of the runway.
2. The other is to overshoot a little past the runway and angle back.
3. The third is to undershoot and angle toward the runway.

The last one is the most common and the worst. When you undershoot, the airplane ends up aimed right at you. Nose on is the worst position for control. It is hard to see small movements and to get the correct attitude for landing. Nose on is also the least safe direction. You are aimed at yourself and must make a turn or go around.

Next, undershooting can put you high on final. Normally this wouldn't be too bad since most beginners land short, but it can put you in a position where you have to make a turn to keep from going over your head. This is a bad position for turning. You are low to the ground and staring at the nose of the airplane. All of these make undershooting the runway the

worst position to land. Overshooting, while not perfect, is not that bad. If you overshoot, you will be angling across the runway away from yourself—a safe direction to be going. You can usually see the side of the airplane so making a turn isn't that hard.

The solution, if you like to make one sweeping turn, is to set up closer to the runway and vary your bank to roll out in line with the runway. Or, you can make a definite base leg and not turn until you are in line with runway.

5. BOUNCING AND PORPOSING.

Bouncing is caused by a very hard landing where the springiness of the gear flings you back up into the air, or it is caused by touching down on the nose gear first. Nose gear first landings guarantee a bounce or a series of bounces called "porposing" for the sea mammal who seems to continuously leap up into the air and splash back down. Lack of concentration and inattention can cause you to let the nose gear touch first. When you get to a couple of feet from the runway, you should concentrate on getting the nose slightly high. If the nose wheel is higher than the main wheels, you can freeze on the controls and just let the airplane land itself. From a couple of feet altitude, you can't hurt it. Normally, in a good landing, at those final few couple of feet of landing, your inputs to the elevator control will be slow and constant until the airplane settles down for a soft and straight landing without bouncing or porpoiing. This is the goal. This is what you want your student to strive for.

6. THE "SLOW CURVE ERROR."

"Slow Curve Error". You see this error all the time and normally don't recognize it. The airplane makes a slow, shallow curve away from the pilot usually ending up on the far side of the runway, maybe in the grass. Here's what causes it. Lack of experience and natural tenseness as the student gets low and close to the runway causes the pilot to make very small errors. The student will make steering corrections, but it is in the wrong direction. The student will immediately notice the airplane is turning the wrong way so you level the wings. Now the student will make the steering correction again, and again it is in the wrong direction. This continues and the airplane nibbles away at a slow, curving path away from the pilot.

To cure the Slow Curve Error, you need to practice some low approaches, flying the airplane low and slow past yourself while trying to keep it in the center of the runway.

NOW, BACK TO THE TRAINING PROGRAM.

Before letting the student land, explain that landing (if done right) is really nothing more than letting the airplane drift to the ground. Explain that if they do it right, they will not have to force down elevator into the approach to get the plane to come down. It will do so naturally because of the low (idle) throttle setting, but will not do so as much because of gravity. To much low nose and the aircraft will not slow down quickly causing the student pilot to add nose which slows it down but it may do so more quickly than desired forcing the nose to go low again, and so on. The best approach is when the throttle is maintained at idle and the nose is kept just so the pilot cannot see the bottom of the aircraft, (here it is again… it MUST be important!) BUT the nose is not high to cause it to slow to quickly. It should be a long slow event that slowly bleeds off airspeed at the rate that allows the aircraft to settle down into a position for the final landing process. Again, hold that trim.

During the last twenty to thirty foot of decent, the beginner must keep the wingtips nice and level. As when taking off, they have to be ready with sharp, precise corrections to keep the plane on the center of the runway. Again, the natural tendency of the plane at idle will be to descend, so if the proper heading is maintained, it is a relatively simple matter of waiting until the plane comes to the ground. When the plane drifts down to within about 1-2 feet above the ground, explain that they should gently pull back on the up elevator to cause the plane to flare out. Still, watch that not to much flare is put in, just enough to raise the nose in the proper position to land, as explained above, ideally with slow steady inputs to the controls for a nice soft touchdown on the main gear, not the nose gear! Slowly pull in elevator to flare slowly and evenly until the aircraft touches down on the main gear. On a no-wind day, if the approach is a good one, the pilot will slowly pull elevator until the stick reaches the stops and the aircraft is rolling smoothly on the ground. The transition from air to ground was perfectly maintained until the airplane is simply rolling to a stop because of the remaining speed.

A beginner's first few landings tend to be a little rough. Though the correct amount of approach practice should help them overcome nervousness, landing can be especially unnerving. Beginners tend to panic when low to the ground. They forget which way to turn, especially if minor aileron corrections are necessary. I tell them to remember that if approaching from the right, right is your friend, meaning if they panic, giving right aileron will take the plane in the direction away from the pits. If approaching from the left, left is your friend. Dumping the plane is always better than flying into the pits.

Practice, practice, practice. Although a beginner's first landing is a great confidence builder, do not let the beginner think they have mastered landing just because they have done it once. As with taking off, every landing will be different. While the beginner will be very anxious to begin flying by themselves at this point, be sure they have practiced landings over and over again - in several directions and in different wind conditions.

TOUCH AND GO'S

One excellent way to practice landing (and taking off) is with touch and go's. After landing (without killing the engine), have the beginner taxi back, take off, and land again. As they gain proficiency, have them reapply throttle as soon as the plane touches down, then rolling to accelerate and gain airspeed, then take off just like you did in the process above, that is, long and straight until good speed and altitude is reached then turn to get in the pattern. This is called performing a true touch and go.

AGAIN, WHAT ABOUT DEAD STICKS?

It is likely that at some point during training you had a few dead sticks. The beginner got to see how you handle them, but they should also practice them, since sooner or later, we all have to land without power. As mentioned before, one obvious way to practice is to simply cut throttle and pretend the engine is no longer running. At first, have the plane in a nice approach position so the beginner can land with relative ease.

As you continue practicing, get the plane into more precarious conditions when you cut throttle. Even if you just have the beginner tell you what they would do if the engine kills in a given position may be good enough. In any case, be sure the beginner is prepared.

IV THE SOLO

ARE THEY READY TO FLY BY THEMSELVES?

The whole point of RC training is to get the beginner to the point where they no longer need your help. If they have successfully completed the four steps we have given, they should be ready. Make sure that they understand, however, that they are by no means expert pilots. The practice they have done has been with close supervision. In the real world, there will be no instructor there to take control when things go wrong. They could still get the plane into rather precarious situations. This knowledge should inspire them to be quite cautious for a while.

SO YOU SOLOED—NOW WHAT?

Achieving the level of flying ability to go it alone and fly your RC model without the assistance of an instructor is a great feeling. You have learned a lot, made some mistakes, and put in the effort and time to master the basics of a fairly difficult sport. You have earned your wings. Where do you go from here?

Most pilots want to keep improving their skills. They want to step up to bigger, faster, more maneuverable airplanes. Buried in the depth of our minds are visions of performing flawless aerobatics like a TOC competitor, the only limits of our performance being that of the aircraft. Most of us know that isn't going to happen. We just don't have the time or the natural ability, but we still want to become better, and to keep improving. How best then, to proceed?

One good way is to take the PET approach—Practice, Education, and Training. This is what most pilots do, even though they may not consciously give it much thought or planning. They continue to practice the basics with their trainer—improving landings, handling windy conditions, and striving for a more graceful, smoother flight. They learn from other pilots, ask questions, and read magazine articles to better understand flying. All well and good.

Further training, however, seems to take a backseat. It is not too often that pilots with newly-earned wings are seen at the flightline with an instructor beside them, with or without a buddy cord. More likely, the new pilot relishes the opportunity to show his peers that he is competent and can manage quite well on his own. Nothing wrong with that. It builds confidence, but it may also slow the progress the new pilot desires. In the worst case, it may even allow some bad habits to develop that result in unexpected crunch testing. It may be impeding the learning process and preventing the growth of knowledge and skills.

Full-scale private pilots are required to take check rides with instructors every two years. These rides provide an opportunity for the pilot to see how well his abilities are being maintained, where improvement is needed, and what bad habits may be forming. Most pilots don't wait two years for this required event to take advantage of an instructor's experience and knowledge. They take frequent flights with instructors to learn and to sharpen their skills.

There is no reason it should be different with Radio Control (RC) models. Instructors are there to help, even after a pilot solos. Although there is no formal program in the club to advance to higher levels, there is no reason to not take advantage of what a more experienced pilot has to offer. There is nothing wrong with being back on a buddy-box if you need help in learning to fly new maneuvers, or with better handling crosswind landings. Don't be afraid to ask for help, but this type of training session would be better if scheduled other than on Tuesday Training Days.

Usually the new pilot is chomping at the bit to build a new airplane and get it in the air. It's a higher performance airplane than the old trainer. This is another place where the instructor or experienced pilot's help can be invaluable. You may think you are ready to step up to a new airplane, and this is good. But it is wise to get an unbiased opinion of whether you are actually ready, or if you may need to bolster your abilities in certain areas. There is nothing worse than taking a new airplane up on its first flight and find you can't handle it. Sweaty palms and weak knees are quick to show, panic sets in, and the result is predictable. This is not what you had planned.

The best approach with a new airplane is to hook up with an instructor or other experienced pilot. Let him look it over for airworthiness. Let him take it up on the maiden flight. He can then offer whatever advice may be necessary to correct any problems, and make adjustments that will fit your capabilities. This may mean resetting control surface travel or balance to provide better stability, and easier handling.

Hook up on a buddy-box when you first take over. Now you have some back-up, and the pucker factor remains in check. You also have an opportunity to get an expert opinion about how the airplane performs or why you may be having difficulty with some aspect of its flight. It also allows you to let an experienced pilot demonstrate the airplane's capabilities and shortcomings, if any. This provides an opportunity to learn the best ways to fly this particular aircraft, and avoid learning the "hard" way.

Unfortunately, there is usually some point in the path to becoming a better pilot at which overconfidence grabs us. It just seems to be a natural thing for most of us. Some pilots are able to avoid it, but most will, at one time or another, fall prey to the feeling that they are better than they really are. The result is predictable. Most of us have experienced it.

Confidence is good. It is a necessary part of flying. It is part of the foundation from which we improve. But it should be confidence based upon knowledge, not hope. This is where the PET approach comes in. Practice the basics of flight until they are solidly-formed into habit. Even straight and level flight—the most basic of all—needs continued practice.

Too simple, you say? Most maneuvers begin from straight and level flight. If not precise at the start, a maneuver can end up looking like something completely unplanned.

Add to your skills gradually, and practice each small part until you are confident of the outcome. As you attempt new things, ask others and listen. Read everything you can find. If you don't understand, keep asking. On a regular basis, hook up with an instructor to get feedback on how you are progressing. Let him demonstrate new things with your airplane, and give advice to help you improve your skills.

Not all pilots want to be top notch aerobatic masters. Many are content to just build good looking, good flying airplanes, and spend some time at the field enjoying some relaxed easy flying along with the usual hangar talk and socializing. That's as it should be. Just use some PET along the way to make sure the "relaxed easy flying" part is truly that, and you are enjoying this great sport in the manner you desire.

V. OTHER IMPORTANT THINGS BEGINNERS MUST KNOW

Here we include discussions you should relate to beginners as they learn to fly. These presentations are made directly to the beginner, so feel free to copy and distribute this information to your students.

SAFETY! SAFETY! SAFETY!

The time we spend at the flying field is intended to be fun, right? From the time we pull into the parking lot until the time we pack up to leave, the only thing on our minds is to enjoy the time away from our troubles. Nobody likes going to out to the field only to be bombarded with a bunch of rules and regulations. And of course, no one likes to be yelled at for doing something wrong. We all want to go about the business of having fun.

Unfortunately, our hobby can be a dangerous one. As flyers, we must all treat the hobby with respect and acknowledge the potential for danger. There are numerous times when what one flyer thinks is safe and acceptable will be totally rejected by other flyers on the flight line. We've all heard and seen what happens when a fellow flyer steps out of line. It isn't a pretty sight.

Truly, no intelligent flyer will intentionally do something to cause an accident. It is only when one flyer or another makes an unintentional mistake that accidents can occur. While beginners bear the brunt of the silliest mistakes, even experienced pilots have been guilty of unwittingly breaking safety related rules. In this section you will find several safety related guidelines. They will all be explained so that the reasoning behind each rule will help to enlighten beginners and is with why everyone should consider them so very important.

PERFORM A CHECKLIST:

The below is an example of a simple yet effective checklist that each flyer should perform:

BEFORE LEAVING THE HOUSE

→ Do you have the transmitter with the correct channel, your airplane, wing, rubber bands or wing bolts, glow starter, electric starter, proper fuel, and your flight box?

→ Check your airplane and transmitter batteries. Is there any damage to the airplane, wing, or covering? Turn your transmitter and receiver off.

→ Do you have cold drinks, a hat, sun block, sunglasses, insect repellent, and long pants for walking in the woods?

BEFORE A NEW MODEL'S FIRST FLIGHT

→ Is the model too heavy? Is the center of gravity within the range shown on the plans? Is the model balanced side to side?

→ Check the airplane.
Are all flying surfaces at the proper angle relevant to each other?

Are the control surfaces securely attached with all snap-links closed?
Are the control throws in the proper direction and amount?

→ Check the hardware.
Have all screws been attached to servo horns?
Are all engine screws tight?

→ Check the fuel system.
Is the fuel tank level with the flying altitude of the airplane?
Is the carburetor at the same height (not above) as the fuel tank?
Is the fuel tank clunk in the proper position and moving freely?

→Perform a range check
Has a full range check been performed on the radio?
Has the flight pack been checked with a voltmeter?
Is the receiver and battery been protected from vibration and shock?
Is the receiver's antenna fully extended and not placed near a fuselage with any sort of metallic covering?

BEFORE THE FIRST FLIGHT OF THE DAY

→ When you remove the transmitter from the car, make sure it is off. Put your AMA card in the slot and the transmitter in the impound if someone already has the frequency.

→ Before putting on the wing:
Check all servo mounts for loose or missing screws.
Check all wiring to make sure there are tight connections and no broken wires. Check for broken antenna wire.
Check wing mounting blocks to make sure they have not broken loose, or if using rubber bands, check rubber band pegs for tightness.
Check the vertical and horizontal stabilizers for damage. Make sure the fuel tank is not loose in the airplane and the clunk (fuel pickup) is in the back of the tank.

→ Check landing gear for loose wheel collars or bent materials.

→ Check for holes in the covering.

→ Make sure the muffler is attached and the engine mounts are tight on the firewall.

→ Is the propeller tight?

→ Check the throttle linkage.

→ Pull on the ailerons to check hinges.

→ Check the aileron servo and linkages.

→ Check rubber bands for cracks or oil.

→ Make sure the wing is on straight and is square with the fuselage.

→ Make sure the wing is on tight if using bolts, and that both bolts are in the proper holes.

→ Check the balance before filling the fuel tank, and after filling the tank, check for leaks.

→ Get your transmitter from the impound. Make sure you tag your frequency. Turn on your transmitter and then turn on the receiver in your airplane. Stand behind the airplane and check that all control surfaces work properly and move in the correct direction.

→ Do another range check. Make sure the antenna is down all the way and both the transmitter and receiver are turned on. Walk about 25 yards and try all the controls. Someone should be near the airplane to make sure everything is working. Put your antenna up now. Check all trims on the transmitter. Are they where they should be?

BEFORE STARTING THE ENGINE:

→ Make sure throttle is in the idle position.

→Start your engine.

→Idle okay?

→High speed okay?

→Will it run if it's at a 45% angle at high speed?

→Will it transition from low to high to low to high without stalling?

→Will The engine shut off from the transmitter?

START THE ENGINE

→Test the entire throttle range.

→Run it at full throttle with its nose in the air for at least 15 seconds.

BEFORE EACH FLIGHT

→ Always refuel, even after short flights.

→ Check the operation of all control surfaces.

→ Make sure the wing is tight and the rubber bands are okay.

→ Check the landing gear.

→ Check for any damage or holes in the covering.

→ Make sure the antenna is up.

→ Start and check the engine.
Always run the engine at least to full power before takeoff. An engine that just ran perfectly may never run right again.

→ ***After a hard landing****:*

→Basically do the “before first flight check” again paying extra attention to dirt in the engine, bent landing gear, control surfaces, the propeller, clunk in the tank, and internal damage to the wing or fuselage.
→When you land, turn your receiver off first, then your transmitter.

IMPOUND YOUR TRANSMITTER

→As soon as you arrive at the field, be sure to place your transmitter in the impound stand (be sure it is turned OFF!).

→Check to see if anyone else is using the same frequency. If there is, find out who each flyer is and alert them to the fact that you are on their frequency.

→As other flyers enter the flying field, check to see if they are on your frequency.

SOME COMMON SENSE ITEMS TO HELP KEEP THE SPORT SAFE AND FUN

→Keep your transmitter in the impound area while you're not flying.
This serves two purposes. First, you will be forced to walk over to get your transmitter whenever you wish to fly, keeping you from fiddling with your aircraft when you haven't pinned your frequency. Second, and more importantly, if someone who is on your frequency crashes, you can easily prove that your radio was off at the time of the crash. Understand that under these conditions, the pilot of the crashed airplane may become suspicious. Together with the suspicious pilot, you can walk to check the status of your transmitter. On the other hand, if you store the transmitter close to your airplane, he can easily accuse you of having your transmitter on while he was flying.

NEVER!!!

→Never turn on your transmitter without pinning your frequency
Before you are allowed to turn on your transmitter, you must place a pin (with your frequency number) in the corresponding tube at the transmitter stand. This gives you control of the frequency and no one else on your frequency can turn on their transmitter.

There may be times when you are tempted to temporarily turn your transmitter on when setting up or tearing down. Maybe you want to move the throttle setting. Or you just want to run the fuel out of the engine. NEVER give in to this temptation. If you do, you may be paying for someone's broken airplane or worse!

USE FREQUENCY PINS AND FLAGS

We've seen some of the strangest devices used as frequency pins. Screwdrivers, pens, pencils, and even broken ailerons have made their way into those little holes. While any object that can be seen from a distance will work to pin your frequency, the best frequency pins include your frequency number in LARGE characters so that everyone can see them from a distance.

To help other flyers, you should also have your frequency number on you transmitter in large enough characters that a person can see it without having to ask. This helps each pilot determine who else is on their frequency.

Remove your frequency pin every time you finish flying - As a courtesy to other flyers, unpin your frequency as soon as you are finished flying. You should do this as soon as you impound your transmitter. Especially on crowded days, this keeps people from having to track down pinned frequencies that are not being used.

If you get in the habit of impounding your transmitter and removing your frequency pin every time you finish a flight, you'll never leave the flying field with your frequency pinned. After you leave, if your pin is still in the frequency hole, you will cause another pilot a great deal of grief while they try to figure out who has the frequency pinned.

DON'T HOG THE FREQUENCY

As a courtesy to other flyers, every time you finish a flight, check o make sure that no one else is waiting for your frequency before you fly again. You will notice that there is a slot under each frequency pin hole. If another flyer wishes to fly and the frequency is taken, he will place his pin in the slot, making it very easy for the flyer who currently has the frequency to tell when another person wants to fly.

BE EXTRA CAREFUL!

As a flyer, you must be VERY careful whenever you turn your transmitter on. If your frequency is pinned, and you cannot find the owner of the pin, ask EVERYONE in the pit area. Another possible explanation for your frequency being pinned is that the pilot may have crashed before you arrived and is looking for his plane in the cornfield (possibly with his transmitter still on!)

SAFETY IN THE PIT AREA

Now let's address the matter of being safe in the pits. While most of these rules may seem to be nothing more than common sense, you'd be surprised at the number of pilots who break these rules.

Hold on to your plane whenever the engine is running
NEVER, repeat NEVER let go of an airplane with its engine running until it is on the flight line and ready for taxi out. Always keep it under complete control. And always treat an airplane with the engine running as if the radio is going to fail at any moment. We highly recommend the use of hold-down devices that ensure that the airplane cannot move until the flyer is ready to carry it out to the flight line.

NEVER taxi in the pit area
Along the same lines, when you are ready to bring your airplane out to the flight line, carry it out. NEVER taxi out to the flight line! In the same manner, after landing, carry your airplane back to

the pit area. Never stand in line with the propeller of a running engine - A propeller rotating at 10,000 to 20,000 RPM carries a great deal of centrifugal force. The most dangerous position to be in near a running engine is directly in line with the prop. A piece of dirt attached to the prop during a hard landing will usually be thrown from the prop. Or, if the propeller is fractured in any way, an injury could occur if the propeller shatters. Once the engine is started, ALWAYS stand behind the airplane.

Make needle valve adjustments from behind the airplane
Once your engine is running, if adjustments must be made to the needle valve, be sure to get yourself into a convenient and safe position from which to make the adjustments. If you are behind the airplane, you can easily hang on to it with one hand while you adjust the needle valve with the other.

Use a glove, chicken stick, or electric starter
Especially for beginners just getting started with RC, until you really get to know your engine, exercise extra caution when starting your engine. A flooded engine can really bite you if you use your bare finger to start it.

Do not break in new engines in the pits
As a courtesy to other flyers, NEVER break in an engine in the pit area. If you must do it at the flying field, move down to the end of the pits (just South of the out houses). From there, the noise in the pit area won't be excessive.

SAFETY IN THE AIR

These rules are apply from the time you enter the flight line until the time you carry your airplane back to the pit area.

VI PRIORITIES IN FLYING

Here we list the basic rights of way for the flying field in the order of most importance.

Dead stick landings
When an airplane's engine dies, the airplane is going to come down no matter what. The flyer with the dead stick must yell ``DEAD STICK!'' immediately. Anyone on the field must know an airplane is coming down in order to stay out of its way. A flyer with a dead engine has the highest priority. ALL other flyers must give the right of way (including any that have already called their landing).

A person on the field
Whenever a person goes onto the field to retrieve an airplane, they MUST call (very loudly) ``ON THE FIELD!''. This person has the right to safely retrieve their airplane. While ANYONE is on the field, no taking offs, landings, or low passes are allowed. The only exception to this rule is a dead stick landing. Once the person re-enters the pit area, they must alert all flyers with the call ``FIELD'S CLEAR!''. If you are the person retrieving your plane, be sure to take the shortest route off the field to help others who may wish to land.

A flyer calling a landing
The first flyer who calls a landing has the right to land. Some flyers have tried to hurry their take

off to beat the airplane landing. However, if the engine stalls, an airplane will be sitting in the middle of the field while another airplane lands!

A flyer ready to take off
Notice that take-offs get the lowest priority. At times a flyer may have to wait for several minutes while other pilots land and retrieve their airplanes.

Fly in control
As beginners, we all need to keep trying new things in order to improve. However, all flyers must fly within their abilities, especially when the field is crowded. Save your new maneuvers for a day when the field is less populated, or get an instructor to help.

Call your take-offs and landings
The more informed you can keep other pilots, the safer flyer you'll be. Some one may have called a landing without your hearing it. If you call your landing loudly, another flyer will be sure to alert you that someone else has already called their landing.

Be sure you know which way everyone is taking off and landing
Especially on calm days, flyers have a tendency of taking off in all directions. Watch to be sure you know which way everyone is taking off and landing. If in doubt, ask! If it is a perfectly calm day everyone should be taking off and landing toward the trees.

Do not fly by yourself.
Beginners have a tendency to prematurely think their ready to fly by themselves. Maybe they've had one or two solos and their feeling pretty brave. NEVER fly by yourself unless you've had your instructor's OK to do so. Keep in mind that your airplane is not the only thing at risk!

When in doubt, ask for help!
No matter what the rule, if you do not understand what you should do, ask an experienced flyer for help.

Tunnel Vision:
Following an uneventful flight, you complete your final leg and holler “landing.” You make a gentle turn and set your airplane into a nice glide path to the runway. You start to level off for your touch down, then ... surprise, surprise! Your wing tip catches a fence post to the right of the runway and your airplane does an abrupt about face. Your wing is damaged, and you have egg on your face.

What happened? The first thing that probably comes to mind is that your depth perception betrayed you. Sorry! That’s just not so. Depth perception is effective only on what you are looking at. You were looking, but you weren’t watching. You were looking so intently at your airplane that you were unaware of what was on either side. That’s called “tunnel vision.”

Tunnel vision occurs when your vision centers so intently on the main subject, in this case, the approaching airplane, that the focus tends to narrow and you lose your perspective of the surrounding area, kind of like a horse wearing blinders. This is quite common with beginning flyers, but we should all be aware that it happens.

Fortunately, tunnel vision is easily avoided. It is merely a matter of establishing good flying habits. Your eye is much faster than your airplane. It only takes a fraction of a second to glance

quickly and determine where your airplane is in relation to its surroundings. Make it a practice to let your eyes sweep the area several times as your airplane is making its approach. This can also apply to in-flight conditions when you should always be aware of other airplanes.

VII THE BASICS OF ENGINE TUNING:

In this short discussion, we will give the most basic considerations when making adjustments on your new engine. While there are many potential problems that can cause similar symptoms, and while each flyer has his own way of doing things, we will do our best to acquaint you with proven ways of handling the most common problems a beginner faces.

A good running engine is a novice flyer's best friend! Nothing is more frustrating than trying to learn how to fly with a poorly performing engine. You can't get much quality stick time if your engine is constantly quitting in the air. And, when you eventually begin setting up for landings, it will be MANDATORY that the engine responds properly. If the engine dies close to the ground, the results can be disastrous.

Fuel draw problems The biggest cause of a poor running engine has to do with how the fuel tank is mounted in the airplane. As the instructions that come with your airplane and engine say, the fuel tank MUST be mounted at the same level as the engine's drive shaft. Ideally, the middle of your fuel tank will be in line with your drive shaft when viewed from the side. If there must be a variance, try to keep the fuel tank mounted on the high side of center. If mounted too low, the engine will have problems lifting the fuel to the carburetor (and tend to run lean). However, if mounted too high, the same problem will exist with inverted flight (though most novices couldn't care less about inverted flight).

Kinks in the fuel line MUST be eliminated. ANY kink or sharp bend will limit fuel draw. Be sure you drill the fuel line holes in the firewall are large enough for your fuel lines. If you have to force the fuel line through the hole, the hole is not big enough! Be sure the ``clunk'' line within the tank can extend to the bottom of the tank without closing off the clunk. If this line is too long, the clunk hole may be pressed against the back of the tank. Keep the fuel line and muffler line as short as possible so as not to impede fuel flow.

Mechanical and electrical problems New engines are notorious for going through glow plugs quickly. This is predominantly because new engines are commonly run quite rich to ensure a good break-in. However, as you begin leaning out your new engine to gain performance, the glow plug problem should go away. If it does not, check your head bolts. Loose head bolts will cause also cause premature wear to your glow plug.

Your carburetor must be connected to the engine so that no air can leak from the bottom of the carburetor seal. If you remove your carburetor for cleaning, be sure to seal the bottom properly before tightening. Most carburetors have a rubber seal that must be compressed before the carburetor hold down screws can be tightened. In the same way, the crankcase bolts must also be tight, as must be the engine mounting screws.

Breaking in a new engine No matter what the engine manufacturer says, it is ALWAYS best to break in a new engine. Breaking in will ensure that internal engine parts wear into position properly, while not under a great deal of load. While you can break a new engine in while it is mounted to your airplane, many flyers like to perform the break in procedure on a test stand.

Either way, keep the engine running cackling rich during the first stages of the break in procedure. At full throttle, keep the needle valve well open to ensure that the engine never comes close to peaking out. As the fuel tank empties, be ready to stop the engine to keep it from leaning out. We recommend running about two to three full tanks of fuel through the engine in this manner.

The second step to breaking in a new engine is to begin leaning it out. Start the engine again and slowly turn in (CW) the high end needle valve. As you do, the engine will begin to accelerate. Don't peak it out yet. Just get it running faster, a little at a time. As you do this, start manipulating the throttle to let the engine run at various throttle settings for 10-20 seconds at a time. Repeat this for 2-3 full tanks.

Finally, the engine is ready to peak out. With the engine running, continue turning the needle valve in (CW) until the engine peaks. To tell if it has peaked, lightly squeeze the fuel line. If the engine accelerates more, go another click of the needle valve in. Squeeze the fuel line again. Continue until the engine has peaked. THEN BACK OFF ABOUT TWO TO THREE CLICKS of the needle valve (making it slightly richer). Keep in mind that any engine will have the tendency to lean out in the air. Backing off a little on the ground will keep the engine from becoming too lean in the air.

We cannot stress enough the importance of keeping a new engine running on the rich side. Admittedly, there are times when an airplane (even a trainer) is somewhat underpowered and the engine must be peaked out to its maximum before the plane can even be flown. However, in most cases, there is ABSOLUTELY NO REASON to peak out an engine to the max, even after break in.

For example, if you are flying a 40 size Avistar with a O.S. Max .46, your plane is highly overpowered. The engine could be running quite rich and still pull the plane nicely. If your plane is overpowered, why not run the engine a little rich to ensure that the engine properly breaks in? This way, when you're ready for your first hot low wing plane (like an Ultrasport), your engine will still have something left to give. REPEAT AFTER ME: A rich running engine will last forever - a lean running engine will soon wear out!

Tuning the engine's low end (idle) Most high performance model airplane engines have two needle valves. The needle valve we have been talking about to this point is the high end needle valve. This needle valve controls the high throttle setting and functions basically the same for ALL model airplane engines. Turning it in (CW) leans the engine and turning it out (CCW) richens the engine.

However, the low end needle valve may vary from one engine to the next. For most ABC style engines, like the O.S. Max .46 SF, the low end needle valve functions the same as the high end needle valve. Turning it in (CW) leans the low end and turning it out (CCW) richens the low end.

Keep in mind however, that certain carburetor configurations are just the opposite. The FP series of the O.S. Max engine is one example. Before you can adjust your engine's low end, you MUST know which way is which! (Consult your owners manual or ask an experienced flyer.)

As with the high end needle valve, you begin peaking out your low end from the rich side. With the low end needle valve wide open, bring the engine to its idle position (with the glow plug

battery disconnected). The idle position should be set so that the carburetor is open to about 5-10 percent of maximum. If the engine cackles and dies, lean the low end needle valve about a quarter turn and try again.

When the engine will run at idle, quickly advance the throttle and listen. At this point, probably the engine will cackle up to its maximum speed. This indicates that the low end is still too rich. Lean out the low end needle valve by about 1/8 of a turn and try again. If you go too far, and the engine's low end needle valve setting is too lean, the engine will bog down and possibly die when you try to advance the throttle.

Be aware that you may be fooled at this point. Since an engine consumes fuel at a very slow rate when at idle, if you are too quick to make changes, the engine may be under the influence of the last idle adjustment as you increase the throttle. Repeat the throttle advance and slow down several times to confirm the setting. If in question, squeeze the fuel line slightly to force the engine to use up the residue fuel. Eventually, by repeating the above procedure, the engine will respond quickly and accurately to your every throttle command.

Adverse Yaw:
Stick your hand out the car window with the palm down and you'll feel some rearward force. Now turn it so the front edge is tilted upward slightly. You will feel it being forced upward and rearward. You just felt lift, both the upward and the rearward components.

The upward component is what holds your plane up, and the rearward component is what causes adverse yaw. On a remote control airplane, it's the down aileron that is increasing lift on that side of the wing causing adverse yaw. This causes the aircraft to yaw opposite the direction you are trying to turn, necessitating some rudder input for correction.

With most of our remote control airplanes, we don't notice adverse yaw. It tends to become large and noticeable when the airplane has a long, narrow wing, fairly slow airspeed, and barn door ailerons (sounds like the perfect description of a few lightweight trainers and gliders).

Long wings give the rearward drag component more lever arm, tending to accentuate the adverse yaw. Most RC airplanes favor lower aspect ratio, wider wings. High speed airplanes need very little aileron deflection to cause a roll, and the ailerons produce very little drag at low deflections. To obtain the corresponding roll rate at a lower speed would require greater deflection with greater drag. Finally, because barn door ailerons have all their area near the wing tip, the drag tends to be produced by the wing tip. So the combination of a long, narrow wing with barn door ailerons and a slow speed usually produces the maximum adverse yaw.

A quarter-scale Piper Cub comes to mind as a great adverse yaw demonstrator. Watch a Cub in an aileron-only turn. It has a tendency to stick its nose up in the air and not track around the turn very well. Use a little rudder with the turn and the Cub rolls right in and flies around the turn nicely. A fast Pattern or sport airplane, on the other hand, probably would not have enough adverse yaw to notice.

There are a couple of ways to cure adverse yaw. One sure way, as I have already mentioned, is to coordinate rudder. All full-scale pilots learned this early in their training. When you move the stick, you step on the rudder. For RC, this requires that you learn to use your left hand, as well as your right, while flying.

For those of you who want to mechanize the function, many radios have rudder/aileron mixing or several mixing circuits, one of which can be used for adverse yaw correction. Start with only a small amount of rudder, as it shouldn't require much. Watch the airplane as it turns, and make your mixing adjustments from what you see. Many people like to turn mixing off for take off and landing, claiming the rudder makes the tail waggle on climb out and also on final approach. (Isn't a small amount of rudder/aileron control in the same direction as a barrel roll? And isn't a large amount of rudder/aileron control a snap roll? Why not learn to use the rudder rather than rely on mixing that could cause the loss of a perfectly good aircraft? As you can tell, I'm not a proponent of rudder/aileron mixing. I've seen many good aircraft lost due to mixing. Don't be lazy, learn to use the rudder.)

Another good way to cure adverse yaw is by using differential ailerons. My type of flying precludes differential as I invariably adjust the ailerons for maximum throw in both directions to obtain the fastest roll rate. This leaves no room for differential.

Differential requires you to adjust the linkage such that the down aileron travel is less than the up travel. Since the down aileron is the one producing the adverse yaw causing drag, reducing the down aileron travel reduces the adverse yaw.

On a high wing airplane, for example, you should lengthen the aileron pushrods. Instead of mounting them in holes opposite each other in the servo wheel, mount them in holes farther from the ailerons. As the wheel turns, you'll get more push movement, giving more up travel. Likewise, you get less down movement for less down travel. If you don't have a servo wheel, use one of the star shaped arms—the one with six arms—mounting the pushrods to two of the arms, which makes a "V," rather than two that are opposite each other. For a low wing airplane, the pushrods need to be shorter and need to be mounted on the servo wheel closer to the ailerons instead of in the opposite position.

What if nothing works? - Though the techniques given in this article should handle 90% of all engine problems, there are possible problems that affect an engine's performance that have nothing to do with tuning. If you find that no matter what you do, you cannot get the engine to run properly, by all means, ask for help. Surely one of the experienced flyers in the pit area will be more than willing to help you**.**

Flight Box Checklist
Most newcomers have yet to accumulate the correct tools to perform routine maintenance on their models. The below is a list of basic items that will, at some point, come in handy for just about every flyer. Of course, it can take a long time to accumulate all the tools you need, so don't feel as though you have to rush right out and buy everything today. Chances are somebody else will have what you need. But, in the mean time, it's a good idea to start accumulating your own tools so you can become self sufficient. Besides, sooner or later you'll be flying on your own! Here is what you should have in your flight box:

Engine starting equipment

- Fuel (5% to 15% nitromethene content. Consult your instructor or engine manual for proper fuel content for your engine)
- Fuel filling system such as an electric pump or hand-crank pump with required fuel can/filling fittings and fuel tubing *(I know it's a tongue twister, but that's the best description)*

- 1.5-volt glow plug igniter or 1.5-volt battery and glow plug clip
- Optional: Electric starter and a good but small high ampere-hour 12-volt battery (this battery may also be used to operate a 12-volt fuel pump)

Tools

- Small crescent wrench or correct-size box wrench for the propeller nut (a 10mm wrench works for most .40-size engines) **and**
- 5/16-inch screwdriver type socket wrench for glow plugs **or**
- Hobby-type 4-way wrench (has sizes for glow plugs and propeller nuts)
- Small (#1) Phillips® screwdriver
- Pliers
- Medium (#2) Phillips® screwdriver
- Small (#4) regular/slotted screwdriver
- Small Allen® wrenches as required:
- 1/16-inch is most common for set screws on wheel collars
- 2.5mm is most common for 3mm engine screws
- A good hardware store can supply you with the round-tip allen sets that will be sufficient for any application in both national standard and metric sizes.
- Hemostats (available at the hobby shop-*you never know when you'll need them, but when you do ...)*
- #1 Hobby knife with sharp #11 blade (keep tip covered in flight box!)
- 1/4-ounce or 1/2-ounce of thin or medium CA (for small field repairs)
- A roll of clear plastic tape.

Other

- If appropriate, spare #64 rubber bands for wing hold-down (always store rubber bands in a small container with talcum powder or kitty litter to absorb oil from previous flights). If your aircraft uses wing bolts, a set of spares is also a good idea.
- Spare, balanced propellers of suitable size. Consult your instructor or the manual for your airplane – engine combination for the right prop size. Remove sharp edges from plastic propellers by lightly sanding with 320-grit sandpaper.
- Spray cleaner and quality paper towels for cleaning the model at the field.
- An aircraft tie-down method. A strap attached to a stake driven into the ground, for instance, that will hold the aircraft from moving while running up the engine.

VIII SOME NICE TO KNOW THINGS

High Wing versus Low Wing:

We finally master our high-wing trainer—or trash it, whichever comes first. Maybe then we build a shoulder wing plane. Only after we are somewhat competent at flying do we try flying a low-wing airplane, and then with white knuckles and shaky knees. Why? Just what is it about low-wingers that make them "tougher" to fly? Are they faster? No! All other things being equal, there's virtually no difference in drag or top speed. The illusion comes from designers' choice. They tend to put faster airfoil sections and lower aspect ratios on low-wing airplanes, making them speedier. Low-wing airplanes do have some characteristics, compared to high-wingers,

that make them more suitable for higher performance aircraft.

1. “Nicer” (and quicker) roll response. This comes from the relative placement of the center of gravity (CG) being closer to the natural roll center of the wing. The CG will be at or only slightly above the roll center of a low-wing, but well below that of a high-wing. Assuming at least a little dihedral, the roll center of the wing will be slightly above the center of the wing. In a roll, the wing (providing the “power”) wants to roll about its own roll center. The rest of the airplane (the “resistance”) wants to roll about the CG. The wider the distance between roll center and CG, the funnier-looking is the roll (i.e., “non-axial”).

2. The low-wing reacts more neutrally to power changes. Our old high-wing trainer, with the thrustline very low, will respond by pitching nose up when power is added, nose down if power is reduced. This contributes to stability with the nose going the way we want it to on a trainer. On the other hand, the low-winger will be more neutrally stable, without much pitch reaction to power changes. The low-winger will also be more wind “resistant” on the ground, a function of wing height above the wheels. The high-winger will naturaily be more “tipsy,” reacting to wind while taxiing and during takeoff and landing.

We must all understand that we’re only talking of tendencies here. There are many other variables that have an impact on the characteristics involved—the designer can juggle these around to get the desired handling. But wing placement is definitely one of the biggies when it comes to establishing how an airplane is going to handle.

Most of all, **ENJOY RC**!