

This booklet is used as a guide for instructors of the Tri-County R/C Club, and their students. It primary applies to how to teach beginners to fly R/C. There is a large amount of information that is good for all R/C pilots, not just instructors.

Instructors - please read this thoroughly, and re-read it every so often so that as a club we maintain some unity in our instruction of student pilots. At the back of this document is a list of DO's & DON'Ts, a Student Pilot Solo Checklist, and a copy of the 3CRCC rules. Please have your Student Pilots read this and sign the back page saying they've read it and agree to the club rules. Additional recommended reading to all student pilots is The Basics of Radio Control by the SIG FACTORY FLIERS, this 23 page booklet has many photo's and illustrations covering everything from construction and radio installation to flying.

Student Pilots - When you are thru reading this please return it to your instructor. Recommended reading to all student pilots is The Basics of Radio Control by the SIG FACTORY FLIERS.

Teaching R/C Model Airplane Flying

By Mike Lynch

A note to readers

Just because you're good at something does not necessarily mean you can teach it. Some of the best fliers at our field freely admit that they do not have the patience to teach beginners. Additionally, teaching requires an ability to see things through the eyes of the beginner, and to modify your discussion accordingly. Not everyone is cut out for this. It is the intention of this text to teach experienced fliers how to teach RC flying. While it will be most useful to beginning instructors, even fliers who have been teaching for some time should find many of our points helpful.

Outline To Text:

- I. Do You Have What It Takes?
 - Special notes for beginning instructors
 - Our approach
 - What we assume
 - Flying preferences

- II. Before Flight Instruction
 - Common RC questions
 - What is the trainer system?
 - What makes the best trainer?
 - Wing configuration
 - Weight versus rugged design
 - Plane and engine size
 - Pre-flight inspections

- III. Step One - Teaching How To Master Turns & Level Flight
 - The first flight
 - The beginner's first few attempts
 - What about planes without ailerons?
 - Throttle setting
 - Wind and turning
 - Ballooning Tendencies
 - When are they finished with this step?

- IV. Step Two - Teaching How To Set And Hold Headings
 - Setting headings
 - Practicing with figure eights
 - Holding headings and flying with precision 8

- V. Step Three - Teaching How To Take Off
 - A note about trainer systems
 - Setting the plane's ground tracking
 - Teaching to taxi
 - Take off practice
 - Actually taking off

- VI. Step Four - Teaching how to land
 - A note about engine reliability
 - Teaching slow flight characteristics
 - Practicing approaches
 - Actually landing
 - 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

I. Do You Have What It Takes?

Surely as you were learning to fly, you 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 will show you how you can become an RC flight instructor. While there are many ways you can give back to your club, instructing for a flying season is one of the most rewarding ways.

Before we begin, let me say I freely admit that there are many ways to teach RC flying, and no two instructors will totally agree on how every concept along the way should be related. The methods I show are rather simplistic, yet they have been proven during ten years of instruction and have always worked well. But you will surely improve on what I show as you develop your own teaching style.

The goal of our 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 my 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. While you can eventually mix and match certain techniques described during each step to match your own teaching preferences, we recommend that you thoroughly understand our entire process before you begin changing anything.

Also let me point out that this text will stress the teaching of flying skills. We assume you can relate the basics of aerodynamics and flight, control surfaces, and in general, what makes an airplane fly. While we do 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) Demand 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.

For myself, if the student does not have the trainer system capability (maybe they have a Futaba "Attack" Radio, for example), I can easily help them with the early stages of learning how to fly (steps one and two). As long as we keep the airplane high enough, the plane will never be in danger. Though I have to be much more attentive, I am confident enough in my flying. However, as the student begins taking off and landing, I make it very clear that there will be little I can do to save the plane when it gets close to the ground. More than likely the plane will be dumped (and damaged) several times before take-offs and landings are mastered. As long as the student understands this, I'll work with them. However, if they show any signals (during steps one and two) that they may blame me for the plane's damage, I won'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. I make it very clear at the start that if the student protests when I ask to retake control, I will stop helping them.

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 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) **Be sure the beginner has an AMA membership card or that you are an AMA Intro Pilot.** 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 provides 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.
- 8) **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.
- 9) **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.
- 10) **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. Students 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.
- 11) **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 student's 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

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!

What we assume: Before taking a beginner up for the first time, there are several things we assume you have explained. We assume, for example, that the student knows the basics of aerodynamics and flight. 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, we assume the student's airplane has been checked out by a pre-flight instructor and has had at least one trim flight.

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) have done everything.

Fingers or thumbs? - Thirty years ago, I was taught to fly with my thumbs. I have flown with my thumbs all this time and though I'm considered one of the better pilots at my flying field, I freely admit that flying with fingers is better. I've tried to get comfortable with fingers, but (as yet) I have not been able to. As you teach a new person to fly, I would suggest you start them off right from the beginning using their fingers. 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. Take it from me - 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.

What throttle setting do you use? - When I first begin training, I 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, I have actually had 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.

When do you teach rudder coordinated turns? - I 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. While I freely admit that rudder coordinated turns make for nicer looking turns, and rudder is helpful when landing in a crosswind, I 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.

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 beginner's 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

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. This section of the book is devoted to handle 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.

In this section, I do mention some brand names and actual models, but keep in mind I do so for the sole purpose of offering comparisons. I am not endorsing nor criticizing any of the products mentioned. There are numerous radios, airplane kits, ARFs, 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.

Common RC questions: It has been my experience that most beginners to the hobby tend to have the same set of questions as they enter into the RC airplane hobby. So we'll begin by giving a summary of these questions and supply 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 radio control systems can 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 you have 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 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 at 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, 3CRCC 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 lose 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 ounce 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):	\$150.00
Flight box accessories (fuel, etc.):	\$60.00

Approximate startup cost:	\$400.00

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 \$42 per year, and pay your 3CRCC dues and initiation fee if you're just getting started. The Tri-County R/C Club dues are \$50 per year and there is a one time initiation fee of \$20.

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 have 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** - It's 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.~~

The above lined out text is Mikes Original text. It is lined out because the past few years of instructing have shown some very important differences. The current dogma says to learn to fly RC model airplanes the best way to start is with a Trainer that has a high flat bottom wing with generous dihedral so it self corrects. I believe this is wrong! I believe the following are the best characteristics for a trainer.

Characteristics of a good Trainer

1. **Flies Slow** - To fly slowly and still be stable a plane needs to have a relatively light wing loading. In .40 size planes a wing loading of less than 20oz. per square foot is good for trainers.

2. Flies Very Stable

3. **Responds to controls in a uniform fashion** (Does What it's told When it's told the same way every time)
4. **Inexpensive and easy to repair** – being Rugged as Mike originally suggests is good but you sacrifice slow flight characteristics I think you'd be better off with a lighter plane that is easier to repair. Keep a .40 size airplane under 5.5 pounds.

Take note, nowhere in that list do I list the type of plane, high wing, low wing, mid, wing shoulder wing, doesn't make that big a difference as long as it is slow stable responds to it's controls uniformly. It is an easy task to limit the amount of control to get the control rate at an acceptable level for a beginner.

Nowhere in the list is the term "Self Correcting". Planes designed to self-correct are harder to fly. If you try to allow them to self correct they will crash long before finish correcting themselves or you fly them so high you can't tell what the plane is doing. "Self Correcting" also means that you will have to fight the plane to turn up wind, fight the plane to turn it in general. We are teaching people to fly R/C models not guide free flight models. The early days of RC we used modified free flight models. Current Trainers reflect our free flight heritage.

My experience has shown that people who learn with typical Trainers all learn in about the same amount of time as somebody who learns with a "Sport" plane. I know a lot of people have successfully learned to fly with Eagle II's and the like but from what I've seen the people who learn with a Trainer crash more after they solo, especially when they go to something sportier. After learning with a Trainer they pretty much have to re-learn to fly anything else. People who learn with a "Sport" plane learn to fly just as fast, crash less after they solo, and can fly a larger variety of aircraft sooner.

Planes I think make good trainers and that I have successfully taught people to fly with:

1. Four Star 40 (probably the best trainer ever!!!)
2. American Flyer (ARF)
3. Mid Star 40
4. Ugly Stick (any of several variations)
5. Easy Sport 40
6. Armadillo Trainer
7. Great Planes Trainer 40 (fully symmetrical wing)
8. Thunder Tiger Wold Trainer 40H (semi-symmetrical high-wing low-dihedral ARF - This one looks like a typical Trainer but flies like a typical "Sport" model)

All these planes are very stable, don't tip stall, can fly very slowly, respond uniformly to controls, and have fairly light wing loading. These characteristics make better trainers than typical Trainers. Now all we have to do is get instructors to take a critical look at Trainers. I don't buy arguments like: "The XYZ trainer has worked great to train zillions of students for years", or "I learned on a SR. Kadet, so that's the best trainer". Doctors used to bleed people that didn't make it right. With the absolutely dependable radios of today, and buddy cords, we don't need to learn with glorified free flight models.

(End Notes by Tom Rhodes)

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? (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're 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 you 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 and you'll have control. If you get into trouble, he releases the button and he has control again. No more passing transmitters. The 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 is a company that sells slave transmitters that work with Futaba FM series radio systems. (Danielle's RC Specialists, 3141 Ambrose Avenue, Nashville, TN 37201, 1-800-235- 6353) The cost is about \$45.00.

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!

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 tends 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.

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.

For these reasons, we urge beginners to have their planes checked for air-worthiness. 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, 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 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.

III. Step One: Teaching How To Master Turns & Level Flight

Objective: 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 your job 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:

- 1) Bank with the ailerons,
- 2) Maintain the turn with up elevator
- 3) Level out with the opposite aileron.

Demonstrate turning with hand movements as well as on the stick of the transmitter. 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 - We're assuming you're using the trainer system. 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), they 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 (I like to alternate corners of the field, forcing them to practice left and right turns equally).

[Again let me digress. As the instructor, you set the rules for when you retake control. Early on, I tell beginners that there will be times when they may be in control of the airplane, yet I'll 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, I retake control. While it is possible that the student may have been able to continue flying without crossing the flight line, I don't take any chances where safety is concerned, especially on the beginner's first few flights. Second, I 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, I retake control, even though they may be doing rather well (this also gives them the goal of keeping the airplane above my cut-off point). Third I set a distance limitation. If the plane gets so far away that it becomes difficult to see, I retake control. You may also 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, I have just set the plane up for the student to make a gradual left turn when I push the trainer button to give the student control of the plane.

"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 too 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. I admit that I have a tendency to say too much. I'll notice the student doing something or another that may be causing problems for something coming down the

road and I 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.

That brings up a good point. 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 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.

Watch out for two more things. 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 too 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 split-S and Imillman turns, which are much easier turns to perform.

Right and left Right 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 I 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 downthrust, 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. I call this tendency 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. I have seen students (and instructors) waste entire flying sessions adding downthrust 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 not have this tendency. 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: 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, I 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), I have them start by making left turns on our right side and right turns on our left side. I stress the importance of flying much more precisely. Since we fly on a rectangular shaped flying field, I use each corner of the field as the target heading for each turn. The student is told to maintain each turn until the desired heading is reached. They are to come out of the turn pointing directly toward the 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), I have them practice on what I call free form turns. Based on the position of the airplane at a given time, I'll call the turn I wish them to make. For example, if I say "45 degrees right", I expect the student to veer off to the right on a new heading 45 degrees from the start. If I 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, I 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!

[Again, let me digress. This is about the point in the training when I 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. I like to see the student get some practice with an out of trim airplane. On their slave transmitter, I'll 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 I've started doing this with a beginner, I'll repeat trim setting practice on the first flight of each practice session.]

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!)

For practice, once again I begin with the figure eight. But this time I 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. They must practice making minor corrections as the plane tends to wander from its desired heading. 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 figure eights (in both directions), I 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, I recommend having 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.

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, I usually omit rudder coordinated turns from basic flight training. While I do mention and describe them, I usually wait until the beginner has their first sport airplane to have the beginner practice them, when the rudder will have more of an impact on the quality of turning.

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, 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 they are ready to progress to step three, making takeoffs.

V. Step Three: Teaching How To Take Off

The objective: To get the student to the point where they can taxi and take off.

Another note about trainer systems 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. I make it very clear at this point (to beginners who do not have trainer systems) that if we proceed it will be at their own risk. By this time, I have grown to know the student quite well. If they have shown the slightest tendencies that they may blame me for an accident, which causes damage to their airplane, I will not help them any further until they have the trainer system. Additionally, I 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 advice 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. I cannot stress this 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 roll down a shallow grade (with the radio on). Many suburban driveways 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.

Teaching to taxi your particular flying field's particular taxi surface (asphalt, cement, grass, etc.) has a great deal to do with how hard it is to taxi. Personally, I find hard surfaces 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 our field, for example, we're only supposed to takeoff and land in an East or West

direction. If the wind is out of the North or South, we must takeoff and land in a crosswind condition. Also, we're 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.

Once they can move one control without the other, explain the plane's ground handling characteristics. You've been doing a lot of taxing with their airplane 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. I see many beginners (on our 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. I teach beginners to quickly goose the throttle to about half way and back to idle in 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 overcontrol 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.

If your field allows it, position the beginner so that they can takeoff in a direction directly away from them. Walk them out to the middle of the field if necessary. (Once they master this, they will still have to learn how to take the plane off in different directions while standing at the pilot's station.) 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! I see many beginners who think they have mastered takeoffs with their first successful one, regardless of how scary it was. However, 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.

Are they 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 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.

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 aerobatic 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, 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. 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, I recommend having 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 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. I teach 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.

I 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, I have the student veer off to the right (at about 45 degrees) shortly after the plane passes by. I 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 and veers off to the left (at about 45 degrees). 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 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 windier it is, the more important this point (and the more severe the downward attitude). While some pilots try to counteract the wind with higher throttle settings, I feel the decent 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.

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!

Before letting them 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 be having 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. 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. Of course, you should demonstrate the landing procedure prior to having the beginner do it.

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 though a beginner's first solo 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.

One excellent way to practice landing (and taking off) is with touch and gos. 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, performing a true touch and go.

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. 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.

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.

VII. 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 (including myself) have been guilty of unwittingly breaking safety related rules. In this section, I intend to give several safety related guidelines. I will also explain the reasoning behind each rule so as to enlighten beginners with why we consider them so very important.

Safety around the transmitter impound stand Mistakes made around the frequency stand can be costly. Many an airplane has gone out-of-control because these simple and basic rules are not followed. And an out-of-control airplane can end up anywhere.

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!). While doing this, check to see if anyone else is on your 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.

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. 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 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.

We all know what will happen if someone on your frequency is flying when you turn on your transmitter. There may be times, however, when you're 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.

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 your transmitter in large enough characters that a person can see it without having to ask. This helps pilots 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 to 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 that 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.

No breaking 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.

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

1) 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).

2) 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.

3) A flyer calling a landing - The first flyer that 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!

4) 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.

If you need help, 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.

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 tank fulls 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 tank fulls.

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 an 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 owner's 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.

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.

The Tri-CountyRC Club has volunteer instructors.

If you need help learning to fly or are interested in being an instructor please contact the Training Committee Chairman Tom Marr or any 3CRCC instructor or 3CRCC officer.

Phone numbers available on the 3CRCC application and newsletter

Tri-County R/C Club

Student Solo Flight Check List

Student's Name _____ AMA # _____

- 1. Field Safety Rules. _____
- 2. Impound Area and Frequency Control. _____
- 3. Assemble and Test Aircraft. _____
- 4. Perform Flight Maneuvers:
 - A. Start & Taxi _____
 - B. Take off & Trim Aircraft _____
 - C. Rectangle Pattern (hold altitude & heading) _____
 - D. Figure Eight _____
 - E. Landing _____
 - F. Go-Round or Aborted Landing _____
 - G. Landing _____
 - H. Taxi Back and Shutdown _____
 - I. Secure Equipment (receiver & transmitter
off, antenna down, transmitter in impound,
pin removed form board) _____

Instructor:

Observe Student for SAFE operation - was student aware of wind direction and did he/she compensate for it? Was student aware of position of the sun and did he/she avoid flying into its glare? Was student aware of other aircraft in the air and other pilots on the flight line? Was the student confident and in control of his aircraft at all times?

I certify that this student is qualified for unsupervised solo flight

INSTRUCTOR

DATE