

SUN DANCERS R/C CLUB

FLIGHT INSTRUCTORS MANUAL

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INTRODUCTION

The following program is the result of twenty-five years of teaching radio control model aircraft flying.

I teach using my own plane, a Telemaster 40, or the students plane. I always use a buddy box system to allow rapid corrections if the student makes a mistake. After a few crashes, you learn when to take over and how high to fly to allow time for recovery. How long a lesson should be can be a problem. I use a large fuel tank in my trainer so that I can give 15 minute lessons. Most of the students trainers are good for a little over 10 minutes unless there is an oversize fuel tank. The time or length of a lesson can be a problem. Ten minutes seems to be a little short, and 20 minutes can be counterproductive. I used to offer 20 minute sessions, but found that a student can't concentrate for more than 15 minutes and starts to loose it after that. Consecutive lessons give the same problem. It takes at least 30 minutes to recover from a lesson before taking another one.

HOLDING THE TRANSMITTER AND EXPLAINING THE CONTROL FUNCTIONS

People vary a great deal in their ability to use their hands and fingers. Holding the transmitter to support its weight and still use your thumb and index finger on the sticks, is often a problem in the beginning. I recommend that the little and third fingers support the transmitter and that the thumb and index finger hold the sticks like a pencil. Most students want to put their fingers behind the transmitter and use their thumbs on the sticks. I try hard to discourage this, because when flying with thumbs, there is a great tendency to over control. I'm sure the cliché "he is all thumbs" has some truth in meaning he is clumsy. In some cases, small kids or arthritic hands can make thumbs the only way. Some students feel more comfortable using a neck strap or transmitter tray to support the radio. Most find it's not worth the trouble.

The next step is to explain the stick functions and what they cause the airplane to do. Most of the radios these days are two stick Mode 2. Right stick is aileron and elevator and the left stick is rudder and throttle. In the beginning, I tell the student not to worry about the left stick. I will set the throttle, and we won't use the rudder in the air for now. We will concentrate on using the right stick. The left and right movement of the stick causes the plane to rotate or bank. The plane will continue to rotate as long as the stick is off center. If held long enough the plane will roll upside down. Forward and backward movement of the stick will cause the plane to climb or dive. Pull back on the stick and the nose will come up. Stick forward and the nose will go down. If held back long enough, the plane will do a loop. When the stick is in neutral, the plane, when trimmed, will go straight and level.

INSTRUCTOR TO STUDENT COMMUNICATION

The key to teaching a student is to be able to communicate to him or her the way to move the stick. The words that an instructor uses must be precise, and consistent. In a club where there are several instructors, and a student can be changed from one to another, consistency of language is very important. The words are explained to the student and a dry run on the ground lets him show you that he understands. I use the following terms.

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|-------------|---|-----------------------------------|
| Left Stick | - | Move the stick to the left |
| Right Stick | - | Move the stick to the right |
| Neutral | - | Move the stick to the center |
| Pull back | - | Pull the stick toward you or down |

These are the basic directions. The hardest part of learning to be an instructor is to be able to look at the plane and then verbally tell the student which way to move the stick. I still give a wrong instruction once in a while.

There are two additional phrases I use frequently. These are:

- Right (or left) to go straight.- When coming out of a left turn, move the stick to the right and hold until the wings are level, then return the stick to neutral.
- Move the stick toward the low wing. - When the plane is coming at you, move the stick to the side where the wing is low, to bring it up for straight and level flight.

After telling the student what the verbal directions are and checking him out with a dry run, I then take him through a dry run of making a right and left turns. I say “To make a left turn, move the stick to the left about a quarter of an inch and hold it there until the plane banks to about a 30 to 45 degree angle, then return the stick to neutral. Pull back on the stick to keep the nose up in the turn. Move the stick to the right to come out of the turn and return to neutral when the wings are level.” This is repeated and shown for the right hand turn. We are now ready to start flying.

FLIGHT TRAINING PROGRAM

The flight training consists of learning four different patterns of increasing difficulty to teach the basic skills and to land and takeoff.

THE FIGURE EIGHT

The first maneuver is a figure eight with a left hand turn on the right side and a right hand turn on the left side. (see figure 1) This maneuver is designed to teach two basic things. The most important one is learning to coordinate the ailerons and elevator in the turn. The second, is learning to recognize what the airplane is doing from the ground. For most people, recognizing what the plane is doing in the air is difficult. Full scale pilots find this part especially frustrating. If you can't see that the plane is in a diving turn, you don't think about pulling back on the stick. It takes anywhere from a minute or two to several hours of air time to gain this proficiency. The reason for starting with the figure eight is to avoid training pilots that can only make left hand turns. (We all have seen pilots that have to fly behind the flight line to land because they can't fly a right hand pattern. Or worse yet, they walk across the runway and try to land with the plane between themselves and the other flyers.) So, by insisting on both right and left hand turns from the start, we make both turns equally easy. The reason for the left turn on the right and a right turn on the left, is to have the plane going away from you for the first part of the maneuver, and avoid the second half of the turns coming at you. When a student is starting out, it is the second half of the turn that gets in trouble, and it is safer if this part is going away from you rather than coming toward you.

As we start the flying, I usually talk and demonstrate safe practices in starting the engines and adjusting them, hand guiding or carrying the plane through the pits to the taxi point and taxiing past other flyers before starting the takeoff run. I insist on doing all teaching and flying from the pilot stations. I don't allow any students to walk out on the runway except to retrieve a plane after calling out “man on the runway” and checking that no planes are approaching. Before takeoff, we check to see that no other planes are trying to land and then callout “taking off”. I takeoff and climb out gently and smoothly (if I can). After climbing to about 100 feet, I set the throttle at about 3/4 open and then adjust the trim for straight and level flight on my transmitter. I then advise the Student not to touch the sticks and then I pull the trainer switch, and check the trim on the students transmitter. I make the trim adjustments for level flight. It is very important that the trim be set right. There is nothing more frustrating to a new student than an out of trim student radio. Students will often move the trim sets inadvertently. We are now ready to teach the figure eight.

The first thing I do is to demonstrate the figure eight by flying the figure the way I want the student to try to fly it. I then start the maneuver for the student by flying straight and level parallel to the runway and tell the student that he will be flying the plane when I say “you’ve got it”. At about 50 to 100 feet past center I say “you’ve got it”. I then say “left stick” and when the plane gets to about a 45 degree bank I call “neutral” and “pull back to keep the nose up”. I then advise if the pull is too much or call, “pull back “ again if the plane is heading down. After the turn has gone most of the way around, I’ll say, “right stick to go straight”. I’ll then coach the stick movement to keep the plane level until we get to the position to start the right turn. I say “Right stick————-neutral ———-pull back —-pull back—too much—left stick to go straight”. If the student loses control I say “I’ve got it” and then reposition the plane for the student to resume the turn, and then say “you’ve got it”. Etc.’ etc., etc.

I’ve found that most students tend to make a left turn with the bank decreasing and my saying, “more left” and that in a right turn, the bank tends to increase in the turn. I think this is due to students tending to pull the stick to the right as they pull back on it. At first there is usually a tendency to over control even in low rates and I often have to say don’t move the stick more than 1/4 inch in any direction. Another problem is that students don’t hold the stick with their fingers and try to fly by bumping it, or letting it go after moving it. I usually advise that smooth flight requires steady and smooth fingers on the stick at all times.

Once a student has learned to start the turn by moving the stick and returning to neutral when the bank angle is right, I stop calling neutral. Likewise when the student learns to hold the stick back in the turn I quit saying pull back unless he is diving in the turn. Eventually, I stop calling right and left and let the student fly the figure eight on his own and only coach when he is in need of a correction. Some students learn the figure eight in 5 or 10 minutes. It’s usually a kid that has played a lot of computer games or used a flight simulator. Some of the older retired fellows have spent hours learning the figure eight. The average is 30 to 60 minutes. Once the student can do the figure eight, his confidence is way up and he can usually keep the plane in the air without any help.

THE SQUARE FIGURE EIGHT

The second maneuver is the square figure eight. (see figure 2) This is a series of 90 degree turns with the left turns on the right and right turns on the left side. The sides of the square are about 100 to 200 yard long. The center legs are flown toward you. This maneuver teaches two more new things necessary for controlled flight. The first is timing. To make a 90 degree turn, the student must learn to come out of the turn at the right time to end up with a 90 degrees. The second thing that is learned, is flying the plane toward yourself.

This is the maneuver where the student really learns to keep the plane in the air and to start to be more precise in where the plane is going. At first, students often make turns of 45 to 180 degrees. Frequently the bank is too steep, making the timing more critical. A 45 degree bank is usually enough to make a sharp enough turn to call the pattern a square. As the ability improves, steeper banks can be made to make the square look better. A student often forgets to pull back on the stick in making the 90 degree turn. After he gets the 90 degree timing under some control, he can be coached not to forget to pull back on the stick in the turn. At first, when the plane is coming at you, I use the “move the stick toward the low wing” to help the student keep the plane level. Another almost universal problem is for the student to dive the plane when it is coming toward you. I coach that he should watch the position of the tail relative to the wing to see if it is coming down or flying level. Another observation that can be made is the plane’s position against background clouds or the horizon. The plane will look like it is going up against the background as it comes toward you. Another problem students have in flying the squares is to recognize straight and level flight when the plane is on the far side. I tell students to watch the wing. If you see the top side of both wings, the plane is turning toward you. Seeing the bottom of both wings shows you the plane is turning away from you. The proper observation for level flight at that distance is usually the bottom of the wing that is toward you. For a high wing trainer, the bottom of the wing that is away from you is hidden by the fuselage. The square figure eight is probably the most important maneuver used in training. There are lots of turns in both directions in all parts of the sky. Take a lot of time in teaching this maneuver. Getting it right is the key to doing good landing approaches.

APPROACH LINEUP TRAINING MANEUVER

The third maneuver in the training program is the approach lineup training. The purpose of this maneuver is to give practice in lining up on the center of the runway from both directions. (see figure 3) The idea is to fly back and forth over the runway with a turn around at each end of the runway. The turn around can be four 90 degree turns or rounded turns with a 90 degree turn away from the flight line then a 260 degree turn to lineup on the runway going the other direction. Flying back and forth over the runway can only be done when there are no other planes flying. If there are other planes flying, you can only fly over the runway into the wind. There are two more things to learn in this step. They are learning to line up your approach on the runway, and transitioning from flying toward yourself to flying away from yourself over the runway. All of this in preparation for landing.

We fly at about 100 feet altitude, and build on the ability to make 90 Degree turns. In effect, we fly a traffic pattern in each direction and learn to make minor corrections to stay over the runway. By flying past the center, a student has to keep control as the plane flies nearly over head and he has to change from a flying toward you mind set, to a flying away mind set. It isn't easy and often leads to excursions out of the desired flight path. The big problem in this maneuver is when to make that last turn to come out over the runway. The most common error is to turn too soon. The plane is way off the runway centerline. Standing 50 feet from the middle of the runway doesn't make this any easier, but a lot safer. Eventually the student learns to turn at the right time and to hold course as the plane flies by. If the wind is blowing, the downwind leg, (if you are flying in both directions) can be fast. When flying the approach pattern, with 90 degree turns, I often change the last two 90 degree turns to one 180 degree turns to prevent going too far off center when the down wind leg is made too close to the runway.

TRAFFIC PATTERN AND LANDING.

The traffic pattern is the last step in the program where the student learns to land and to takeoff. The pattern is a large rectangle with the leg over the runway into the wind. (see figure 4) With this pattern we simulate the full scale touch and go landing practice maneuver. The legs are called Crosswind, Downwind, Base and Final. In the traffic pattern maneuver we learn to use the throttle and to do slow flight. We learn to position the plane for a slow decent and to flare out for a smooth landing. We learn to steer on the ground with the left hand and to transition from left hand to right hand control during the takeoff and the reverse when landing and starting to taxi. This is the most demanding on the student and the instructor and toughest on the planes. Mistakes in this area are hard to recover from with a buddy box system and impossible without a buddy box.

I start the maneuver with a flyby over the runway at about 100 feet altitude and 3/4 to full throttle depending on whether the plane is over powered or not. I turn into the crosswind leg about the same place as with the square figure eight. The turn into the downwind leg is made at about 100 to 200 yards out. The downwind is flown parallel to the runway and at about 3/4 throttle at first. The turn into base is made as in the approach line up practice. The turn into final again is as in the lineup practice. This pattern is repeated a number of times to setup the traffic pattern. When confident that the student can hold the pattern we repeat the same thing but start reducing the throttle at the start of the downwind leg, and learn to hold back on the stick to maintain altitude at a slower speed. That is about 1/2 to 1/3 throttle. On the final approach leg, the throttle is advanced to full as soon as the plane is past us. It is flown straight ahead until the speed is up and then turned into the crosswind leg. This sequence repeated to give the student confidence. The third step is to do the same thing except that in the base leg, the altitude is brought down from 100 to 50 feet and a glide path established on final with about 1/4 throttle. The student learns to hold a steady, stick slightly back position, for slow flying in a glide path with the fuselage nearly horizontal or slightly nose up. If the plane is out of position for a landing, the throttle is advanced to full and the plane flown straight ahead to gain speed and altitude before turning on to the crosswind leg. When the student gets better, and can keep the plane descending smoothly and over the runway, the throttle is reduced to idle on final and he is coached on the flare as the plane nears the ground. I leave the throttle on the instructors control at full throttle and stay very alert as the student lands. At the slightest miscue, I takeover and get the plane back on track. The most common mistake is for the student

To let go of the stick with the plane at about two feet altitude. I loose more props that way, and usually the nose wheel steering must be adjusted. Once the student has landed, then we let him see how easy it is to takeoff. The hardest part of takeoff to learn, is to steer with the left hand and to shift to the right hand as soon as flying speed is reached. Students have a tendency to continue to hold the stick back and to climb too steeply. A gentle climb rate until full flying speed is reached needs to be learned. Another mistake to be avoided is to turn as soon as the plane lifts off.

Once your student has managed to takeoff and land five times, without your help, he is considered qualified to fly by himself. I think that the most satisfying feeling that one gets as an instructor, is to see the smile of a student when you tell him he or she is qualified.

SPICING IT UP

As you gain more experience in teaching, you can recognize from the students flying, is that he has reached a saturation point in learning for that moment. This is usually in the early stages, after 10 to 15 minutes when the tension is high. When the saturation point is reached, you find that the turns get erratic and over control is common. Now is the time to spice it up with some acrobatics. The first thing I show the student is the loop. It's easy to do and gives a guy who is frustrated trying to make a level turn, and ego boost, because he can do a loop. The kids really get a kick out of it. Even when the kids are doing well, I will take the last couple of minutes of the lesson for the acrobatics. The second acrobatic maneuver I teach is the roll. At first with out using elevator, and then with elevator. When we get those two accomplished, I put the two together for the Immelmann, then the Split S and the Cuban 8. By the time a student learns to land and takeoff, he can usually do a few acrobatics too.

THE INSTRUCTOR

Being an instructor is great for the ego! It's nice to be considered an expert at something. As an instructor you also get to fly a lot of different planes as the test pilot and to meet a super bunch of people and some great kids. I think that the most important characteristic of an instructor besides knowing how to fly, is patience. If you find students that don't know up from down or left from right, take the time, they will learn. Occasionally a student doesn't mentally process what you are telling him fast enough to do much good by the time it gets to his fingers. With this kind of student, I'll take the plane up high and tell him to play with it and try to keep it in the air. Sometimes, hands on control can get through where words don't. With some students that insist on over controlling with the low rates on, I play a dirty trick, and put the students buddy box on high rates. The learn.

Teaching can be a lot of fun and rewarding too. Give it a try.

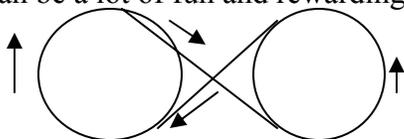


Figure 1—The Figure Eight

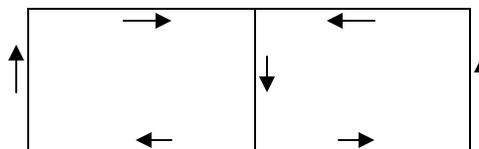


Figure 2—The Square Figure Eight



Figure 3—The Approach Landing Lineup Maneuver

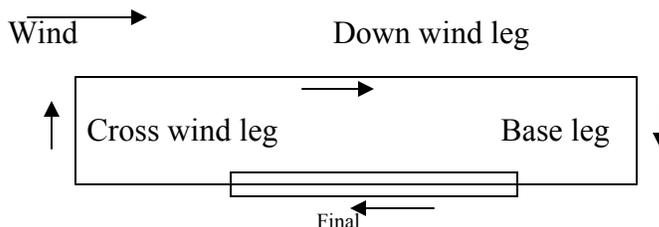


Figure 4—The Traffic Pattern and Landing