# Tom's Tips On Flying Schweizer 2-33s

**Written by: Tom Bales**

## ABOUT THE AUTHOR

In 1967, I started flying gliders with the Soaring Society of Dayton, flying out of Richmond, Indiana, and earned my instructor rating in 1973.

In 1979, I went to the Myrtle Beach, South Carolina, area and founded a commercial glider operation, Carolina Sailplanes, Inc., at Cypress Bay Airport in Little River, South Carolina. In 1989, I sold the business and retired.

I am still actively flying gliders with the Caesar Creek Soaring Club; however, I did not renew my instructor certificate this year. On July 31, 2011, I logged my 10,000$^{th}$ glider flight with my wife, Donna, as a passenger. I also flew tow planes with over 11,000 tows logged.

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## Index

it is the equivalent of about 34 lbs. in the front seat. The top line of the main placard in N36135 reads as follows:

MAX WT AFT PLT / 220 LBS FWD 191 LBS

The easy way to read these placards is to substitute "with" for the "/" and put "is" in front of the last weight that is stamped on the line. It would thus read: "Maximum weight of the aft pilot with 220 pounds in the front seat is 191 pounds."

Line 2 reads:

MIN WT AFT PLT / 100 LBS FWD 88

This reads: "Minimum weight of the aft pilot with 100 pounds in the front seat is 88 pounds."

Line 3 which needs no explanation reads:

MIN WT FWD PLT SOLO 124

The placards for use with the SAC ballast in are read in exactly the same manner. It is obvious that these numbers require some interpolation for people of other weights. The 2-33 flight manual has a weight and balance graph with which all 2-33 pilots should become familiar. It would be wise to memorize the limits for your particular weight.

## Tip 14

### Tom's Tips and Weight and Balance

Every aircraft has a "maximum gross weight". It is the total allowable weight for the empty aircraft plus everything else that is put on board, including passengers. For a Schweizer 2-33, the maximum gross weight is 1040 pounds. Most 2-33s weighed in a little over 600 pounds when built, but of course the total weight depended on what optional equipment was installed. Also, most aircraft gain weight as they age; they get new paint jobs, additional equipment is installed, and they collect dirt that adds a few pounds. In addition to the gross weight limits, the locations of the load must fall within in the center of gravity limits. For these reasons, every aircraft has its own individual weight and balance limits. If any equipment is added or deleted, a qualified mechanic must perform new weight and balance calculations or reweigh the aircraft and then enter this information in the aircraft log book, and revise the weight and balance placards in the cockpit. The FAR's does require that current weight and balance information is aboard all aircraft. Some have the weight and balance in the Pilot's Operating Handbook, but most gliders have this information on the placards.

The placards in Schweizer 2-33s require a little explanation. There are two placards in all of the club ships. One includes speed limitations, the other just weight and balance information with "SAC BALLAST IN". This obviously means with the Schweizer Aircraft Corporation ballast weight in the SAC housing between the rudder pedals. The weight itself is only about 19 lbs., but since it is placed well in front of the seat,



## Tip 1

### Tom's Tips on Pre-flighting a Schweizer 2-33

The Schweizer 2-33 Flight - Erection - Maintenance Manual enumerates all the points to be checked during a preflight inspection and all students should become familiar with this procedure.

FAR 91.10 spells out the pilot's responsibilities. Basically it says the pilot in command is responsible for everything pertaining to the flight; and in the case of gliders, the glider pilot is also responsible for the towing equipment. This is why the person hooking you up will ask for your approval of the tow rope before hooking it up.

Most new students know what to look *at* during a preflight, but many don't know that to look *for*. When examining the tow rope, look for fraying around the rings. If there are just a few broken strands don't worry about it, but if 25% or more are broken, it's time to ask for a new rope. In the cockpit, check to see that the instruments read correctly: airspeed, variometer and altimeter read zero and the altimeter hands are free to move. Ensure that the stick is free to move side to side, and front to back to the stops, and that the *control surfaces move in the right direction.* If this is done before you get into the cockpit, you don't have to crane your neck around to see the controls during the pre take-off checklist; just make sure there is nothing obstructing the full travel of the stick. The rudder pedals should be adjusted to your

liking; it is much easier to adjust them from outside the cockpit. Check the shoulder harness and seat belts for security and operability. After two or three flights, you should have determined what seat cushion setup is comfortable for you, so try to have the same setup for every flight. Check the canopy hinges and latch operation.

On the outside, inspect the skid and tire for soundness and wear and tear. Check operation of the release mechanism and make sure there are no burrs on the hook that would make release difficult. Check the pitot and static system. Insects like to build nests there and this will disable the airspeed indicator. The wing attachment bolts on the lift struts on 2-33 wings do not normally have nuts, just safety pins. In some cases these struts are convenient for tie down points so make sure the safety pins have not been deformed and dislodged by someone wrapping a rope around them. Inspect the aileron hinges and hinge pins. On the tail, look for cotter pins or safety pins in the hinge bolts of the rudder, elevator, elevator push rod and stabilizer strut attachment bolts. The tail wheel should be free to turn, it often collects long grass or mud which will cause it to bind up.

With experience, most pilots develop their own system of performing a preflight inspection, but it is vitally important that this be a system that is followed religiously so that no item is overlooked. Do not allow anyone or anything to interrupt the inspection. If you are unavoidably interrupted, start again from the beginning.



The proper technique for a crosswind take-off is to keep the upwind wing low and use rudder as necessary to keep the glider from weathervaning. Wind blowing on the side of the fuselage, vertical fin and rudder will cause the glider to tend to turn in to the wind. This is where an experienced wing runner is helpful. He will keep the wing low and run as far as possible to help prevent weathervaning until you get enough airspeed for the controls to become effective. Once the glider becomes airborne, the weathervaning tendency will be replaced by a tendency to drift with the wind. This is corrected by crabbing into the wind enough to keep the tow rope lined up with the fuselage of the tow plane.

Crosswind landings are mostly just the opposite of crosswind take-offs. While on final, crab into the wind enough to keep your track straight down the runway. If you are too high, you can side slip into the wind. Just before the touchdown, use the rudder to eliminate the crab and point the nose straight down the runway. Once the wheel touches down, the glider will again tend to weathervane. As the glider slows to a stop and the controls lose their effectiveness, it will take an ever increasing amount of rudder to keep the track straight down to the runway.

## Tip 13

### Tom's Tips on Downwind and Crosswind Landings

Most glider take-offs and landings are made into the wind, however there may be times when it is prudent to do either or both downwind. For example, in the case of a rope break, there may be no emergency landing area ahead in an upwind take-off. In this case a downwind take-off would be preferable, providing it can be done safely. The main thing to remember in downwind operations is that you are going to be traveling at a relatively high rate of ground speed with no aerodynamic control over the glider. The ailerons, elevator, and rudder will not be effective until you have about 15 mph airspeed. That means that if you are taking off with a 15 mph tailwind, you will have to have about 30 mph ground speed before the controls become usable. Assuming that you are using a reasonable powered tow plane, a downwind take-off resolves itself in short order. The wind helps the acceleration, so you can get up to speed fairly quickly. The rate of climb will be the same as in an upwind take-off, but the angle of the climb will be much lower, so be sure the runway is long enough with no obstructions at the end.

Downwind landings are a little more precarious than take-offs. Landing in a 15 mph tailwind, you will lose control at around 30 mph ground speed. If you have the glider heading in the direction you want when you lose control and have an effective wheel brake, it shouldn't be a problem.



## Tip 2

### Tom's Tips on Slow Fight and Airspeed Control

Most flight training operations do not put a great deal of emphasis on these topics but they are very important, especially for glider pilots. Airspeed control is a skill that is pretty much acquired from experience rather than something that is learned from an instructor. A proficient glider pilot can determine his airspeed within 2 or 3 mph just by the pitch attitude and the wind noise from the glider. High performance gliders are sealed much better than the trainers so the wind noise is not as good a clue. However, by the time you are flying high performance ships you should be experienced enough to control the speed by the pitch attitude and the subdued wind noise levels without difficulty. One method that can be used to develop a feel for airspeed control is to cover the airspeed indicator with a piece of paper taped at the top. Then establish a definite pitch attitude, listen to the wind noise and estimate your airspeed. Now raise the paper and see how close your estimate was to the actual air speed. Repeat this at various pitch attitudes until you are satisfied with the results. You will find that the 2-33 makes distinctively different sounds with just a 3 or 4 mph difference in air speed. By covering the altimeter you can practice altitude judgment the same way.

The main reason to practice slow flight is to gain experience flying just slightly above stall speed. In this regime the controls become very sloppy and it takes large movement of the controls to have an effect on the glider. Slow flight is used mostly when circling in small thermals in order to keep the radius of the turn as small as possible.

For any given angle of bank, the diameter of the turn increases with speed. Most thermals, especially close to the ground, have a strong core in the center. The speed must be kept as low as possible in order to keep the turn tight and stay in the thermal. For various reasons, airspeed indicators are not very accurate at these slow speeds. The Schweizer flight manual says the 2-33 stalls at 34mph dual and 31mph solo, but most of them will stall while indicating a few miles per hour higher than that. You will find that the 2-33 gives a definite buffet as you approach the stall speed. As you practice slow flight, you should get into this buffet area and acquire a feel for where it occurs so you can avoid it when you are flying in a gaggle with other gliders. Stalls are no problem if you have made clearing turns and ensured that there is no conflicting traffic, but you certainly don't want to stall when in a thermal with other gliders.



climbing turn stall. From straight and level at 45 to 50 mph, enter a very shallow climbing turn and pull the stick all the way to the back stop. As the stall starts, put in full down rudder, and while holding the stick all the way on the back stop, add about 3 inches of opposite aileron to create some adverse yaw. Sometimes it takes a few seconds for the spin to develop, so continue to hold the stick on the back stop with opposite aileron and full down rudder. If your weight and balance are favorable, you will be in a spin. The proper recovery procedure is to first use full opposite rudder to stop the rotation, and almost simultaneously, move the stick forward to break the stall. In a 2-33 it is only necessary to relieve the back pressure to break the stall. If you move the stick far forward, it will build up speed quickly and unnecessarily. This spin recovery is standard for almost all aircraft, although some may require more forward stick to break the stall. A 2-33 will lose about 200 feet per turn in a fully developed spin.

If you and your instructor are not successful in getting the 2-33 to spin, I would strongly recommend that you take a flight in the Blanik or Grob. They will spin much more easily than the 2-33 and a lot more dramatically.

## Tip 12

### Tom's Tips on Spins

Depending on weight and balance, 2-33s vary from hard to spin to almost impossible to spin. In spite of this there have been, and will continue to be, stall spin accidents in 2-33s. Most stall spin accidents happen in the pattern, which is why we must maintain a minimum of 55 mph and use extra caution to keep the controls coordinated in the pattern. The 55 mph is minimum on a nice, calm day. If it is turbulent and gusty, the airspeed must be increased accordingly. The normal progression of students at CCSC is to move into a 1-26 after 10 solo flights. The 1-26 will spin easily, either on purpose or accidently, so in my opinion, it is important that students have spin training. I don't want my students' first spin experience to be accidental. There is no FAA requirement for spin training, except in preparation for a CFI certificate. It is the FAA's position that most accidental spins occur at altitudes too low to recover, so the training emphasis is on avoiding stalls so there will be no spins. Until that training is 100% effective, I will continue to push for spin training.

As mentioned previously, spins in a 2-33 are dependent on weight and balance. I weigh about 180 pounds and if I am in the back seat with 180 pounds in the front seat, I am usually successful in getting the glider to spin. The more weight in the front seat the less success I have. During a spin one wing is stalled and one wing is still flying. This creates a situation where the stalled wing is lower than the wing that is still flying and the rotation is toward the low wing. To enter a spin in a 2-33 it is best to start with a



## Tip 3

### Tom's Tips on Turns

In this series of Tom's Tips, I have tried to stay away from the theory of flight, in order to keep the message simple. In the case of turns, however, we just have to get into some theory.

There are 3 basic classifications of turns: shallow, medium, and steep banked. A turn with a 25 to 35 degree angle of bank is considered medium, so obviously anything less than 25 degrees is shallow, and anything over 35 degrees is a steep turn. Now for the theory: Consider a wing with an exaggerated dihedral angle of 20 degrees. Looking at it head on, it would look like a wide-angle "V". Assume that this "v" weighs 1000 pounds. Gravity would be pulling down at the point of the "v" with a force of 1,000 lbs. In order to achieve straight and level flight, the "v" would have to generate 1,000 lbs. of lift. The force of gravity is always pulling straight down, but the lift force is always perpendicular to the wing. This means that in order to generate lift with a vertical component of 1,000 lbs., each half of the wing would have to produce somewhat more than 500 lbs. Now, let's consider what would happen if we bank just enough so that one of the wings is exactly parallel to the ground. This wing will still be generating somewhat more than 500 lbs. of lift, but now it is exactly opposing the force of gravity. The other wing is now at a 20 degree angle to the ground. It is still generating somewhat more than 500 lbs. of lift but that lift is perpendicular to the wing, so the vertical component of that lift opposing gravity will be considerably less. This uneven vertical component of lift on the two wings will cause the wing to return to

straight and level flight. If I haven't made this clear, just remember that in shallow banked turns, most aircraft tend to return to straight and level flight. This is called "inherent stability". A 2-33 doesn't have much dihedral but if you get it up on a day when the air is real calm and put it in a 5 or 10 degree bank, it will eventually return to level flight. It may take a while but it will get there in time.

Now let's consider a steep turn with a bank angle of 45 degrees. The amount of lift generated by the wing is proportional to its speed through the air. Remember playing "crack the whip" when you were a kid? Those on the outside went much faster than those on the inside. It's the same thing with the wing; the outer wing is going faster than the inner wing, thus generating more lift. This tends to make the outer wing lift higher and higher and is called "overbank tendency". To compensate for the overbank requires some opposite aileron. In other words, if you are in steep bank to the left, it will require some right aileron to counteract the overbank tendency. As the bank angle increases, the tail is banking also. As you go beyond 45 degrees, the rudder acts more like an elevator, and the elevator acts more like a rudder. As the speed builds up, it takes some top rudder to slow down, instead of back elevator to slow down in shallow or medium turn. As in all other maneuvers, you have to manipulate the controls to make the aircraft do what you want it to do.

If a "shallow" turn tends to return to level flight and a "steep" turn tends to overbank, somewhere in between the two there has to be a turn that will be stabilized. This is called a "medium" banked turn. To enter a medium turn,



From straight and level flight at 45 or 50 mph, establish a climbing turn with about a 10 degree bank and immediately get the ailerons back to neutral and pull the nose up to put your feet on the horizon. The lower wing (the one towards which you are turning) will stall and begin to drop. Your first reaction should be opposite rudder to stop the rotation, and forward stick to break the stall and return to straight and level flight. Like all other maneuvers it takes practice to be proficient.

Stalls are not dangerous as long as they are done at an altitude with plenty of room for recovery. The FAA considers stalls aerobatic, so they must be practiced above 1500 feet. Before doing stalls you ***must*** do clearing turns to make sure there is not traffic below and behind you. So when your instructor or examiner says "show me a stall", remember what he is really saying is, "show me some clearing turns and then show me a stall".

to the front, you might get a breaking stall. In most cases it will fall somewhere in between those two extremes.

One of the reasons for learning stalls and practicing them is that it is a required maneuver for the flight test. Just as flight instructors do stall differently, some FAA examiners want to see them done differently. Some will want deep stalls and some will want incipient stalls with an immediate recovery. Be prepared to do them however the examiner wants. If you are aware that a stall is caused by too high an angle of attack, you know the recovery requires that the stick be moved forward. But how far? For a 2-33 it is only necessary to move the stick forward to the neutral position, but some aircraft require much more so some instructors want to see a lot of forward stick in a recovery. The only bad effect of getting the stick farther forward than needed is that the speed will build up more than is needed. By virtue of flying with different instructors you will more than likely be exposed to various techniques, but if not, experiment some on your own. The 2-33 has very docile stall characteristics. If you continue to hold the stick on the stop, the tertiary stall will be a little deeper yet, but from then on, they will not get any deeper. There is no point in doing this other than to demonstrate that stalls are nothing to fear. If you are one who doesn't like stalls, start out doing a few gentle ones each flight and increase the number and their steepness as you develop a tolerance for them. Some people will actually enjoy them, and others will at least lose their apprehension.

Turning stalls are more difficult to do well, mainly because most people put too much bank in before the stall. In a 2-33 you should not have more than 5 or 10 degrees of bank or the glider will not do a clean breaking stall.



use aileron to establish a 25 to 35 degree bank and simultaneously use the rudder to stay coordinated (yaw string straight). It will also be necessary to use a little back pressure on the stick to keep the nose up. Remember that in a bank the vertical component of lift is less, so in order to increase the lift, we must increase either the angle of attack or speed. Once the desired angle of bank has been reached, *return the aileron control to neutral* – otherwise the angle of bank will continue to increase – but continue to use enough rudder to keep it streamlined with the airflow and the yaw string straight. The one most important thing about turns is to "stay coordinated".

## Tip 4

### Tom's Tips on Take-off

Towing is one of the most difficult things for new student to learn, but the initial part of the takeoff is one of the easiest, mainly because during the first part of the take-off roll there is nothing you can do to screw it up. Until you build up enough airspeed, usually around 15 miles per hour, you have absolutely no control over the aircraft. If you are not comfortable with the progress of the take-off, your *only* option is to pull the release knob. Don't be timid about pulling the release. It only takes a couple of minutes to re-hook and start over again. Once you give the thumbs up to the wing runner and he signals the tow pilot to go, he will hold your wings level or keep the upwind wing low in a cross wind. Hopefully he will be able to run fast enough that your ailerons will become effective before he lets go.

One question beginning students frequently ask is: "Should I start out with the stick all the way back or all the way forward?" Until you build up enough airspeed for the elevator to become effective, it really doesn't make any difference. The loading of the glider and how fast the tow plane accelerates determine the pitch attitude of the glider. If the glider is lightly loaded in the front seat and the tow plane starts out fast, the 2-33 tail will bang down on the ground and stay on the ground until the elevator becomes effective. If a heavy person is in the front seat and the tow plane accelerates very slowly, the 2-33 is going to stay on the skid until the elevator becomes effective. Since the tow rope is pulling on the nose of the 2-33, it tends to pull it straight toward the tow plane. So – we have covered all three axes: the wing runner is going to determine your roll axis at the start,



## Tip 11

### Toms Tips on Stalls

Many new students are either apprehensive or downright afraid of stalls until they understand them, and then sometimes they even become enjoyable.

A stall occurs when there is not enough air passing over the wing to generate enough lift to counteract the force of gravity. The way to get more air over the wing is to increase the airspeed. Since the glider is designed with the center of gravity in front of the center of lift, the nose will automatically drop when a stall occurs, the speed will increase and the stall will be broken. "Tom's Tips" is not meant to be a textbook on the theory of flight; the astute student will seek out one or more books on the subject. One that I would highly recommend is Wolfgang Langewiesche's, "Stick and Rudder".

If you do stalls with five different instructors you will probably do them five different ways. For a straight ahead stall in a 2-33, I like to have about 45 or 50 mph airspeed, then pull the stick back abruptly enough to the rear stop so that I put my feet on the horizon. If you are looking straight ahead at the horizon pull the nose up to put your feet in your line of sight. In most cases you must pull the stick all the way to the rear stop to get a clean breaking stall in a 2-33. If you just ease the stick back gradually, the nose will not come up far enough and it is not likely that the 2-33 will stall; it will probably just sit there and buffet. How the glider reacts depends on weight distribution. If heavily loaded to the front, it will more than likely not even buffet, even with the stick on the back stop. If very lightly loaded

across the ground. The Schweizer 2-33 flight manual suggests airspeed of 45 to 50 mph for the maximum rate of descent. This is below our recommended pattern speed and I would urge students to use the higher speed while training. Later, if a maximum effort landing is necessary, it could be done at the 45 to 50 mph speed.

Like everything else, it takes practice to become proficient. Slips can be done at higher altitude, but you don't get the same sensation as you do when slipping close to the ground. The time from turning final until touchdown is very short, so that doesn't allow much time per flight to practice slips. To increase this time, you can purposely enter the pattern a little high and then do a slip on the downwind leg. Select some prominent landmark straight ahead and slip toward that point keeping your track across the ground straight with the ailerons. If still high, you can extend the downwind to give more slipping time on final. Most people develop a preference for slipping with one particular wing down. It is sometimes more advantageous to slip one direction over the other so it would be best to develop the skill to slip with either wing down, so you will be prepared for whatever conditions you encounter.



the tow plane will help with the yaw (direction), and you make the decision about the elevator. If the tail wheel is on the ground, move the stick forward. If the skid is on the ground, move the stick aft. If you are riding along nicely on the wheel, enjoy it because in just a few seconds you will be airborne and it will be up to you to control the aircraft in *all three axes at the same time*. Now is the time to read "Tom's Tips on Towing".

# Tip 5

## Tom's Tips on Towing
## *(use your rudder)*

In most learning endeavors, you begin with the easiest things and work up to the more difficult in steps. Not so with learning to fly gliders. Usually, by the second or third flight the student is expected to *try* to fly the tow, which is one of, if not the most difficult part of learning to fly gliders. At some point in their training, most students get the feeling that they will never learn to stay behind that tow plane. Don't despair. I have never heard of anyone who wasn't finally able to at least do a reasonable job of flying the tow. Here are some thoughts on why it is so hard. Almost everything you have ever tried to steer, from your first kiddie car to your tricycle, to your bicycle and your car, you have steered with your arms and hands. I have seen many glider pilots become reasonably proficient at towing without using the rudder pedals correctly. You may have flown with someone who has done an admirable job of staying behind the tow plane on a very bumpy day, but if they are not using the rudder pedals, the stick is probably going from side to side and back and forth at a rapid rate. We call them "stick churners". If you learn proper rudder technique, you will be a much smoother pilot and even on a turbulent day, the stick will require very little movement.

Let's review some basic aerodynamics. The rudder makes the glider rotate around the vertical axis; when you push on the right rudder pedal, the glider rotates to the right; the left wing speeds up in relation to the relative wind, creating more lift and raising the left wing. Of course, the opposite is true when you push on the left rudder pedal. In most cases, when a



# Tip 10

## Tom's Tips on Slips

From day one, your flight instructor has stressed the importance of coordination. Now we want to teach you how to be uncoordinated. When the yaw string is straight back, and the ball of the inclinometer is in the center, the glider is flying in its most efficient mode. Sometimes, especially in landing, we want to increase our sink rate to control our glide path, and slipping is one way to do this. Actually, in modern gliders, slipping is rarely necessary, as the dive brakes are usually powerful enough for most all landing situations. There are cases though, when you want the maximum glide path control possible, and you need both the dive brakes and a slip for a successful landing. In a slip, we are creating extra drag by moving sideways through the air and generating more resistance to the relative wind.

Three of the most common problems associated with learning to slip are: failure to use enough rudder, not using the proper amount of aileron to control the ground track, and allowing the speed to build up too much. Slipping a 2-33 (or a 2-22) is usually a matter of pushing the rudder pedal to the stop and then applying enough opposite aileron to control your track across the ground. For the most efficient slip you must apply full rudder. In most cases you will be lined up on the centerline of your landing lane so you will want to do a forward slip. This will not require a whole lot of aileron control. If you are not lined up on the centerline of your intended landing lane, you can use more or less aileron to move right or left and change your track

back to the old saw that you use the proper input into the controls to make the glider do what you want it to do.



student on tow uses ailerons to pick up a low wing, it ends up in an overcorrection. The next step is then an overcorrection in the opposite direction and then the frustration sets in. So, next time you are on tow and a wing is low, use some opposite rudder instead of aileron to pick up the low wing. Like everything else, it takes practice, and you will have to concentrate and remember to ***steer with your feet instead of your hands***. I guarantee you will become a better, smoother pilot.

As the rudder controls movement around the vertical axis, the ailerons control movement around the longitudinal axis. For the purpose of this exercise, we want to use as little aileron movement as possible. The elevator controls movement around the horizontal axis, and causes the glider to be high or low with respect to the tow plane. There is no hard and fast rule on where the glider should be, but it is generally accepted that the tow plane's wings should be approximately on the horizon. One thing to keep in mind while on tow: don't *ever* let the glider get more than a little high on the tow plane. The glider and long tow rope act as a lever on the tow plane and can overpower the tow pilot's ability to control the plane. If you cause the tow plane to turn or climb, it is usually not of that much concern to the tow pilot, BUT if you cause the tow plane's nose to be pointing to the ground, he will more than likely release the tow rope ***before*** you put him and the tow plane in jeopardy. If you ever find yourself too high, remember the proper action is to release the tow rope before the tow pilot is forced to release.

When making corrections with the controls, try to think of it as using pressure on the stick, not jerky movements. When you find yourself out of position, don't try to get

back in a hurry. The first thing to do is to keep from getting further out, then just try to get half-way back with each attempt. If you try to get all the way back in just one step, it generally ends up in an overcorrection. Easy does it.

In order to stay directly behind the tow plane, one reference to use is the tow rope. It should be kept perfectly straight and in line with the fuselage of the tow plane. Also remember that when making turns on tow, the glider turns where the tow plane turns, not when it turns, keeping the glider in the same flight path as the tow plane with the same angle of bank. With practice and patience you will soon have the art of towing mastered.

*Note: You don't have to be a student to benefit from this tip. It will work for some of you experienced "stick churners" too!*



Once we have flown a proper pattern and have established ourselves on a glide path that will end at our intended touchdown point, we have to get the beast on the ground and stopped. There are two basic ways to land, and as you might have guessed there are two schools of thought on how it should be done. You should learn both, and as you develop more experience decide which is best for you in the particular aircraft you are flying. First is the full stall landing which has come into favor recently; mostly for the three wheel "tail dragger" type gliders. For this type of landing you gradually reduce your speed as you get lower and try to achieve a stall just as the main wheel touches the ground. Because the center of gravity is behind the main wheels, this is the preferred type of landing in most cases, for conventional gear (tail wheel) airplanes. In a 2-33 with a pilot on board, the CG is in front of the main wheel so most people prefer a "wheel" landing. In this type of landing, we round out about five feet or so above the ground, slowing the descent rate somewhat and then flying the glider on to the ground at about 45 mph. With the CG in front of the main wheel, the nose tends to go lower at the touchdown reducing the angle of attack. This prevents the glider from becoming airborne again; it helps to put just a little forward pressure on the stick as soon as you touch down. Now that we are on the ground, we still have to keep on "flying" until we are stopped. We still have control until the airspeed drops to around 15 mph, after which we have no control except for the wheel brake. It is important to have the glider headed in the direction you want it to go before you lose control, especially if there is a crosswind. In a crosswind, the glider will tend to weathercock into the wind and it will take a judicious amount of rudder to keep it straight until you are stopped. There are hundreds of variations in landings and it all goes

previously selected touchdown point. There is one point out in front of you that is your actual touchdown point. This is a point that is stationary in the canopy, not moving up or down. To illustrate, think of a spot not far in front of the glider. It will be moving down on the canopy and soon be behind you. Now pick out a spot on the horizon. As the glider gets lower, that spot will be moving up on the canopy. Somewhere in between the two extremes there is one spot that will remain stationary. That is your actual touchdown spot. Now all you have to do is adjust your glide path so that the selected and actual touchdown points coincide. Finding that spot in the canopy that doesn't move is like looking for the hidden scene in one of those 3D pictures. It takes practice and patience, but it can be done. If the stationary spot is below your selected touchdown spot, you have goofed and there is no correction. You are going to land short. We use displaced thresholds on the glider landing areas of both runways in order to minimize problems with short landings. If the stationary spot is above your selected touchdown spot, you only need increase your sink rate with dive brakes or a slip or a combination of both as necessary. One common problem when high, is a tendency to point the nose at the intended touchdown spot. This does not increase the sink rate, it just increases the airspeed and causes the glider to float farther down the runway in ground effect and results in a longer landing that you would have had in the first place. Once you are on final, hold your airspeed constant and adjust your rate of descent with dive brakes and slips. Even though the best speed of the most efficient slip in a 2-33 is 45 to 50 mph, a slip is still very effective at the recommended pattern speed. If you let the speed build up too much though, the slip becomes less effective.



# Tip 6

## Tom's Tips on Tow Release

Remember when we talked about the take-off and how easy it is? Well, the tow release is ***really*** a no-brainer. Just pull that red release knob. You'll hear a "big bang" and you'll know you've been released! But wait a minute. Let's do it right. Safety should always be the number one priority when flying. Remembering the FAR'S, an overtaking aircraft should always pass on the right and well clear of the aircraft being overtaken. Just maybe on this day you are being overtaken by a pilot who has never seen a glider on tow and he wants to get in close for a good look just as you release. He may be in the area you are about to turn into. You should always clear the area to your right just prior to pulling the release knob. Then you should make a climbing right turn immediately after release. The purpose of the climbing turn is to get away from the tow rope and its tow ring. I know it sounds far-fetched, but in the past there have been cases of the tow ring hitting the glider canopy after release; in one case it caused a fatality. Now that we know to clear the area out to the right just prior to release and to make a climbing right turn immediately after release, let's add a little finesse to the tow release and eliminate that "big bang". This will also save some wear and tear on the gliders. In the recent past we have had some extensive repairs to two 2-33s caused by the constant pounding of the release arm on the fuselage. To eliminate this problem, make sure you are at least even with or slightly above the tow plane then put just enough forward pressure on the stick to take the tension off the tow rope and pull the release. Instead of the "big bang" you will hear a "click". It will be much easier on the fuselage and you will have demonstrated some flair in executing the tow release. One note of caution when taking the tension off

the tow rope: don't put enough forward pressure on the stick to cause slack in the rope. We just want to ease off on the tension.



pattern should also change. As you reach the IP, you should adjust the elevator trim for the proper pattern speed, 55 mph minimum for a 2-33 on a calm day. Add ½ mph airspeed for each mph of wind. Look for other air traffic and check the landing area for gliders that have just landed. As you are moving on the down-wind leg it would be wise to test the dive brakes, select your intended touchdown point, and try to keep about a 30 degree angle between your sight angle and the ground as you turn to base leg. Maintaining this 30 degree angle on all approaches will result in a wider pattern if you are high or a tighter pattern if you are low. Remember, you have to adjust for the conditions at the time. Flying in a 2-33 into a 25mph wind reduces the glide angle to about 10 to 1. Most students do not have a problem getting to this point, but flying from base leg to the touchdown is arguably the most difficult part of learning to fly. If you haven't already decided which landing lane you are going to use, you should do this on base leg and then turn final on the centerline of that lane. From the point where you turn from base to final, unless you alter your flight path or sink rate, there is one spot where you are going to touch down. Since we can't lessen the sink rate, we want to be sure that we are high. There are several corrections to make if you are too high, but there are NO corrections to make if we are too low. During your training, you have been practicing airspeed control by pitch attitude and sound. Here is where you put that to use. Controlling airspeed is one of the most important factors in landing, but you must be alert to what is going on outside the cockpit, so don't stare at the airspeed indicator. Most experienced glider pilots can tell their air speed within 2 or 3 mph just by the air noise and pitch attitude. As we turn from base to final, we look at our

## Tip 9

### Tom's Tips on Patterns and Landings

In the absence of a tower, it is the responsibility of the pilots involved to sequence themselves in proper order for a safe landing. To make this task easier, we fly specific traffic patterns so you know where to look for other traffic. The alert pilot will also be aware that someone may not be flying a standard pattern; they might even be landing downwind. According to the FAR'S, unless there is a segmented circle indicating otherwise, all airplanes should make left hand turns in the pattern. Also, the aircraft at the lower altitude has the right of way. The FAR'S do not require that gliders make the left hand turns, but if you are intermixing with other traffic, it would be best to conform with their established pattern if possible. The normal pattern for airplanes at most airports is a 45 degree angle mid-field entry into the downwind leg at approximately 800 feet agl. Maintain the 800 feet until abeam your intended touch down spot and then continue your descent, turning base and final at the appropriate time. In order to better judge the wind strength, most glider operations add a crosswind leg to the pattern.

At CCSC, we have established our IP's (initial point) at 800 feet agl over the opposite end of the runway from our intended landing runway. When landing on runway 27 you should cross the west end of the runway on a southerly heading at 1000 feet. Since we fly a right hand pattern when landing on runway 9, you should cross the east end of the runway on a southerly heading. From there on you should not have a fixed altitude for any reference point in the pattern. As wind and weather conditions change, your



## Tip 7

### Tom's Tips on Boxing the Wake

Boxing the wake, though not difficult, is one of the more perplexing things the student glider pilot has to learn. Mainly because there are no definite parameters. Since this is a required flight test maneuver for all glider ratings, it should be developed to a high skill level. The "Practical Test Standards" require that the applicant "maneuver the glider slightly outside the tow plane wake in a rectangular, box-like pattern." What is wake turbulence? In the old days it was called "prop wash" and later it was determined that it was caused by wing tip vortices and was called wake turbulence. In simple terms, it is a cone-shaped area of turbulence that extends back from and below the tow plane.

Before describing the task, let's review some definitions. "High tow position" is really a misnomer. As mentioned in "Tom's Tips on Towing", we ***never*** get high on the tow plane. "High tow position" really means "normal tow position", with tow plane wings approximately on the horizon, as opposed to "low tow position", which means below the wake turbulence. Now let's get on with it. You should communicate to the tow pilot your intention to box the wake before takeoff, but this is not an absolute necessity. At CCSC we begin by going straight down through the wake, then straight back up through the wake. This is a signal to the tow pilot that you are going to box the wake. It is helpful for the tow pilot to know you are going to box the wake so he can plan to be heading upwind at around 1000 feet – the minimum altitude to begin boxing the wake. Be sure to keep the glider centered behind the tow plane because the vortices are pushing mostly straight

down directly behind the tow plane. If you are off to one side, it will cause the inside wing to be pushed down, putting the glider in a steep bank. The next step is to move off to the right (keeping the tow plane wings on the horizon). Here is where the difficulty begins. Most students ask, "How far out do I go?" There is no specified distance or point to go to, but one reference I have found to be helpful when towing behind a Pawnee, is to move out until the tow rope lines up with the inside "jury struts". (The struts that go from the wing to the fuselage are called "lift struts" and the vertical struts between the wing and the lift struts are called "jury struts".) For a perspective on what this should look like, get 100 feet or so behind a tow plane on the ground, pick up the tow rope and move out to the side until the rope lines up with the jury struts. Then move out to the other side doing the same thing. This will give you a feel for what it should look like when you are in the air. Unfortunately, it is not possible to get low enough to simulate what it should look like at the low tow position. You should have the horizontal stabilizer and the elevator of the tow plane positioned a little bit above the top of the fuselage, where the lift struts meet the fuselage. Have your instructor demonstrate this on your next flight and get a picture in your mind of what it should look like. Now that we have defined the positions we want to use, let's review the steps for "boxing the wake".

1. Communicate your intentions to the tow pilot verbally or write it on your tow card.
2. For safety considerations, do not start the box until you have at least 1000 feet of altitude. While it is possible to box the wake while turning, it is easier to learn when the tow plane is going straight.
3. Move smoothly and slowly down through the wake turbulence and then right back up to the high (normal) tow



absorber instead of having the dead weight of the glider applied to the rope instantaneously as the slack comes out. As your flying skills develop, you can use the rudder to get the nose pointing at the tow plane just as the last of the slack comes out. This will make a seamless transition back to normal tow. Demonstration of slack out procedure is a required maneuver for the flight test, so it should be practiced until you are proficient. To purposely get slack in the rope, get a little high (15 or 20 feet) on the tow plane, and then quickly push the nose over. Care must be taken that you do not allow a large loop to develop in the rope that could wrap around the glider. In the event you do get a large loop in the rope, you always have the option of releasing the tow rope.

be ample room to land in the fields straight ahead or off to the right. If you have a rope break on runway 27 (toward the west), the choices are more limited. Depending on the circumstances at the time, the most favorable landing spots will probably be ahead to the left. On each training flight, you should ask yourself where you would land if the rope breaks. You should do this on a great number of flights at various altitudes so that if it does happen, you will not waste precious time wondering what to do. It will already have been determined. Remember, if you have a rope break at low altitude, you are in the pattern, so maintain pattern speed. While it is important to not waste time after a rope break, it is not a time to make rash decisions. If you have planned properly, you will have ample time to make a safe landing. The pilot in command of the glider is responsible for the condition of the tow rope and all other launching equipment, so be sure to include it in your preflight inspection and pre-take off checklist.

At CCSC, we do not usually have weather conditions that cause us to get slack in the rope. But, if you go to other areas where there is good ridge or wave flying, you will more than likely encounter that kind of turbulence. It doesn't make any difference how good you are at flying the tow; there will be occasions when you cannot avoid getting slack in the rope.

One method of eliminating this slack is to open the dive brakes, and then slowly close them so that the last of the slack comes out just as the dive brakes reach the fully closed position. Timing this takes a little skill and practice. The method most people prefer is to yaw the nose away from the tow plane with the rudder. As the slack comes out, the rope will pull the nose of the glider back towards the tow plane, acting like a shock



position. It should take about 8 or 10 seconds, give or take a few.

4. Now we want to describe a nice rectangular box around the wake. Move slowly but deliberately out to the right (or left; rotation direction is optional) keeping the wings of the tow plane on the horizon until the tow rope is lined up with the inside jury strut on the left wing of the tow plane. Allow about 4 or 5 seconds. Many instruction books say to use "rudder only" to move to the side, but it will be easier if you also use a little aileron.
5. Next we want to move straight down, keeping the rope lined up with the jury strut, until the elevator is sitting just above the fuselage. This should take about 4 or 5 seconds.
6. Now we want to move to the lower left corner of the box by moving straight across. Use mostly rudder, but again, a little aileron will make it easier. All the while, keep the elevator just a little above the fuselage. Give this 6 to 8 seconds.
7. To move to the top left corner takes just a little up elevator, but a whole lot of left rudder and maybe just a little bit of left aileron to make the ascent vertical and not get pulled into the wake on the way up.

   Keeping the tow rope lined up on the inside jury strut on the right wing this time, stop the ascent when the tow plane wings are on the horizon.
   Again, 4 or 5 seconds for this segment should be about right.

8. To complete the box, get directly behind the tow plane again. Right rudder and a little aileron should get you there in about 4 or 5 seconds. Be sure to keep the tow plane's wings on the horizon as you move.

*If you can complete a nice rectangular box, with a steady deliberate pace with a 1 or 2 second stop to clearly identify each corner, without encountering the wake turbulence, you have mastered the art of "Boxing the Wake".*

This is a maneuver that should be practiced frequently, especially by advanced students. It doesn't cost a penny more and is a good demonstration of a pilot's ability to make an aircraft do what he wants it to do by proper manipulation of the controls. Also, this is one of the first things the examiner asks you to do on a flight test, and you know what they say about first impressions.



# Tip 8

## Tom's Tips on Rope Breaks and Slack Out Procedures

If you fly gliders, sooner or later you will have a rope break. Most often it will occur as the tow plane starts the take-off roll, or after you have reached a reasonable altitude. In either case, it usually doesn't present much of a problem. If the rope breaks above 200 feet, you will normally have enough altitude to do a 180 and make a downwind landing on the runway. It's when the rope breaks shortly after liftoff and before attaining an altitude of 200 feet that you have a serious problem. The primary concern is that you don't have much time to decide what to do, so you should have made that decision before starting the take-off. The cardinal rule is that if the rope break occurs below 200 feet you land straight ahead, steering left or right to miss obstacles.

There can be no hard and fast rules for emergencies; you have to make decisions based on the circumstances at the time. In ***any*** emergency, the most important thing to do is ***fly the aircraft***. In other words, keep the aircraft under control. Even if a crash is inevitable, it is much better to have control over where the crash is going to occur, so maintain flying speed. There are three things to consider in an emergency. The number one priority is the safety of the passengers and crew. Second is the protection of the aircraft from damage. The least important is to land back at the airport.

In the event you have a rope break at low altitude while taking off on runway 9 (toward the east), there should