Harness Mounted Drogue Chute

Operator's Manual

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Introduction To The Harness Mounted Drogue Chute

The drogue chute is a device designed to increase drag and in so doing significantly reduce your glide ratio. The drogue reduces glide ratio noticeably even at slow speeds, but the affect is much greater at higher speeds. In effect, the drogue gives a high performance glider the glide ratio performance envelope of a much lower performance glider, and as a result, makes many aspects of landing much easier.

First, the drogue allows you to set up much higher, making it easier to avoid obstacles at the approach end of the landing area. Second, the steeper glide path the drogue provides makes it much easier to set up an accurate approach to the target, because the same error in altitude results in a smaller error in distance traveled. Third, if you do find yourself too high after turning final, the drogue gives you a much greater ability to shorten your glide by flying faster. Finally, after you round out, the extra drag from the drogue will make you slow down to landing speed much more quickly. As a result, you will spend less time in that vulnerable phase of the landing where you are "floating" across the LZ, at near minimum controllable airspeed. Also, because you will slow down more quickly, it will be easier to time your flare and make a good landing.

In short, in many ways using a drogue chute for approach and landing will give you the feel of flying a much lower performance glider.

Safety Considerations

There are several important safety considerations in using a drogue chute. Since approach and landing takes place close to the ground, this is a critical phase of flight, and even small problems can create a very dangerous situation for the pilot. A few years ago a pilot in Europe died after deploying a drogue chute either over his side flying wire or his basetube, which caused him to lose control of the glider and led to a fatal accident. If a drogue chute were properly deployed, and then subsequently became caught or entangled with the keel or a batten on the trailing edge of the glider, it could dangerously compromise the pilot's ability to control the glider during the approach and landing. Even just the distraction to the pilot created by a drogue chute which is oscillating significantly, or collapsing and re-inflating, could cause a lack of attention that could lead to a serious accident. The safe use of a drogue chute requires constant and careful attention on the part of the pilot to all potential safety concerns.

Caution: Do not hold the drogue in your hand for any longer than it takes to make a clean, safe deployment. Do not fly the glider holding the drogue against the control bar. Avoid any possibility of the drogue being deployed over the basetube, over the side wire, or in such a way that it could pull directly on any part of the glider.

Specific Features Of The Wills Wing Drogue Chute

After experimenting with several types of drogue chutes, chute attachment methods and chute deployment methods, Wills Wing has settled on the Asymmetric Mount, Short Coupled, Harness Mounted Drogue Chute as the best design. The features of this design are as follows:

1) The canopy is a 60” diameter pulled down apex parachute.

2) The total deployed length of the canopy from bridle end to canopy apex when inflated is approximately 45” and is thus designed to deploy and remain inside the trailing edge of the glider, to prevent any possibility of entanglement.

3) The parachute bridle includes an integral swivel to prevent a spinning canopy from wrapping up the lines and closing the parachute. A new canopy will generally not spin, but if the canopy becomes asymmetric with age, it may start to spin after deployment.

4) The parachute is designed to be attached on one side of the harness, at the point of attachment of the main support strap to the harness. (The parachute requires a secure attachment to a part of the harness which is fixed and stable to prevent induced oscillations in the canopy). When used with a harness which has a single, center mounted main support, a means must be provided to attach the drogue chute to the side of the harness, at a point even with the main support attachment, and in an area where the harness is reasonably rigid when the pilot is in landing position.

5) The drogue chute is designed to deploy and remain slightly out to one side of the pilot. You can expect that the parachute will try to fly outwards, and slightly upwards after deployment. This keeps the parachute in a relatively clean airflow, and will help to keep it stable and inflated. A canopy which is mounted symmetrically on the harness and/or one which tends to fly directly behind the point of attachment, will be much more subject to deflation and oscillation caused by flying in the wake of the pilot’s body.

Attaching The Drogue Chute To The Harness

1) First lay out the drogue chute with the lines extended and make sure that the lines are not tangled and run straight from the skirt to the bridle. Holding the end of the bridle, pull the parachute through the air and check that it inflates properly. Note that the center (apex) of the canopy will be pulled down below the top of the canopy. This is by design and normal and results in a higher drag coefficient for the canopy.

2) Check that the swivel turns freely with the bridle ends under a tension load of about 30 lbs. You should not be able to put more than one full twist in the bridle without the swivel turning to release the twist.

3) Decide which side you want the drogue mounted on. Right handed people will generally want to mount it on the right side of the harness. Pass the end of the bridle through a closed loop of webbing at the lower end of the main support strap on that side. Pass the entire drogue chute and lines through the loop in the end of the bridle to larks head the bridle end to the harness attachment point. (Note: Do not larks head the drogue chute bridle around the main support strap in such a way that it is not fixed to the base of the main, and could slide up the main towards the glider.)

4) Have the drogue chute container sewn to the harness. The container must be mounted immediately adjacent to the drogue chute attachment point and at a place on the harness which can be easily reached in flight.

5) Place one hand around the lines and slide it towards the apex until you have captured the skirt of the drogue chute. Holding the chute at this point, place the other hand around the chute and slide it upwards until you are holding the chute at the apex with that hand, and the chute is collapsed into a long, roughly cylindrical configuration. Fold the canopy back and forth in thirds, and then fold the lines back and forth at the same length against the canopy. Turn so the lines face the bottom of the container, and place this package into the container, allowing the bridle to pull out just as much as is required to reach to the attachment point on the harness. The canopy is now packed and ready to use.

Using the Drogue Chute In Flight

Before every launch, pre-flight the drogue chute to make sure it is secure in the container. Also make sure that any lines attached to the harness, such as zipper opening and closing lines, are in a proper state of maintenance so that they can be securely fixed to the harness during flight and will not come loose and become entangled with the drogue chute.

To use the drogue chute for landing approach, we strongly recommend that you deploy the chute at the beginning of your approach, and fly the entire approach with the chute deployed. There is no reason not to do this, and there are significant safety benefits to not having to deal with a configuration change during the latter stages of your approach.

Before you use the drogue chute for the first time on an actual landing approach, we recommend you fly out over the landing area with more than 1000 feet of altitude, (2000 or 3000 feet is better),

deploy the drogue, and explore the performance and flying characteristics of the glider. (See the section below for how to actually deploy the drogue). You should note that the drogue does not significantly change the flight characteristics of the glider at lower speeds. Glider trim and general handling should feel pretty much normal. Pick a reference point on the ground on your expected glide path and observe how the drogue changes your glide path at various speeds. Note how dramatically your glide ratio is reduced and your sink rate increased as you fly faster. Get used to the feel and sound of having the drogue deployed. The canopy will rattle in the slipstream, especially at higher speeds, and it will move around some. If you go upright and twist your body in the vertical axis, (especially if you twist to the right with the drogue mounted on your right, or vice versa) the drogue will be pulled closer to being behind you, and may oscillate or deflate temporarily. The drogue will tug gently on you, but not so hard that it will interfere with your control. At sufficiently high speeds, if the drogue is pulling upwards against the bottom rear wire, you may notice an induced turn in the glider. Observe where the drogue flies throughout the range of body motion you make in pitch and roll, and make sure there is no way the drogue can become caught on the trailing edge or the rear of the keel.

Drogue Deployment In A Normal Landing

Assuming you are using a standard aircraft approach, the recommended sequence for use of the drogue in a normal landing would be as follows:

1) Fly to the initial point of the approach. Note that you need to set up significantly higher than you ordinarily would. This can be done by arriving at the initial point higher and flying the same approach, or by entering at the initial point at the normal altitude and extending the 45 entry leg to bring the downwind closer in to the field, and thus set the approach entry higher. Unzip your harness and verify that the zipper control lines are securely fastened to the harness. Check the area for traffic.

Caution: If the bridle or lines of the drogue become entangled with your zipper control line, it will probably cause the drogue to deflate. Make sure your zipper control lines are securely fastened to the harness before deploying the drogue.

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2) Establish yourself on the 45 entry leg of the approach, and when the glider is stable and under control, and the air is relatively smooth, look down and reach for the top opening of the drogue chute container. Put your hand inside the container, put your hand around and grasp the folded chute.

3) Look back to your direction of flight and check again for traffic. Pull the chute out of the container and holding it close by your hip, drop it down, back, and out away from your body. (Note: If you are wearing gloves, or if for any other reason you have difficulty reaching into the container and getting your hand around the chute, place your hand around the chute bridle just outside the container. Pull down, outwards and forwards, allowing your hand to slide up the chute bridle and lines as they are extracted from the container. Slide your hand up the lines until you have the canopy skirt firmly in your grasp. Then hold the skirt tightly and pull the rest of the canopy from the container. Drop the canopy down, outwards and back to deploy it.)

4) Continue the approach. Remember that at each stage of the approach you will want to be significantly higher than normal. On your first few approaches it will be difficult to convince yourself to be high enough. It is better to err on the side of being too high, especially if there is a landing area threshold that you must clear for a safe landing. This is so because it is much easier to shorten your glide with the drogue than it is to extend it.

Caution: Make sure to allow yourself plenty of altitude to clear any obstacles, such as trees or power lines, at the approach end of the landing area.

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5) Once the drogue is deployed, try to avoid sudden maneuvers. Make your turns wide, using a gentle initiation and a shallow bank angle. Change airspeed gradually. Sudden maneuvers will increase the chance that the drogue will be pulled into the turbulence behind your body, and may collapse.

Caution: It is always possible that the drogue will deflate. It is important to leave yourself an "out" in your landing approach in case this happens. If possible, set up your intended target nearer to the approach end of the landing field so that you have extra room to overshoot if the drogue fails. In any case always have some way you can alter your approach to make a safe landing in the event of a drogue failure.

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6) When you turn to final, you should be somewhat too high for hitting your intended target, even for your expected glide path with the drogue deployed, and you should be much too high for a normal approach to your target. At this point, fix your eyes on the target and simply use your flying speed to adjust your glide path so that it is straight to the target (the target does not move in your field of view). If the target is moving towards (underneath) you, speed up. If it is moving up in your field of view (coming up short) slow down. (Caution: Do not slow down too much if conditions are such that you expect a strong gradient near the ground.)

7) As you near the ground, perform a normal round out, but be prepared for a substantially shorter period of time between round out and flare, much like you would expect if you were landing on a slight up hill slope. When the time comes, execute a normal flare.

(Note: The use of the drogue quite accurately simulates landing on a slight up hill slope. By the same token, using the drogue will make landing on a down hill slope feel more like landing on level ground. This can make a very dramatic difference in the usability of landing fields that slope down hill at a rate that approximates the maximum L/D of the glider. Without the drogue, one tends to "glide forever" on such a slope leading to a high probability of over shooting the target and / or having an improperly timed flare, or flaring with a wing down or the glider yawed to one side. With the drogue, these problems are greatly alleviated, and landing areas that may previously have been impractical become quite reasonable again.)

A Few Important Additional Considerations

Wind Speed vs. Speed To Fly: Please note that the above instructions assume light to moderate wind conditions (less than 12 mph) in the landing area. Note also that the prescribed method for using speed variations to control glide path on final is opposite to what is taught for approaching a landing area when there is significant wind. When approaching in wind, your glide path relative to the ground is already steepened by the effects of the headwind. To glide further you would normally speed up to reduce the effect of the wind (by reducing the percentage of your flying speed that is represented by the wind speed.) For example, if you are approaching at 25 mph in a 20 mph wind, your forward ground speed is only 1/5 of what it would be in no wind, so your glide ratio is only 1/5 of your L/D. Approaching in the same wind at 40 mph, your glide ratio over the ground is now ½ of your L/D, so even though your L/D has been reduced by speeding up, your glide ratio is improved. The ability to improve your glide ratio in a head wind by speeding up is one aspect of what pilots call "penetration." Note that if your L/D falls off steeply enough with increasing speed, you can conceivably have no ability to extend your glide by speeding up. In the example above, if the L/D at 25 mph was 10:1 and the L/D at 40 mph was 4:1, the glide ratio at either speed in the 20 mph head wind would be 2:1. That is, the glider would have no ability to increase glide ratio by speeding up.

This is in fact what occurs on low performance gliders in moderate to strong winds, and it is what occurs when using a drogue chute. With the drogue chute out, your glider is a low performance glider. If the wind is strong, you may have no ability to adjust your glide slope by adjusting airspeed, so make sure you set up plenty high. Alternately, if the wind is smooth and strong, you can simply elect not to use the drogue and thus retain your ability to improve your glide into the wind by speeding up. The effect of the wind will be to foreshorten your glide in much the same way the drogue would in no wind, so you may not feel the need to use the drogue. (In turbulence, when there is strong lift and sink combined with strong wind, we feel that the use of the drogue enhances landing safety.)

Landing Pattern Considerations: One potentially serious safety problem with using the drogue is how it affects the mixing of gliders in the landing pattern. When you deploy the drogue, you are going to just about double your average descent rate. You can reduce your descent rate by slowing down, but no matter what you do, you are going to descend significantly faster than another glider without a drogue. Pilots do not expect another glider to descend through their altitude when they are on approach, and to have this happen can be quite dangerous. This would suggest the following rule – do not deploy the drogue until you are the low glider in the pattern. This is the easiest, and surest way to be sure you don't cause a landing conflict by sinking through another glider.

If the pattern is crowded, following this rule may not always be feasible, as it may require that you delay deployment until you are too close to the ground to deploy with optimum safety. In this case you can fall back on rule #2 – do not deploy the drogue until the only glider below you is at less than half your altitude.

Another Use For The Drogue

One other use for the drogue that could enhance your safety is as a way to increase your sink rate in an emergency situation. If you find yourself in strong lift and need to descend, the drogue will allow you to achieve a much higher sink rate at any flying speed.

A Few Things We *Don't* Recommend:

1) We don't recommend that you wait to deploy the drogue until after you've turned final. This is sometimes suggested as a way to avoid having the drogue cause you to "come up short" of the landing area. We don't think it is safe to be fumbling with a drogue when you're close to the ground and precise control of the glider is imperative. The way to avoid coming up short is to set up a little high, and dive to get rid of excess altitude if necessary. That's what the drogue allows you to do.

2) We don't recommend that you try to reel in or re-stow the drogue chute once you've deployed it, unless you're in a true emergency situation and it is your only option. Same reasons and alternative strategies as (1) above.

3) We don't recommend you attach the drogue to your harness with a quick release device. We would be concerned about the possibility, however remote, that the drogue could become entangled with the glider after release, which could be very dangerous, especially if it were off-center.

4) We don't recommend you use the drogue on every landing. It is a great aid to improve your ability to target a small landing area, and when landing in light winds in a thermally landing area it will reduce your float time prior to flare and improve your chances for a clean landing. When you have the opportunity to land in smooth air, in a large, unobstructed field, we recommend that you land without the drogue so as to preserve and continue to improve your basic landing skills.

5) We strongly recommend against using the drogue to allow you to "step up" to a glider that would otherwise be more demanding of skills than you could safely handle. While it is true that the drogue can greatly simplify the most difficult aspect of flying a high performance glider, it is also true that the drogue is itself a complex and potentially dangerous system. To use a drogue safely you need at a minimum to have adequate skills and experience to be completely comfortable in your glider.

In Closing

The drogue chute is potentially a very useful tool for improving the quality and safety of your landings. At the same time, it increases the complexity of your aircraft, and raises serious new potential safety concerns that must be managed. Please use caution when using the drogue chute. Please contact us if you have any questions, of if you have any experiences with the drogue from which we or others might benefit.

Fly safely.

Wills Wing, Inc.

Drogue chute pocket template for harness