

From The Downwind Rigging Loft
#12
15 June, 2004
Line Twists

We get a lot of questions about line twists. Line twists used to be little more than an inconvenience but are now a major problem if jumping a highly loaded high performance canopy. A heavily loaded wing with a taper to its planform can spin violently if it opens with line twists. Once the canopy begins to spin, kicking out of line twists is more difficult than if it flies straight and stable. While spinning, the canopy loses a lot of altitude, very quickly, at least as quickly as in a hard spiral using steering lines, if not more so. This, of course, reduces your reaction time and greatly increases your stress level. The line twists can also increase your cutaway forces.

The following are my experiences and observations, and are in no way the end-all and be-all about line twists:

What causes line twists?

1. As the main bag comes off your back it may spin around the vertical axis, this of course causes line twists. After the canopy comes out and inflates you look up and see.....twisted lines.

What causes the bag to spin and how do I prevent this?

Any asymmetric force on one corner of the bag as it lifts off. This can include not having enough unstowed line from the last stow to the links on your risers, uneven airflow over your body, and pilot chute wear.

- a. Have at least 18" of excess line from the last line stow to the riser links. To see how this works, take your main bag, stow all the lines all the way up to the links, place the bag in the container, and pull it out via the pilot chute bridle. You will notice how the tension between the last stow and the risers will tend to cause it to turn as it comes off your back. Now do this with about 1 ½ to 2 ft of unstowed line neatly folded in the main container. The result should be a neater lifting of the bag out of the container. This method not only results in fewer line twists, but also speeds up packing.
- b. Heading control. Lots of newer jumpers tend to have a turn during deployment. As we get closer to pull time we tend to fixate more on that than anything else. Lesser priorities go out the window, like being stable and on heading. A slight pitch down of one shoulder and yaw to the left or right will result in the jumper being turning as the bag comes off their back. Even if the bag comes off evenly, if the jumper is pitching, yawing or rolling (basically not flat, stable and on heading) twists in the lines can and will result. A stable, neutral, on heading body position can reduce line twists substantially.

- c. Line stows. If you use different stow media, meaning a mix of rubber bands and tube stows, this can result in a different tension as the stows release. Use the same thing, we recommend rubber bands, tightly stowed and double wrapped.
- d. Airflow. If there is a difference in the air pressure over one side of the body than the other, this can cause the bag to spin or tumble. Again, stable body position.
- e. Pilot chute wear. If your pilot chute comes down with lots of twists in the bridle, it may be excessively worn on one side or need a new kill line. Refer to previous articles about kill lines as I am blue in the face about this subject.
- f. Unknown. How many of us actually is able to watch ourselves as we deploy. Maybe your bad puppy, after chewing up your sofa cushions, opened your container, spun your bag around and reclosed it. I know I've had that happen. Keep your dog away from your gear.

2. As the canopy inflates, one side inflates faster than the other, causing that side to begin flying before the other is inflated, guess what happens, that's right, you guessed it, you fly yourself into line twists.

What causes this and how do I prevent it?

- a. Again, stable body position and how you sit in the harness is at issue. If you place more weight on one side of the harness than the other you are already inducing a turn before the canopy even inflates.
- b. Even risers, tying the 3 rings together during packing helps to maintain even risers during packing, this can help symmetric inflation.
- c. Even flaking of the canopy. If one side, especially the leading edge, tends to hit air before the other, this can result in uneven inflation. Flake the canopy evenly. For my 90 Velocity, I have found this is especially important for the trailing edge and stabilizers, and having the slider evenly distributed in the center.

This cause of line twists can be anticipated and even watched as it occurs. This allows us to fly through and counter act it. I had several jumps on my Ve 90 where I literally flew myself into twists before I learned to reduce them by proper packing technique and body position, and then fly out of them by inducing harness input via leg straps and rear risers before they flew into twists. Basically you need to fly through the entire opening process. Nonetheless, I found myself able to kick out of the twists with little trouble when I did have them.

You can easily learn to anticipate which direction the canopy is going to spin to by watching it inflate. For example, if the right side inflates first and starts to turn around the left, apply pressure on the right leg strap and reduce pressure on the left by lowering the right leg and lifting the left, this can keep the flying side a little more under control while the not yet flying side gets its act together.

3. All else fails, you get line twists, the canopy spins like a B*#\$ch and you have to pull like a Mother F*%#er to cut-away.

In my experience, this is created by an uneven force on one side of the harness over the other. If your risers are uneven or if you sit un-even in the harness when the canopy opens in line twists you are inducing a turn on the wing. The wing is not designed to fly in twists under normal conditions, now you have a locked in uneven loading,,,,,gee, does the Pope become a Bear in the woods?!?!?!?!?

Add to this that if the risers are included in the line twists, the cut-away cables may be twisted up as well. This can greatly increase the pull forces on your cables.

Finally, Velcro pulled in a shearing rather than peeling fashion, is much harder to separate.

- a. Make sure your risers are even, leg straps even, body position stable, and fly through the opening.
- b. Clean and lubricate your cutaway cables, and conduct basic 3 ring maintenance.
- c. Use risers with cut-away cable channels installed. There are two basic types, metal and plastic. Either is better than none, but we recommend the metal.
- d. Replace your pilot chute when it wears out. Replace the kill line when it shrinks.
- e. Peel the Velcro of the cut-away handle before punching downward and strip the cables clear of the channels to assure both cables clear the locking loop.