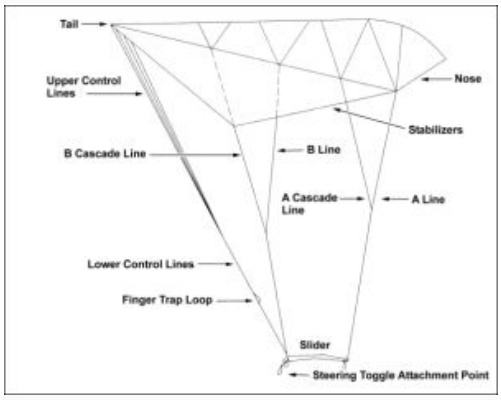
# Parachute Flight Inputs

There are 8 inputs that you can use when controlling your parachute: you have two brake toggles, two rear risers, two front risers, and two legs with which to do harness turns.




## Toggle Turns

Let's go back to the figure that we used when looking at parachute aerodynamics and see where our brake lines attach to the parachute. If we follow the control lines up from the toggles, we see that each control line splits into 4 lines. These 4 lines then are attached to the tail (or trailing edge) of the parachute on either end. I have crudely highlighted in red the control lines from a jump that I made a while ago (on a Navigator 200, if anyone is interested).

Remember the term "drag"?

There were several things that we could do to decrease our drag (i.e. thinner lines, changing our body position to reduce our surface area, collapsible sliders, etc), but there are also ways that we can increase drag.

When we pull down on a steering toggle we are pulling down on the tail of the parachute, causing increased drag on that side of the parachute. The increased drag slows down that side

of the parachute and the other side continues to fly at full speed. Essentially, we are flying our parachute around the increased drag side.

If you found that confusing then try this little experiment:

Stand up and walk forward. No problem – we do this all the time!

Now, stand up and walk forward, but your right foot can only go half a step every time your left foot takes a full step. What ends up happening? If you did this correctly, then you would find yourself turning in a circle.

The only difference between what you just did and what happens when you turn your parachute is that we are always on the way down (losing altitude) when we are underneath our parachute. Hence, we cannot make turns under our parachute without losing some altitude.

Back to toggle turns:

The parachute will continue to turn as long as we hold a toggle down, and the speed of the turn is directly proportional to how far down we pull the toggle. In other words, pulling your toggle down to your hips will result in a much faster turn than pulling your toggle down to your shoulder.

But, that is not all that happens:

Let's take a moment to think about what happens to the pilot during these maneuvers.

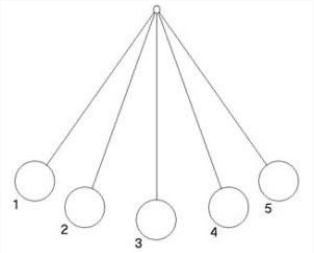
You are effectively a pendulum (a weight suspended from a pivot so that it can swing freely). And we venture to guess that this is not the first time that you have been a pendulum. If you think back to your childhood days, there was probably a playground involved at some point (hopefully many times) and you got on a swing. As you were happily swinging along, you were a pendulum, and probably didn't even realize it.

And for those of you that were super lucky children, you may have experienced the wondrous fair swing. You eagerly awaited your turn and then rushed for your seat. The ride started slowly at first when it first lifted off the ground, but then it began to pick up speed and turned faster and faster.

And what happened to you as the ride turned faster?

You swung out further from the center and screamed with glee (or terror, depending upon your enjoyment level). Due to Newton's Third Law of Motion (for every action there is an opposite and equal reaction) and the relationship between centripetal and centrifugal force, the faster the ride turned the further out the swing occupant was from the center of the ride.

The other thing that happened on that fair swing is that you began to feel heavier in your seat due to the increased G's that your body felt. Now some people love that feeling, but if you're not careful it is possible to make yourself light-headed; the blood that is pushed down into your legs has a hard time returning through the veins back to the heart. Around 5 G's is when most people lose consciousness, according to the Go Flight Medicine website.




The same things happen when making turns under a parachute. The faster the turn, the further the jumper swings out from his parachute. The further out you swing, the longer it will take you to get back under your parachute once you stop your input by returning to full flight. And this explains why turns low to the ground hurt tremendously.

Is it possible to keep your parachute above you while turning?

Yes! Slower turns will not have such a pendulum effects and there are also marvelous turns called flat turns that can be very useful during the times when you would like to make a turn and conserve as much altitude as possible. But, we'll discuss flat turns at another time.

Go ahead on your next jump and notice the difference between making small toggle turns and dramatic toggle turns (lots of clear airspace needed here). While you're at it, look up at your parachute and notice where your brake lines attach to the parachute. Keep your eyes on the tail of the parachute, and see how far down you need to pull your toggle before you begin deflecting the tail. Have fun and ensure you are in clear airspace above 2500' before performing any of these maneuvers!

## Front Riser Turns

What happens when you pull on your fronts:

When we discussed rear riser control, we said that by pulling on the rear risers we are pulling down the C and D lines of our wing. So, the parachute line groupsshock should be quite small, when you find that by pulling down on your front risers, you are pulling down the A and B lines of your wing. Once again, by pulling one of the risers, you are essentially pulling down on a fourth of the parachute.

Now, the question is why would you want to do this?

As a student, you try to do front riser turns because USPA says that you must in order to get an A license. So, we go up and give them a go, and realize that the amount of strength that is needed to pull down a front riser on a student canopy borders on the inhuman. The majority of us then immediately abandon front riser turns because they are so bloody hard to do.

Eventually we downsize and find ourselves flying a canopy that is finally responsive to front riser input and we go nuts....or we don't.

(Warning: about to stereotype here)

Most females don't see the need to use front risers. You say that front riser turns are fun and thrilling? We don't care. You say that you can lose a lot of altitude with front riser turns? Definitely not doing them then. You see, we are interested in making it back down to the ground safely and don't really care too much for thrilling rides.

You say those same things to boys and most will get all giddy and do a bunch of jumps where they are only doing front riser turns. And then one of them will attempt it too close to the ground and hurt himself, but I digress...

So, why should anyone want to perform front riser maneuvers:

Front risers are useful for when you want to gain airspeed. The classic example is using front risers to get yourself just beyond an obstacle when faced with a strong headwind. But you may also need to use them when flying relative to your friend. Or, you may just use this as an exercise to get more comfortable with your wing.

Go do a hop n pop and try some front riser maneuvers...above 2500 feet of course. And here's a tip if you find the front riser pressure on your wing to be quite high. First, flare your parachute, hold it for a few seconds, and then smoothly let up on your toggles. As the parachute begins to surge forward, pull down on your front riser and see if that is a bit more manageable.

## Rear Riser Turns

We have already discussed toggle turns, and now it's time to dwell on rear riser turns for a bit. Rear riser turns are typically the second set of inputs that we learn to use (Category D jump for all those that are following USPA's AFF program).

Did you get a chance to read our poem that we posted?

Rear risers, rear risers

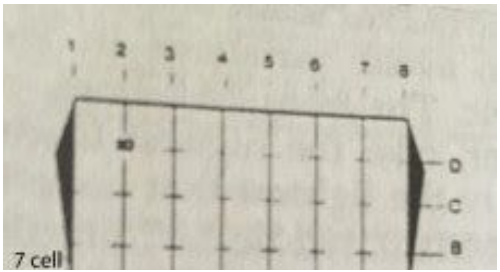
How I love you today

You always help me out

When another canopy is coming my way

....especially right after opening!

A fairly bad poem, you say? Well, yes, it is. But it does highlight just one reason that rear risers are a useful tool.



*Modified from The Parachute Manual, Vol. 2 by Poynter*

So, let's get back to being a little bit serious:

What are the rear risers?

The rear risers are the black webbings that connect to the C and D lines of your parachute. Generally speaking, if you have a 9-cell parachute then you will have 10 A lines, 10 B lines, 10 C lines, and 10 D lines attached to the parachute. If you have a 7-cell parachute then you will have 8 A lines, 8 B lines, 8 C lines, and 8 D lines attached to the parachute. Due to the magic of line cascades, you will notice that you only have 4 or 5 lines that are attached to each rear riser.

Caution: the above paragraph does not always hold true with high performance parachutes.

What happens when we pull down a rear riser?

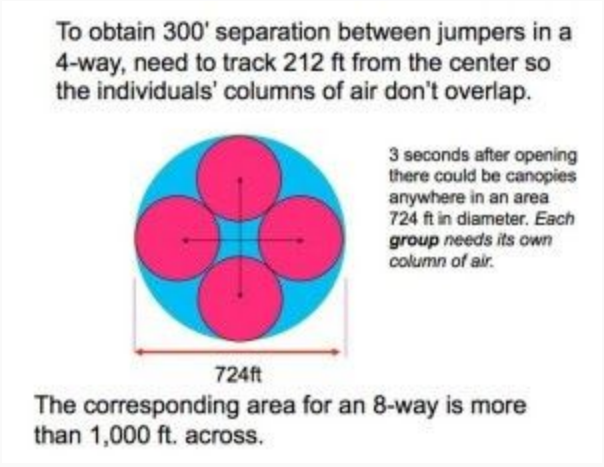
*Adapted from the APF Intro. to CReW Manual*

When you pull down on one rear riser you are pulling down on half of your C lines and half of your D lines (either the left-half or the right-half of your parachute), effectively one-fourth of your parachute. This makes for a lot of pressure when compared to pulling on your brake toggles (they are only attached to the trailing edge of the parachute). However, we don't need to pull on our rear risers nearly as much as we do on our toggles to turn, and the range with which we can pull our rear risers is reduced too.

By pulling down on a fourth of our wing, we are not dramatically altering its shape like we are with toggle turns. You'll find that rear riser turns do not lose as much altitude as toggle turns do. But the principle of the turn is the same…pulling down on a rear riser pulls down on the rear half of the parachute, causing more drag on that side while the other side continues to fly normally.

Back to the poem:

There are two times when in-air collisions between two parachutes are quite high. First, is right after deployment. If you (or your jumping friend) cannot or did not track away very far, then an off-heading opening could mean potential disaster. The second time that the risk of canopy collision is highest is, as we would expect, in the last portion of the landing pattern (turning from the base leg on to final).




*from USPA's canopy collision presentation*

What to do if someone is heading towards you right after opening?

Shall we take precious moments to release our brakes so that we can make a turn to the right? The answer is no (leading question, we know). By pulling down on our right rear riser we can turn to the right with the least amount of time wasted, and avoid hitting one of our sky friends.

How can rear risers help if I've got a long spot AND a head wind?

By pulling down on our rear risers slightly (and we mean maybe an inch), we can reduce our drag just a bit and fly faster. Combining this maneuver with "getting small" body position-wise, you just might make it back from a long spot.