Armchair SIV *by Calef Letorney*

Modern Collapse Response

On occasion, I'll ask my hang glider friends if they've ever tried paragliding. Many have. Those who have never touched a paraglider often respond with, "I don't want to fly a wing that's likely to collapse and fall out of the sky!" Fair enough. This piece isn't an argument for the safety of one air vehicle over the other, but they're right that a lot of "bad times" have begun after a paraglider collapsed.

Conversely, there's an argument that the collapse is a safety feature. When paragliders dive forward, a collapse stops the glider from flying below the pilot, which could "gift-wrap" or tangle the pilot in fabric and lines. Modern paragliders benefit from generations of development that have reduced the drama of a collapse. So while collapses can be traumatic, they're usually recoverable, unlike being gift-wrapped in fabric.

A paraglider collapses when its angle of attack (AoA) gets too low and the glider folds under itself. The reduction in AoA is easily visualized when our gliders dive forward. However, collapses can also happen without the glider pitching forward. How is this possible? AoA isn't something we can directly observe, as it's the invisible angle at which the air contacts the wing. In turbulence, our glider is abruptly exposed to new wind vectors that instantly change our AoA until this new air movement overcomes our inertia. This explains how we can suffer

◁ *The author demonstrates an asymmetric collapse.*

a collapse seemingly out of nowhere, without the paraglider pitching forward.

Fortunately, paragliders rarely suffer large collapses if you're actively piloting. Active piloting is the process of continually adjusting the brake handle position to maintain constant wing pressurization and prevent unwanted pitch movements. The active piloting skills that you need to keep a glider open change with the air conditions and the glider you're flying.

We can generally avoid collapses by choosing to fly in reasonably smooth air, avoiding strong midday thermals until our skills are sufficient, and by staying out of bad spots, such as those with rotor. Often, the mistake that leads to a collapse is a pilot's decision to launch into turbulent air that exceeds their ability. However, we all know that it may not be possible to prevent all collapses in the strong thermal conditions that produce the best cross-country flights. Even the best pilots experience collapses. Poor energy management, such as a bad spiral exit, can also create a dramatic collapse. Whatever the cause, big collapses provide cause for reflection later.

Not all collapses are the same. We are not talking about little ruffles of the wingtip. Outside tip collapses while thermaling are nothing to fear. This Armchair SIV is devoted to big collapses. If you've ever felt your glider "explode" and have looked up to discover a majority of your air-vehicle "inside-out", you know what I'm talking about. If you haven't, and you fly thermals, you will likely know eventually.

For brevity, we'll refer to full-frontal collapses as "frontals" and partial or asymmetrical collapses as "collapses." Cravats and riser twists have their own recovery techniques, which are worthy of a deep discussion for another time. Finally, we're talking here about normal paragliders, not para-kites, speedwings, or reflex paragliders, which may require different recovery techniques.

THE INITIAL RESPONSE

Whether on the brakes or the rear risers, we should always actively pilot, feeling the glider by hanging the weight of our arms to maintain some tension. When this tension goes away, we should immediately add brakes to the side(s) that lose tension to increase the AoA and prevent a collapse. From here on, I'll refer to "brakes," but actively piloting on the rear risers works similarly. I like to think of the rear riser control and brake control as different dialects of the same language, so when I say "apply the brakes," a rear riser input will also work.

Our goal should be to mirror the air. If the air whispers, whisper back with small, timely brake inputs. If the air punches you in the nose, punch back: a giant application of brake may be needed to keep the wing open. In many situations, the faster we can respond, the smaller our input can be, thus minimizing unwanted pendular motions. For this initial jab, you want to pull as much brake as needed to find line tension again. It might be a one-inch movement or a full arm extension below your butt. As soon as you find tension again, bring your hand up quickly. You won't risk spinning or stalling if you don't hold deep brake inputs, so make it quick.

Do this first brake pump even if the glider has already collapsed, as it will mitigate the damage. Without pilot intervention, a collapse that starts small may quickly become much larger; so, if you do nothing, a small 30% tip collapse could quickly become a 70% explosion. When the line tension

Situational Awareness

This entire discussion assumes you're experiencing a low AoA issue (a collapse, or anticipation of one). It should be noted that if you're having a high AoA problem (a stall or spin), the brake line tension is will also drop sharply. Here, we need to rely on our ongoing situational awareness to distinguish between the two scenarios, because adding brakes to a high AoA problem will quickly exacerbate the problem.

goes away due to a sudden drop in AoA, don't think: just bang on the brakes.

When using the speedbar, we should always actively pilot with the rear risers and never with the brakes. Using brakes while on the speedbar is not only inefficient; on some wings, it can provoke a significant collapse. Just as with the brakes, if the tension drops sharply while on speedbar, we immediately apply the rear risers. If a collapse materializes, we should immediately release the speedbar and then sharply apply the rear riser (or move to the brakes) to increase the angle of attack.

FULL-FRONTAL COLLAPSE RECOVERY

Some frontals are tame, recovering before you can look up (let alone react). In more extreme situations, especially when flying on speedbar, frontals can be violent; here, it's particularly important to perform a quick brake pump to minimize the damage. This initial brake input also helps prevent the dreaded "frontal horseshoe," where the tips come together in the front and sometimes stick together. Fortunately, this is almost exclusively a concern on high aspect-ratio wings.

After the initial brake input, frontal recovery should involve recognition, going hands-up, and patience. Let the glider dive, regain airspeed, and recover. We need to give the glider time to "think" and dive. Generally, the bigger the frontal and the hotter the paraglider, the longer the glider may need to "think" while the pilot patiently waits with hands up. It may take several seconds for the glider to dive and regain airspeed. It may feel like an eternity, but it's crucial not to brake too early, as our gliders are particularly prone to accidental stalls while recovering from a frontal. If the glider is out of trim, wet, or otherwise compromised, it may "think" for even longer before it flies; in these cases, it's especially important to wait patiently with hands up.

Once the glider is flying forward energetically, you may control the dive with brakes if you're afraid it could collapse again. But don't overdo the correcting brake input, as the glider must dive to regain airspeed and return to normal flight. Braking enough to keep it overhead may stall the glider and lead to a memorable rodeo, where the worst potential outcomes become much more likely. If you do choose to arrest the dive with brakes, release the brakes fully as soon as the glider stops moving down in your field of view to swing underneath the wing and return to normal flight.

AT ONE POINT, I ENDED UP ABOVE THE GLIDER AND DOGGY-PADDLED THROUGH THE LINES TO AVOID ENTANGLEMENT.

In the moment of surprise, pilots often mistake a massive frontal collapse for a full stall, which proves problematic as the recovery techniques differ. I learned this lesson the exciting way on March 27, 2006, which was the start of my second paragliding season and the day before my twenty-second birthday. New and eager to soar, I was blissfully unaware that the windy, grey midday conditions exceeded my abilities. After gaining a few thousand feet in a strong and turbulent thermal… WHAM! I was on my back, looking up at a wad of trash instead of a paraglider.

"How did I full-stall?" I thought. I remembered from the P3 test that "hands up" is the worst response immediately after a stall (as the glider could shoot hard, pitching the pilot over and into the canopy), and so I intentionally did nothing. Of course, I'd misdiagnosed a massive frontal collapse, and holding 6" of brakes was enough to prevent the glider from returning to normal flight. The ensuing rodeo got properly violent as I brake-checked each dive, repeatedly preventing the glider from flying again. At one point, I ended up above the glider and doggy-paddled through the lines to avoid entanglement. I was about to toss my reserve when my observer said over the radio, "It's not flying! Hands up and count to five." That was the feedback I needed! I landed without injury, aside from a fear of turbulence that lasted for several years.

My story is all too common, so let's avoid this mistake by planning ahead. We should always be flying with sufficient airspeed, far from stalling. While active piloting, we need to regularly return our hands to the home-base position (hanging the weight of

our arms on the brake lines, hands about ear height if you're using a brake wrap). Avoid the tendency to creep deeper and deeper into the brakes: the extra tension only provides a false sense of security as we approach a spin or stall. If we're not flying slowly (and we shouldn't be) when the glider explodes, our first theory ought to be a frontal collapse.

POSSIBLE ASYMMETRICAL COLLAPSE RECOVERY TECHNIQUES

STEER AND CLEAR This is the most widely-taught collapse recovery technique because collapses can cause the glider to dive and turn, and bad things happen when that movement abruptly ends in a collision with something hard. Therefore, steer and clear is the go-to technique if we're close to hazards. To steer and clear, look at your good flying wingtip (so you can observe your heading while seeing how close you are to spinning), lean towards that flying side, and apply brake on the flying side of the wing. Use all the available weight shift and as little brake as necessary to maintain your desired heading.

Big collapses burn time and altitude while the glider "thinks," dives, and then recovers. This process can't be rushed or expedited, but nervous pilots often try to force it and pull too much correcting brake. The resulting spin often precedes a cascading series of mistakes. So if we're going to use the steer-and-clear method, it's important to continuously watch our flying wingtip for signs of a spin while using peripheral vision to observe our heading, ensuring we continue to fly away from the terrain and other hazards. You'll know the glider is about to spin when its cupped shape looks more exaggerated; as the tip peels back and begins to fly backward, it will spin (practice spin recognition and recovery at SIV). The larger the collapse, the more easily a glider will spin. To contextualize this risk, I theorize that the percentage of our wing that is flying is roughly equivalent to the percentage of our brake range that is available for use. If you've suffered an 80% collapse and have 20% of the glider flying, then you might only have 20% of your normal brake range available to maintain your heading. Yikes! So, if you're going to overcome the collapse to fly straight, use the correcting brake sparingly as you watch that wingtip for signs of spin.

The dangers of over-controlling a glider while using the steer-and-clear method are so significant that I recommend we don't default to this strategy. Paraglider reopening behavior is finely tuned and then certified. Barring a cravat or twist, we can trust that it will reopen. But that certified reopening behavior assumes no pilot response: hands up. You are the wild card here! If you don't need to make it fly straight to avoid collision, then don't force it.

We must make a split-second decision to pick the appropriate recovery technique. I prepare in advance by imagining a PROXIMITY alarm in the flight deck of my mind. When there are hazards (terrain, other pilots, etc.) within about 300 feet, my imaginary blinking red PROXIMITY alarm is flashing at the front of my mind. Be extra alert when your PROXIMITY alarm is active, especially in conditions known to produce large collapses, such as strong thermals and wind, mechanical turbulence, etc. Better yet, avoid PROXIMITY in these conditions.

If your PROXIMITY alarm is not active, you might be better served by one of the following recovery techniques.

DO NOTHING Before using the "do nothing" technique, we must double-check that we have ample altitude. Then sit flat, put your hands up, and be patient while the glider fixes itself. This is how our gliders are tested and certified to recover from collapses. It takes a bit of trust in the paraglider, but if there's plenty of altitude and nothing to hit (and no cravat or riser twist), our primary focus can be to avoid pulling too much corrective brake. We just need to be patient while the glider fixes itself.

LEAN IN AND TAKE A RIDE This collapse response is all about trusting your glider. Again, only let the glider turn toward the collapse if you have ample ground clearance and no cravat or riser

Q&A: Flapping

Calef, *I just finished reading your excellent article in the summer issue of the USHPA Pilot magazine. I'm wondering if you encourage your SIV folks who want to learn to practice flapping right off tow, high up, so there is plenty of room for recovery if things go sideways?* ***-Bill***

Great question, Bill! As you pointed out, high over the water, with a flotation device, and a coach on the radio, does logically appear to be a good environment for practicing flapping. I suspect most SIV students would be fine, but I avoided making that recommendation due to the diverse experience and skill set of the readership and the potential for negative outcomes. During a stall, the glider falls back as the pilot swings forward. With the glider far behind the pilot, the worst thing we could do is go hands up to restart the glider with a long runway to shoot forward as the pilot swings back underneath the glider. The combination of these forces can yield a surge of shocking speed and power (even on beginner wings, but especially on performance wings) that may toss the pilot above the glider to get tangled in fabric and lines (AKA getting "gift-wrapped").

While practicing flapping, some students will inevitably accidentally stall. Pilots who accidentally stall are likely to forget to keep the paraglider stalled (until the body is again underneath the wing), and even less likely to smash brakes at the correct time to arrest the massive surge that follows. When considering that the flapping exercise is composed of deep brake inputs followed by hands up, I worry that this exercise gives students all the ingredients necessary to have a really bad time. Even high over the water, you really don't want to get gift-wrapped, so I suggested only practicing at heights we are okay to fall from.

While not something I'd recommend to the average reader, if you're well-practiced at full stalls and comfortable catching the strong surge that results from an early restart, then this could be a meaningful exercise at your next SIV clinic. I recommend discussing this with your SIV instructor, as there's nobody better positioned to judge your readiness or perhaps refute my subjective opinion on the matter. **-Calef**

twist. Leaning into the collapse helps reload the collapsed side and creates the energy for a lovely recovery, which you can bleed off like a spiral exit. Leaning into a collapse helps prevent riser-twists as we move with the wing and shift our weight to the collapsed side. This is especially beneficial with higher aspect ratio gliders, which are more prone to riser twists when leaning away from the collapse. You don't have to use full weight shift towards the collapsed side; it's often sufficient to just "roll your hips with the dips," gently loading the collapsed side while the paraglider recovers.

HOW TO PRACTICE?

I encourage pilots to practice various collapse responses at an SIV clinic over water. SIV isn't a perfect simulation for what the sky can throw at you, but it's the safest and most effective training available. SIV isn't a one-and-done thing. Most pilots need annual SIV for a handful of seasons before they can reliably perform the same maneuvers under pressure.

I'd love to conclude with confidence and bravado that "collapses are nothing to fear," but I'm definitely still afraid of collapses, especially those featuring cravats and twists. Better pilots than I have taken a collapse and pounded in, so fear of collapses appears quite rational. But fear can be a useful tool. Rather than an unfocused anxiety, I put my fear to work to observe the PROXIMITY alarm and avoid the conditions known to produce big collapses. Take a moment to visualize potential collapse responses, including a timely reserve throw. After checking in with our fear and confirming ample safety margins, we are free to make the best decisions, and that's all that matters, as paragliding is just a mind game.

Happy flights and soft landings.