why stall?

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Photos by Niklas Daniel.

Anyone who takes a quick look at the USPA Canopy Piloting Proficiency Card (the completion of which is required to receive a B license) will notice that most of the maneuvers are of the slow-flight variety. The big question jumpers always ask is, "Why do I need to perform stalls? What practical application does it offer?" Learning more about slow flight and stalls not only prepares you to land your parachute better, but also teaches you just how versatile your wing can be.

Slow flight makes most jumpers uncomfortable because they associate low airspeed with lack of control. This is because the word "stall" is often misunderstood. A stall is an aerodynamic phenomenon; it is not equivalent to a car engine that stops working. Because parachutes are flexible wings, their pilots can stall them at any airspeed and any angle of attack. What determines whether a parachute stalls is the overall shape of the trailing edge of the wing. When the parachute becomes sufficiently distorted at its trailing edge, the parachute will stall. Canopy pilots accomplish this by pulling down excessively on either the rear risers or toggles.

Discovery

Becoming proficient at recognizing your parachute's stall warnings allows you to avoid or counteract a stall when necessary. This is especially important at low altitudes. Stall drills give a pilot the ability to handle a bad situation on the low end of the performance range. This kind of sensitivity may come in handy when you have to land in a tight spot such as a backyard and have to avoid the onset of a stall in your high-angle-of-attack approach. But on a more positive note, slow-flight exercises can increase your flare performance on no-wind days by giving you the confidence of knowing your perfect flare point. In addition, proficiency at stall maneuvers can increase a canopy pilot's aerobatic abilities, confidence and therefore enjoyment. Yes, intentionally stalling your parachute can be a lot of fun.

It may seem strange, but you can also use learning about stalls to help you better anticipate your canopy's descent rate during a low-speed malfunction. In the scenario where a jumper has a lot of fabric overhead but it is not inflating properly, the descent rate may be quite similar to that of a stall. During your stall practice, ask yourself, "What is my altitude loss over time (descent rate)? How quickly am I approaching my decision altitude? How much time would I have to deal with this potential problem?

Common Concerns

Because newer jumpers are generally unfamiliar with slow flight and stalls, they are hesitant to explore these flight modes fully. But it's simple to do so safely. First, always discuss any drill you are planning to perform with an instructor. Always perform stall maneuvers with plenty of altitude (above your decision altitude). Remember to clear your airspace. Isolate yourself by making a hop-and-pop away from other jumpers whenever possible. After opening and achieving initial heading control, do a canopy control check. Then check your altitude and position relative to your landing area. If all is good, proceed with a stall-discovery drill, which you can find in Skydiver's Information Manual Section 6-11, Advanced Canopy Piloting Topics. To feel more confident, remember that the amount of stress a parachute experiences during a stall is typically less than it experiences during a deployment.

Stall Recognition

The characteristics and warning signs of a stall vary with different canopy designs. However, there are a number of ways to recognize if a stall is imminent. The first indication may be that your flight controls (i.e., your toggles or rear risers) feel mushy and less responsive. Or you may feel a slight buffeting in your harness. Detecting the onset of an impending stall and making appropriate adjustments is a priority. With proper training and an understanding of the types of stalls, a canopy pilot will be able to recover the parachute at the first indication that one is occurring. But if a jumper allows the stalled condition to progress, either intentionally or through inexperience, the recovery will be much more difficult. There are several types of stalls:

Dynamic Stall: You'll typically see these occur during landing, after the jumper performs a dynamic nose-up pitch maneuver. After the jumper holds the toggles down, it is the moment when the jumper's body swings back under the canopy.

Aerodynamic Stall (aka "sink" or "steady-state stall"): Jumpers can perform these with either toggles or rear risers. They occur when the nose of the parachute is too high in relation to the relative wind (i.e., has reached a critical angle of attack). The wing is no longer able to generate lift over the top skin.

Full Ram-Air Stall (aka "reverse flight"): Jumpers can perform these with either toggles or rear risers. They occur when the trailing edge of the wing is pulled below the level of the nose. The toggle version, which makes the parachute look like a taco, is not recommended on some canopy models, so check with your manufacturer.

Keep in mind that stalls work independently of airspeed. This means that a canopy pilot is not immune from stalling just by flying fast. When the parachute becomes sufficiently distorted, it will stall no matter how fast your airspeed. The SIM refers to this as a "high-speed stall." You'll see these occur most often during canopy piloting competitions. If the pilot approaches the course too steeply and relies too heavily on the rear risers to recover from the dive during a scoring run, the wing may stall.

It is advisable to start learning about stalls in the slow-flight performance range first. While you perform these maneuvers, become aware of the reduced sound of air flowing past your body. What is your minimum controllable airspeed? Use all of your senses—not just your eyes—to mentally record your experiment.

Rear-Riser Stall

Toggle Stall

Skill Building

It is important to understand the factors that contribute to stall development. Slow-flight practice is a precursor to stall training. When entering a stall, a jumper does not re-enter freefall. Instead, think of a stall as just another flight mode. It just so happens that the canopy is not generating as much lift as before and your descent rate has increased. The goal is to maintain a level wing and heading control during the stall. In other words, do not let it turn you on the vertical axis.

Just as an AFF student must demonstrate recovery from self-induced instability in freefall, a proficient canopy pilot must be able to perform stall recovery. Once the pilot holds this flight mode for a few seconds, the goal is to recover from the stall by keeping the wing level and dampening the canopy's need to surge forward. This is accomplished by releasing the control inputs slowly and smoothly.

Though counterintuitive, performing the recovery slowly will actually cause you to lose less altitude than if you moved more quickly, another major revelation of stall-recovery drills. How much altitude did you lose from onset to recovery? Check your altimeter to hold yourself accountable. If you execute the recovery poorly, the wing will surge forward very abruptly and will decrease the tension on your suspension lines. This means a momentary loss of control (like a marionette with slack lines). Furthermore, if you release the brakes asymmetrically, you may induce line twists when the line tension is low. You can avoid all this if your release is smooth and deliberate. Keep in mind that as the tail pressure of the wing increases from the sudden exposure to the relative wind, the toggle or rear-riser pressure will suddenly increase.

Be strong. After all, skydiving is an athletic activity. Precisely controlling your toggles and risers will allow you to recover seamlessly from a stall.

It is important to note that parachutes with a high aspect ratio will be more sensitive in handling when trying to maintain control over a stall. It is best to become acquainted with stalls using a low-aspect-ratio canopy. Most seven-cell designs will fall into this category.

Toggles vs. Rear Risers

Toggles only affect the very trailing edge of the canopy, whereas the rear risers control the entire back half because they're connected to the C and D line groups. Therefore, your hands need to travel a shorter distance to create a rear-riser stall because you are pulling on a larger amount of fabric.

Rear-Riser Stall

Stall Recovery

Stalling a parachute on rear risers tends to have a much more abrupt or sharper onset than stalling with toggles, and these stalls are quicker and easier to recover from. This is why you should try rear-risers stalls before attempting toggle stalls when exploring your wing.

Landing With Rear Risers

Most jumpers land their parachutes with toggles. But a select few, specifically those who wish to push their performance envelopes, will give landing entirely with their rear risers a try. Learning to land using only rear risers is no simple feat. You must do so using a careful and considered approach. As discussed earlier, the pilot distorts the wing drastically when pulling down on the rears and so is more likely to stall the wing near the ground during the attempt—even when flying fast. The margin for error is small, therefore you should practice this at high altitudes a lot—including recognizing when to abandon the maneuver and finish with toggles—before attempting it near the ground.

Understanding when you are most susceptible to stalling your parachute and recognizing stall indicators will allow you to avoid accidents and build confidence. Unless you are practicing stalls as a discovery drill, do not wait to allow a stall to develop fully. Through proper training and practice, you will intuitively apply stall recovery techniques at the first sign.

"Foundations of Flight," AXIS Flight School's monthly column in Parachutist, *has covered slow-flight and stall topics in depth in three installments. Readers can access these columns, "Toggle Stalls" (July 2011), "Rear-Riser Stalls" (November 2012) and "Braked Canopy Flight" (July 2015), at parachutistonline.com.*

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