FOUNDATIONS OF FLIGHT
LONG SPOTS—INCREASING CANOPY RANGE POTENTIAL

AXIS Flight School®

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So far, this long-spot series has covered how to visually identify range potential, brought attention to the energy footprint and explored how wind affects glide ratio and therefore range. This installment covers how jumpers can increase range potential through equipment changes and technique refinement. The goal is to focus on the strategies and options that collectively create a streamlined configuration resulting in a canopy pilot's best gliding distance.

There are two ways to improve a canopy system's range: 1) Traveling with the wind, and 2) improving the system's lift to drag ratio (see October 2022 "Foundations of Flight").

EQUIPMENT

Collapsing the slider after opening reduces drag (see March 2018 "Foundations of Flight"). While this improves a canopy's range, additional improvements are possible.

Suspension lines bend as they pass though the slider grommets above the pilot's head, negatively affecting the shape of the wing. Stowing the slider at the bottom of the risers (typically behind the head) and loosening the chest strap improve the wing's shape and aerodynamic efficiency. As the suspension lines straighten, the wing's anhedral shape reduces (the wing becomes flatter span-wise) and its projected area increases. This simple change in geometry also has a big impact on handling characteristics, specifically on the roll axis.

On smaller, more heavily loaded parachutes, a removable deployment system (RDS) increases efficiency greatly. Whether you should choose to jump such a system depends on the type of jumping you are doing and your experience.

Tight-fitting clothing and jumpsuits produce less drag than looser clothing and therefore positively affect the lift-to-drag ratio. However, they may not offer adequate skin protection during a botched landing.

BODY POSITION

An aircraft with retractable landing gear becomes more aerodynamically efficient by stowing its landing gear inside the fuselage. Similarly, by balling up (pulling legs up into the fetal position), a canopy pilot presents a smaller profile to the oncoming relative wind, reducing drag. This in turn shifts the pilot's position slightly forward under the wing, pitching the nose of the wing up, increasing glide. Spreading out and presenting a large, flat, X-shaped body posture with legs extended has the opposite effect. A jumper may need to alter the position of their leg straps to make these leg movements more accessible (see May 2023 "Foundations of Flight").

In a more extreme example, high-performance canopy pilots frequently use a forward leaning "torpedo" body posture to increase speed and distance (or supine, back-to-earth, using United Parachute Technologies' Mutant harness).

The benefits of learning to fly your body in conjunction with the parachute goes beyond just making it back from a long spot. You will find that your accuracy improves, as well, because you can use body-position techniques to fine tune the last few feet and inches to your target on final approach.

FORWARD SPEED

Several independent factors contribute to a canopy system's drag production and therefore influence forward velocity. Because no two systems are truly identical, every skydiver is a test pilot who must figure out the optimal configuration for their own needs. Consider the following thought experiment:

On a no-wind day, a canopy with a true glide of 3:1 will fly farther than a canopy with a true glide of 2:1. So far, so good. Let's say that the 3:1 canopy has a forward speed of 15 mph while the 2:1 canopy travels at 20 mph. In a tailwind scenario, both canopy pilots will enjoy an increased range due to a higher ground speed. In this scenario, the 3:1 continues to fly farther than the 2:1. However, in a headwind scenario, things get interesting. Let's imagine that both canopy pilots are flying into a 15-mph headwind. From the ground you would notice that the 3:1 is standing still, while the 2:1 is advancing at 5 mph. So, while the 3:1 has a superior lift-to-drag ratio, its slower forward speed prevents it from covering any ground. Slower parachutes are more susceptible to strong winds. Therefore, the greater a canopy system's forward speed the better it can combat a head wind. (This is not advocating that readers justify rapidly downsizing by saying they can deal better with strong winds.)

TECHNIQUE

Accomplishing the farthest gliding distance hinges on finding the optimal flight configuration that creates the fastest achievable average ground speed. The inputs to execute this task vary from jumper to jumper based on their equipment and the conditions in which they are flying. In simplest terms, a pilot can choose between minimum sink (least amount of altitude lost over time) and maximum lift-to-drag speed. A general rule of thumb would be the following canopy inputs for each scenario:

- Larger, lightly loaded wings benefit from being in roughly quarter brakes when flying with a tailwind and rear-riser input when flying into a headwind.
- Smaller, heavily loaded wings benefit from rear-riser input regardless of wind direction. This is because the pilot's body contributes a significant amount of drag (approximately a quarter) to the system. Therefore, efficiently altering body shape and position (as mentioned above) becomes crucial.

In a strong headwind, a canopy pilot may need to fly faster than max lift-drag, which, depending on a wing's design, can be accomplished at trim speed (full flight) or by using front risers. It is true that front-riser inputs increase airspeed, but they also degrade the system's lift-drag ratio while applied. As described above, trading a steeper glide for a faster ground speed may pay off if you wish to clear an obstacle you are hovering over in a strong headwind. The amount and length of time you pull on the front risers must be appropriate to get the desired effect. This must be verified visually in the moment using the trick discussed in the July 2023 installment of "Foundations of Flight." Muscle fatigue is the main factor in their effectiveness. When a canopy pilot applies front risers, the faster descent rate equals less exposure time to the wind. Receive proper training in the technique and use caution at low altitudes, and remember that flaring is a landing priority.

Adding weight by using a weight belt or vest increases speed because the wing loading will be higher. This may prove advantageous in a headwind, as the system's true glide remains mostly unaffected. But the added weight may be a hinderance in freefall.

CONCLUSION

Drag reduction is the answer to improving glide because drag negatively affects a canopy system's velocity vector. While speed can be your friend in certain situations, it is a power that must be earned gradually through demonstration of competence and sound judgement.

Choosing the right parachute for you should include more than just design specs and wing loading. To set yourself up for success, it is important to jump in locations and conditions that are appropriate for your skill level, experience, currency and equipment. One might get away with downsizing rapidly in a place that has consistently steady winds and a low field elevation. However, the habits learned at such a location with that specific gear may be inappropriate or insufficient in a different location with light to no wind and a higher density altitude. Keep in mind that the different seasons of the year change the local flying environment. If you are considering downsizing, do so in gradual increments with professional coaching and when the conditions are in your favor.

In next month's issue we will go over what factors and actions to consider when you have determined you cannot reach your desired target and need to land out.

Information about AXIS' coaching and instructional services is available at axisflightschool.com. The authors intend this article to be an educational guideline. It is not a substitute for professional instruction.

RATING CORNER
PARACHUTE FLIGHT INSTRUCTION WITH VIRTUAL REALITY

Dedicated skydiving instructors have a continuous mission to enhance safety, refine skills and instill confidence in their students. Addressing landing-related incidents is a significant part of this, as USPA statistics show that 46% of non-fatal incidents in 2022 were due to poor landings. Simulator training, particularly virtual reality technology, has the potential to improve parachute flight instruction and enhance students' canopy flight fundamentals, including navigation, final approach and landing proficiency.

Virtual reality simulation for skydiving draws inspiration from airline pilot training, where flight simulators have proven invaluable in improving safety. Whether in-person (3D, with the student wearing VR goggles) or online (2D, no goggles required), VR training allows student canopy pilots to navigate landing patterns in both ideal and challenging scenarios, such as crosswind conditions. This allows students to gain experience and practice decision making in a safe and controlled environment. Performing VR practice sessions under supervision (where instructors provide advice) encourages student canopy pilots to adopt best practices, accept responsibility for their safety and learn to choose the best options. Instructors can also stay silent during sessions for testing purposes.

Instructors can structure lessons using the familiar brief-jump-debrief format, with increasing levels of challenge (using tools built into the VR program) as the student progresses. They can then evaluate the key learning objectives—assessing wind conditions, altitude awareness, recognizing landmarks, avoiding air and ground turbulence, maintaining situational awareness—for each VR jump and record it in the student's logbook.

During the VR sessions, instructors can encourage their students to ask themselves pertinent questions, such as:

- Do I have a good canopy?
- Are there other canopies I need to avoid? (recurring every 30 seconds)
- Did I remember to look before turning? (recurring throughout descent)
- Where is my landing area?
- What is this altitude's wind speed and direction? (recurring throughout descent)
- Can I get back to the landing area? Where could I land right now if I had to?
- How do I get to my holding area?
- How and where am I joining the traffic pattern?
- Did I assess my landing point on the final approach to avoid obstacles?
- Did I start flaring at the appropriate altitude?
- If I started flaring too early, did I hold my toggles in position (not let up)?
- Was my vertical landing speed more than 10 feet per second?

The skydiving community can harness VR technology to help prevent landing injuries and ensure that students grasp canopy control fundamentals. Pioneering instructors may want to consider using this tool to reduce canopy-related incidents.

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