

Choosing the Right Canopy, Part 2: Cells, Shapes, and Skins

By Scott Miller

This is the second of two articles on how to choose a main canopy. Last month, we discussed canopy size and wing loading, and looked at factors to consider when downsizing. In this article, we will examine differences between various types of canopies.

Today there are many options to consider when choosing a main canopy. The number of cells, overall shape, and type of material used can all affect a canopy's performance characteristics. As with canopy sizing, understanding the facts and avoiding common misconceptions can help you choose a canopy that is best for you.

Seven or Nine

Most skydiving canopies used today are either seven- or nine-cell designs. Originally, nine-cell canopies had several advantages over seven-cells. Nine-cells glided farther, and many jumpers preferred the way they landed. Seven-cell canopies were generally more responsive in deep brakes, and performed better when making sinking, accuracy-type approaches. Because they have fewer lines and fewer ribs, seven-cells usually had lower pack volumes. Although seven-cells remained preferable for CRW, accuracy, and as reserves, nine-cell mains quickly became popular with most skydivers.

In the 1990's, a new generation of high performance seven-cells became available, and these canopies soon regained their popularity. Newer seven-cells benefit from improved materials and aerodynamics, and retain the advantages of traditional seven-cells while eliminating some of the disadvantages. Some modern seven-cells glide farther than comparable nine-cells. Most nine-cells will still level off or "swoop" farther when flared, but landings on some seven-cells can easily be just as soft. Seven-cells still tend to pack smaller than nine-cells, and are more agile in deep brakes.

Deciding between a seven- or nine-cell canopy today is often just a matter of personal preference. Some people still prefer the way nine-cells perform, while jumpers who occasionally make demonstration or CRW jumps might prefer seven-cells. The mellow opening characteristics of some seven-cells have made them popular with camera and wing-suit flyers.

Material World

Modern skydiving canopies are made from either low-porosity or zero-porosity nylon. Most skydivers call low-porosity material "F-111," although this is actually the brand name for a type of fabric that is no longer manufactured. Most "F-111" canopies being jumped today are actually made from newer types of low-porosity material.

The main problem with low-porosity fabric is that it becomes more porous as it is used, meaning more air can pass through the material. After 300 to 500 jumps an "F-111" type canopy will not flare as well as when it was new, and performance in other areas will also decrease. This change will be less noticeable on large canopies, but may be dramatic on smaller ones.

Zero-porosity fabric has a coating, usually silicone-based, which prevents the porosity from increasing. Canopies made from some types of zero-p may last well over 2,000 jumps. Because it does not let any air through, zero-p fabric allows canopy designers to build more efficient wings capable of better performance.

Unfortunately, zero-p canopies have higher pack volumes than F-111 ones, and can be more difficult to pack. Patience and a good technique may be required just to get a zero-p canopy in the deployment bag, especially when it is new. A correctly sized pilot chute, properly positioned slider, and proper line stows are necessary to reduce the chances of a hard opening. Zero-p does become "softer" and less slippery with use, though, which makes packing less difficult in time.

The advantages of zero-p far outweigh the disadvantages, however, and virtually all main canopies designed in recent years use zero-p. Some companies do offer canopies built with a combination of zero-p and F-111 type fabric. These "hybrid" canopies are designed to perform better and last longer than ones made completely of F-111, while being easier to pack than canopies made completely of zero-p.

Contrary to what some people believe, zero-p material does not necessarily make a canopy faster. A zero-p canopy can easily have the same full glide speed as a canopy the same size made from F-111. In fact, the zero-p canopy may have a lower rate of descent, and be capable of flying more slowly in brakes.

Why, then, do people believe zero-p canopies are faster? This is probably due to the fact that many people compare smaller zero-p canopies to larger F-111 ones. If you jump a 210 square foot F-111 main and decide to try a zero-p 170, it will certainly seem faster. It will be faster because of its size, though, not the material.

Although few skydivers today buy F-111 mains, a used one might still be a good choice for someone on a tight budget buying a first rig. Since an F-111 main may not flare as well as a zero-p one, you will probably need a slightly larger canopy if you choose this option. Also, since fewer new F-111 mains are being sold, it is becoming difficult to find used ones in good condition. It's especially important to have a used F-111 canopy thoroughly checked by a rigger, and then jump it a few times before you buy it.

Shaping Up

Planform is the shape of a wing when viewed from directly above or below. Figure 1 shows basic examples of three planform types found on ram-air canopies: rectangular; tapered or "semi-elliptical;" and highly tapered or "elliptical." At one time virtually all ram-air skydiving canopies were rectangular, but most main canopies designed in recent years have at least some amount of taper.

The terms "semi-elliptical" and "elliptical" can be a little misleading. Rather than describing the actual shape of a canopy, these terms are often used to indicate how responsive a canopy is meant to be.

Canopies described as "tapered" or "semi-elliptical" are generally more responsive than rectangular ones. They often have lighter toggle pressure, and turn more easily. Although large rectangular canopies can be a bit sluggish, especially when lightly loaded, some larger tapered canopies feel surprisingly agile. These canopies are ideal for jumpers who want a larger, more forgiving canopy that is still fun to fly. Small tapered canopies can be extremely responsive.

"Elliptical" canopies are usually much more responsive than other types. They turn faster, and generally require less input to start a turn. An elliptical canopy, particularly a smaller one, may react to harness inputs in ways a rectangular canopy will not. You may be able to make a surprisingly fast turn just by shifting your weight.

Elliptical canopies can be exciting to fly, but they can also be unforgiving in some ways. For example, many skydivers unintentionally shift their weight or pull their toggles unevenly when they flare, causing the canopy to turn slightly as they land. On an elliptical canopy this can result in a rather spectacular wipeout.

Because elliptical canopies are more responsive in flight, they are also more responsive while they are opening. To avoid problems such as off-heading openings and line twists, you may need to pack more carefully and pay more attention to your body position during deployment. People with hundreds or even thousands of jumps on less responsive canopies have needed to make a few adjustments, and get rid of some bad habits, once they started jumping elliptical canopies.

Because they can be less forgiving in some ways, elliptical canopies have generally been viewed as "hot rods" only suitable for more experienced, aggressive canopy pilots. Some people believe that elliptical canopies are faster than rectangular ones. This is a misconception, however, similar to the idea that zero-p canopies are faster than F-111 ones. An elliptical canopy may turn faster than a rectangular one of the same size, but might still fly at about the same forward speed.

It's important to remember that a canopy's size also determines how responsive it is, and how unforgiving it may be. Many people who jump larger elliptical canopies experience few if any of the problems encountered on small ones.

It is a good idea to gain some experience before flying an elliptical canopy, but you don't necessarily need to be a hot shot. If other canopies aren't quite as responsive as you would like, and you are thinking about downsizing, you may first want to try an elliptical canopy the same size as your current canopy. An elliptical may provide the handling you want without the risks involved in jumping a smaller canopy.

Things That Make You Go Zoom

Some of today's higher-performance canopies have special features designed to increase performance. Two of the most popular ones are "cross-braces" and "airlocks."

Bill Coe of Performance Designs developed cross-braces in the late 1980's. Cross-braces are extra diagonal ribs that keep the canopy more rigid, allowing thinner airfoils and fewer lines to be used.

Today, cross-braces are used on a few ultra-high performance elliptical canopies. These canopies are generally faster, and create more lift on landing, than non cross-braced canopies of the same size. Because they are only available in smaller sizes, and require a good amount of skill to be flown safely, they are only recommended for pilots who already have experience jumping small elliptical canopies.

Airlocks, patented by Brian Germain in the mid 1990's, are fabric valves sewn into the openings at the nose of a canopy. They allow air to enter the cells, but make it difficult for the air to escape. Like cross-braces, airlocks make a canopy more rigid and improve performance. Airlocked canopies are available in a wider range of sizes than cross-braced ones.

Because airlocks help a canopy stay pressurized, these canopies have a reputation for being very stable in turbulence. Although some jumpers have gone as far as calling them "turbulence-proof," Germain and others caution against this kind of overconfidence.

"Airlocks are intended to give you a greater margin of safety under normal jumping conditions," says Germain, "but if you get caught in a strong downdraft, even if your canopy stays fully inflated, you're still going down." Turbulence can affect any canopy, just as it can affect a rigid-winged aircraft. If the wind or turbulence becomes so strong that you wouldn't jump with a non-airlocked canopy, then you shouldn't jump in those conditions with an airlocked canopy, either.

Although airlocks and cross-braces improve performance in some areas, they are only part of the picture. You certainly shouldn't feel "left behind" if you prefer the overall performance and handling of a more conventional canopy.

Keeping Perspective

Although we have looked at some general differences between types of canopies, there are many other factors that influence performance. The number of cells, planform, and fabric type may give you a basic idea of how a certain canopy will fly, but this is just the starting point.

Canopy designers also use different airfoils, trims, and other design elements to make their canopies perform the way they want them to. Two canopies that appear basically similar may have very different characteristics. Also, canopy size and wing loading are just as important as the design of a canopy. You can only make an accurate comparison between different types of canopies if they are similar in size and flown at the same wing loading.

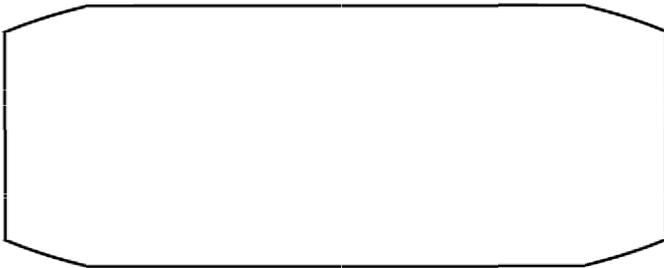
Whether you are considering a differently sized canopy, a different type than the one you currently jump, or both, it certainly helps to hear opinions and advice from people that you trust. However, it's important to trust your own feelings as well. Two different people may have very different opinions of the exact same canopy.

Jumping a canopy is the surest way to know if that particular size and type of canopy is the right one for you. If you consider the big picture rather than relying on a few limited pieces of information, you are more likely to buy a canopy that will make you happy in the long run.

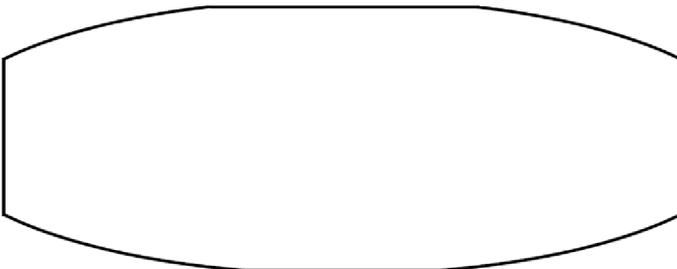
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Rectangular



Tapered or "Semi - Elliptical"



Highly Tapered or "Elliptical"

Figure 1 - planform examples