

What is a backpacking tent? Theoretically, a tent that is going to be carried by its user on some kind of walking trip, somewhere in the world. Not exactly a huge market, then, in the era of the car and the package holiday. But there will always be people who seek a more real experience of nature and are prepared to forgo the luxuries and comforts of home. A backpacking tent offers such customers the opportunity to travel spontaneously and at low cost. New Zealander Carol McDermott, founder of lightweight tent and rucksack brand Lightwave and its climbing alter ego, Crux, gives his expert opinion on the lightweight items available on the market.

Backpacking tents – an overview

A good backpacking tent - even if it is stowed in the back of a car rather than in a rucksack – will be light enough to carry, possibly for significant lengths of time; it will be sufficiently robust to survive being pitched and broken down day after day, and sufficiently resistant to wind, weather and UV to withstand longer-term pitching, perhaps at high altitudes. To fulfil these exacting criteria, any self-respecting backpacking tent needs to employ "high-spec" materials that inevitably carry an upper-end price tag, both for manufacturer and customer. Backpacking tents at the cheap end of the market are invariably only suitable for 1 or 2-season use and are targeted at customers concerned less with performance than with price.

The tent market

Although tents are definitely one of the smaller segments of the Outdoor market, they can still be considered one of the "big five" traditional product areas, along with clothing, footwear, backpacks and sleeping bags. It is true that they trail the other four in terms of volume and value, but for me personally, as a tent designer and manufacturer, they remain one of the most fascinating in terms of technicality, complexity and diversity. Backpacking tents in particular offer scope for creative design and engineering, particular with advances in materials technologies.

It is interesting to note that in the global market of today, where brand consolidation and take-overs are changing the nature of the competitive environment, backpacking tents (along with sleeping bags) are still the preserve of the smaller and niche brands. This situation reflects the economic reality that backpacking tents are simply not a fashion item and demand, even if steady, is largely confined to a small, specialist group of end-users. Their psychological associations with freedom, physical endurance and the rugged wilderness nevertheless lend backpacking tents that unquantifiable quality of "image" that is not without commercial value. The ambitions of bigger

brands often extend beyond profit and volume, and if they are looking for "outdoor" credibility and a more complete product portfolio, tent brands are an obvious target for acquisition.

Lightweight tents

It is a depressing truism that, in the modern world of corporate brands and margin-driven retailing, marketing has in many respects become more important than the product. The tent market has not been immune to this development. Thus the current buzzword in tent marketing is "lightweight", and this is naturally an attractive concept to customers purchasing a specifically backpacking tent. No one likes to carry more than they need to, and for trekkers and climbers travelling to wilderness areas, the chance to shave several hundred grams off the weight of their tent, and carry additional food or vital gear instead, is worth paying for. But there are "lightweight" tents achieving low weights with high-end materials and intelligent design and destined for the slopes of Mount Everest, and "lightweight" tents opting for a single skin and minimum-specification fabrics and heading off for the nearest music festival. So what are the factors that go into the design of a serious backpacking tent?

Getting into shape

Many consumers have strong preferences about the shape of their tent. Of course the choice isn't huge, especially in the backpacking sector, and can be summarised rather simplistically as tunnels vs. domes. Tent shape is determined by pole configuration: dome and geodesic tents use intersecting poles, while ridge and tunnel tents employ a non-intersecting pole structure. The fundamental difference between tunnels and domes/geodesics is that the latter can stand upright without the aid of pegs or guy-lines. Tents with non-intersecting poles are not freestanding, but offer the benefit of more space for your kilogramme. They have a simplicity of design and construction that makes them - in theory - less expensive to manufacture and potentially easier to pitch. The downside is that they are completely dependent upon good anchor points and good pitching skills.

Ridge tents are available in the traditional "upright-pole-at-each-end" shape or in a more modern interpretation employing a single pole curved into a central or off-centre hoop. In these, the occupant can lie across or along the ridgeline. Single-hoop tents are very popular and form one of the largest generic categories of backpacking tents, especially in the solo travel market. Tunnel tents, using two or three hoops, are generically the most widely available on the European market. They optimise space far better than ridge tents with a minimal weight penalty. They are generally easy to erect, and in wetter climates have evolved predominantly into designs where the fly is pitched first.



The Tadpole is an ultralight two-person tent with Fusion Pitch for fast packing.

The North Face

Tents designed with intersecting poles can be split into two groups – those with a single intersection at the apex (domes) and those with multiple intersections (geodesics). Dome tents are a fairly crude design and are generally the preserve of the budget market. They also predominate in the specialist single-skin tent segment. Tents with multiple pole intersections are the most stable of all tent structures. Although usually termed "geodesic", this is something of a misnomer: with the exception of one or two true geodesic designs, most of the category is populated with "hybrid or semi-geodesics" – usually 3-pole asymmetric designs exemplified by the now classic Tadpole from The North Face. While semi-geodesics dominate the North American market, 4-pole "modified geodesics" are the norm in the more extreme mountaineering sector.

Recent innovations in tent design have centred on the creation of more internal volume by distorting the profiles/shapes defined by the poles. The "constant" curvature of the traditional hooped pole is now being modified with pre-bent sharp-angled sections and by the introduction of small sections that effectively create a secondary structure. The modern look is more angular and trapezoid. Although these developments have been driven by the desire to create a more comfortable space without increasing the tent footprint (i.e. floor area), there are additional benefits. These new pole structures are often more rigid, so the shape deforms less in strong winds, and as the poles themselves do not bend as much, they are under less stress, resulting in fewer breakages and greater reliability.

It is in the use of multiple poles with multiple intersections that design becomes sophisticated and the modern designer has real scope to explore shapes and the spaces they enclose.

Inner-first or fly-first?

Another area of choice for designers – and also an area of strong preference amongst consumers – is the way they allow a double-skinned tent to be erected. In other words, they can opt for a fly-first pitch or an inner-first pitch. In a "fly-first" tent, the poles are threaded through sleeves in the flysheet and the resulting structure pegged out. The inner tent is then suspended from the inside by means of various attachments. Fly-first pitching is particularly attractive for those camping in wet climates, because you can get in from the rain at an early stage. The disadvantages are that it is harder to get the flysheet properly taut and that the fittings needed to attach the inner to the fly add weight. Fly-first design has only really been successfully applied to tunnel tents.

"Inner-first" tents work the opposite way around. The inner tent is pitched first and the flysheet draped over the top. The perceived disadvantage of ending up with a wet inner when pitching in rain is unfounded – the canopy fabric is very fast drying.

Fabric, fabric and more fabric

While pitch and pole configuration are obvious areas of primary consideration, fabric is seldom made an integral part of the design process. And yet the average 2-person backpacking tent uses over 20 square metres of fabric. It is roof, floor, and almost everything in-between. It represents 65-75% of the manufacturing cost. But fabric is very often specified afterwards - usually to achieve a price, but sometimes to attain certain performance parameters (e.g. hydrostatic head, complete tent weight), to meet a targeted end-use requirement or to gain a competitive advantage over other products.

A tent employs three different fabrics – a flysheet to keep out the rain, a groundsheet to keep out moisture and an inner-tent canopy. The canopy and flysheet often share the same base fabric and differ only in the coating (a difference that is substantial, however, in terms of end result).



Lightwave develops tents and rucsacks stripped of unnecessary features to reduce weight and complexity.
Lightwave

Flysheet

The flysheet comes under the most scrutiny. It has to be waterproof, possess good mechanical properties in terms of its strength and resistance to stretch, and preferably – in view of the sheer amount of it used – have a low weight. And, of course, to complete the equation it has to come in at a workable price. Surprisingly, it is not too difficult to achieve a reasonable balance of all of the above. Only when you want to go really light does a problem arise, namely the difficulty of maintaining the necessary mechanical properties.

Most flysheets are made from fabrics using 50-70 denier yarns. At this level, it doesn't make too much difference if polyester or nylon is used. Although nylon is stronger, it degrades more rapidly upon exposure to ultra-violet radiation, so overall longevity is much the same. The strength of the fabric is important to maintain seam integrity. Since thread can rip through such light fabrics, tents are sewn with lap-fell seams, doubling the amount of fabric through which the thread is stitched. Improved water-tightness is a secondary benefit of this seam construction, although it is often marketed as the primary one.

Water-resistance is achieved by coating the fabric with polyurethane (PU), silicon or both. PU coatings are the most common – the technology is widely available and the process is inexpensive. PU-coated fabrics also allow taping of the seams, and in the case of the US market, pass the rather pointless flammability regulations. On the downside, a PU coating reduces the strength of the fabric by 50-70%, loses its water-resistance significantly with use and is prone to delamination. Silicon offers none of the above disadvantages. As it is completely hydrophobic, rain runs straight off it (although the fine spray of drizzle will sit on it) and unlike a PU coating it absorbs no moisture. For all its vast superiority, however, it is a very difficult material to work with, and the coating process can only be described as a dark art. Many fabrics conventionally coated with PU on one side will also have a (light) silicon coating on the other to act as a water repellent. Some Far Eastern coating factories also apply silicon in a PU emulsion, but although this is an improvement on straight PU, it is still no substitute for a pure silicon coating. However, if a decision to go for a full double-sided silicon treatment is made, there is a sting in the tail. Sewing with such a fabric is very difficult due to the high frictional qualities of the coating, and very, very few factories have the expertise to deal with it.

Alternative flysheet fabrics are lightweight laminates such as those from Polyant Dimension. Borrowed from the sail industry, these are light and have excellent waterproof qualities and UV-resistance. Their high cost, however, coupled with the amount of noise they make in wind, means they are unlikely to gain mainstream acceptance.

My personal recipe for a truly lightweight flysheet is this:

1. Take a 30 denier fabric.
2. Use nylon. Polyester isn't strong enough. Not ordinary nylon but 6.6 nylon. This is a stronger high-tenacity yarn woven under higher tension.
3. Make sure the weave is a ripstop construction.
4. Coat with silicon on both sides. A PU coating will reduce the strength too much and you'll have an early failure.
5. Find a very good factory. One that can select the right thread and set machines to the right tension. The balance is very fine.
6. Reinforce all stress points subject to loading – i.e. pegging & guying points.

Any fabric using a yarn lighter than 30 denier (experiments have been made with 20 and 15 denier fabrics) will simply not be strong enough for flysheet use.

Groundsheet

Most groundsheet fabrics are a standard 210-denier taffeta nylon with a PU coating. There is a wide choice in the 120-150 g/m2 range and these are perfectly suitable for long-term use. A large number of lightweight tents employ only 70 denier fabrics. These may have an adequate level of PU coating, but cannot offer durability and waterproofness over the longer term. From the "weight-watcher's" point of view, they represent a false economy - a lightweight groundsheet for a typical two-person tent may save 100 grams, but will need to be reinforced by a footprint weighing more than 200 grams. A good tent designer could use a good quality, robust groundsheet and easily take out 100 grams elsewhere.

Poles and accessories

Poles are over-rated in their contribution to the design and performance of a tent. There are four major suppliers with little to choose between them for all but their signature models. By far the most commonly used material is the mainstream 7001-T6 alloy, a little heavy but very resilient. Some of the lighter-weight poles have suffered from inconsistencies in quality (such as brittleness and swaging creep), but these have improved over the past two years.

Pegs continue to be an area where cost is more important than quality or performance. Very few tents come with pegs that you can still expect to be of serviceable use after a couple of years. Considering that a tent ultimately relies on its pegs for its ability to withstand strong

winds, it is deplorable that peg quality should be sacrificed for margin, but that is the fact of the matter. Guylines continue to attract little or no attention from designers. Four years ago witnessed the introduction of Dyneema guylines by Lightwave – extremely light, strong, and non-absorbent (so they don't freeze up their adjusters) – but no other brands have followed suit.

Designing for condensation

Even in today's world of sophisticated design, technology and engineering, many products still have unresolved issues. In tents, this is condensation. It happens. It is caused by environmental factors (ground and air humidity, overnight temperature drop) and human activity – we breathe, perspire and insist on drinking hot steamy tea inside our tents. The only solution is to remove moisture-laden air before it condenses, which for the tent designer means a venting system. Vents can only work if there is a mechanism to move the air, and the only one available is our erratic friend, the wind.

Vent design is not the simple cutting of a hole in the flysheet, nor is it a case of bigger is better. A study of fluid mechanics and thermodynamics reveals that the relevant passage must be kept short and straight to prevent pressure drop and energy loss – the unseen properties of air that make it flow. Equally important is to eliminate drip points, although this is straightforward in tents that don't have pole intersections.

Condensation is a common cause of complaint amongst users, and may even cause a tent to be returned. The customer, in this case at least, is not always right. Quite apart from our unwillingness to allow for temperature differences between day and night or drink our tea outside, even the coating inside a flysheet will distort the truth of what we perceive: a silicon-coated flysheet absorbs no water so will have water droplets beaded all over its surface, ready to drop on you with the slightest shake. A PU-coated flysheet will absorb moisture, look nowhere near as bad but be wet to the touch.

Single-skin tents

The problem of condensation, and specifically moisture on the inside of the flysheet, raises the question of breathable fabrics. Here at last, it would seem, is an achievable solution. With the miracles of laminate and coated breathable fabrics having transformed the apparel market, their use in tents looks logical. And indeed, they can be found in the design of a number of single-skin tents (so-called because they do away with a separate inner tent). Interestingly, these tents are restricted to the very specific uses of mountaineering and adventure racing, but this is because they are light and compact, not because they address or solve condensation. Even "breathable" single-skin tents don't work. If they did, they would be mainstream products! The problem remains the temperature differential in cold weather: moisture-laden air inside will still condense even on contact with a breathable tent wall. In mountaineering, condensation that does occur is arguably more acceptable – it is frozen, and a snow shower is less unpleasant than a wet one!

The future

The tent market is never going to set retailers or brands on fire – it is too small and too expensive to service. In a world where prices continue to move downwards, high-end backpacking tents are facing an increasing struggle both in terms of market share and brand survival. As in all niche product groups, manufacturers must keep their eye firmly trained on improvements and meaningful developments, although in the case of the backpacking tent market I expect these to be led by design rather than driven by technology or new fabrics. It is difficult to predict how the usage of tents will continue and/or change, but it seems inevitable that the marketplace can only get tougher for all concerned.