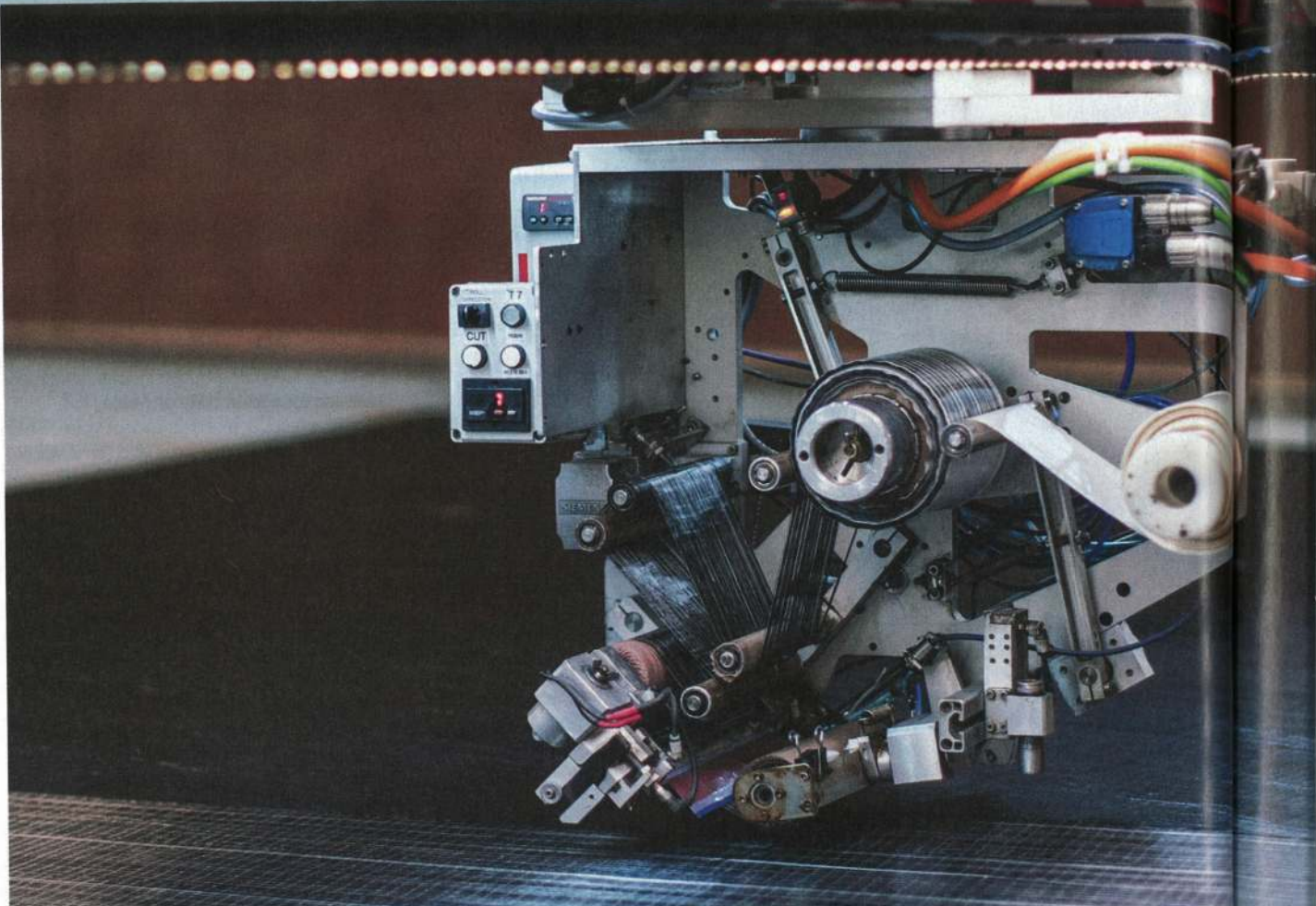




Technical insights from the industry



Sail revolution!

Point higher, cruise faster and extend the life of your sails: Advances in technology mean performance cloth is now available for everyday cruisers. PBO finds out more from sailmaker Ian Brown...

You wouldn't climb a mountain in jeans, nor would you antifoul your boat in a tuxedo. Every day we make decisions about what fabrics are best suited to our activities. Are they comfortable and durable? Do they look good and perform as they should? The same should apply for sails, yet sailcloth for many cruising boats is low on the priority list.

True, you can't change your sails as often as your wardrobe, but you do have a choice that can make a significant difference to the handling and performance of your boat. You needn't stick with the sails that come with your boat – if secondhand these might reflect the age and miles under the hull; if new, stock sails won't necessarily be designed for your needs. A bluewater cruiser will want different sails to a round-the-cans

racer, and a fully crewed yacht different ones to a single-hander. Budget is also key. How often can you afford to change your sails – every two seasons or ten? All these questions come into play, which is where a sailmaker can help.

"Over the past 20 years or so I've had lots of conversations with people baffled by the plethora of options out there," says Ian Brown of OneSails. "If shopping around, an owner might be offered a dozen or more



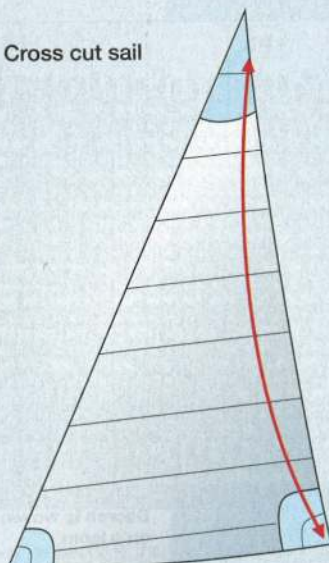
Amory Ross/North Sails

cloth choices or a huge range of prices for what appears to be the same product."

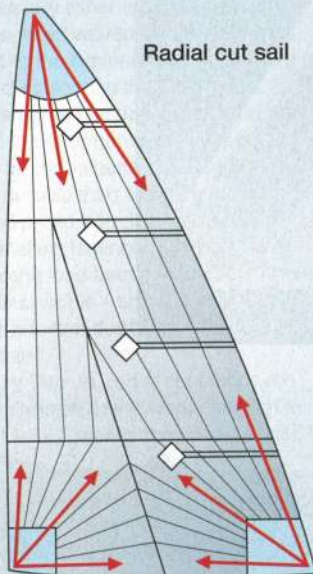
Of course, what Ian's talking about isn't the same product, and to understand why we need to look at the three main types of sail construction: Cross cut, radial cut and membrane (or 'string').

"Once you understand what is being offered, you can use this knowledge to drive the conversation with your sailmaker," says Ian.

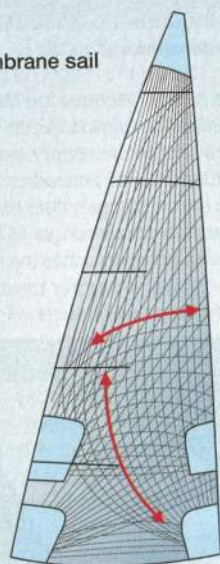
Cross cut sail



Radial cut sail



Membrane sail



PBO sails expert Ian Brown

Three questions with Ian Brown

Q. How long would a cruising sail last compared to a high performance racing sail?

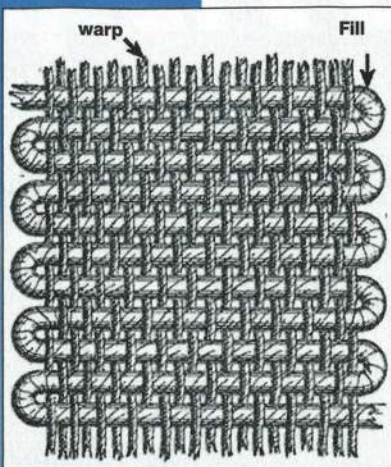
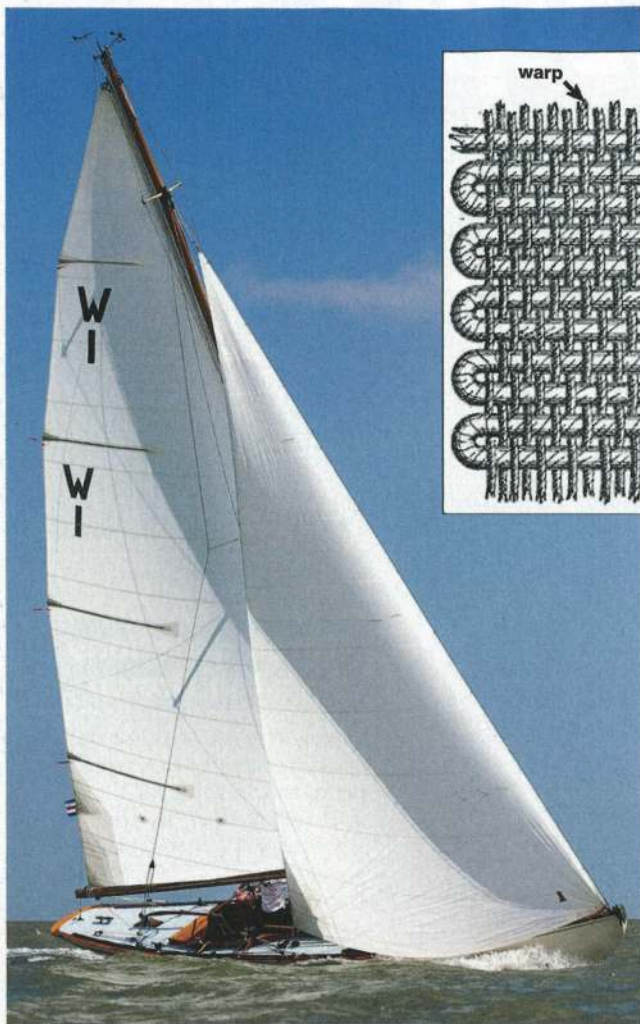
A. Broadly speaking an out-and-out race sail might last a couple of seasons, though that depends on how windy it is, how much the sail is used and how well it is looked after. A Dacron sail for a cruising boat might last eight to ten seasons as a usable triangle though its shape will have gone off by then and it will certainly look a bit scruffy. Having said that, in both examples it's not unusual to see sails that have lasted twice as long.

Q. What are the pitfalls of going for a budget sail?

A. Essentially you're compromising on cloth and engineering resulting in poorer shape stability and performance. There are expensive products and less expensive ones in the marketplace. It's a bit of a cliché to say you get what you pay for but the differences start from the thread upwards.

Q. What advances in sailmaking do you predict to see in the next ten years?

A. The biggest change at the high-tech end is likely to be a move towards composite sails rather than laminate sails. At the moment there are a fairly limited number in the marketplace. The weak link with laminates at present is the film and the glue. If we can remove these we can make products that are lighter, stronger and more durable.



Dacron is woven on a loom

1 Cross cut

Cross cut sails are usually constructed from panels of cloth that run roughly horizontally across the sail, using woven polyester sailcloth known commonly as Dacron, a trade name for the polyester fibres made by DuPont. Dacron has been around for decades and is the mainstay of sailcloth; the one that most people have.

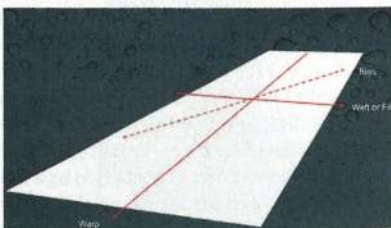
It's a traditional woven product made on a loom the same way that fabrics have been woven for hundreds of years. As such, Dacron sailcloth is made up from warp fibres and fill fibres and it is the relative properties of each that help define the characteristics of a particular style of cloth. The relationship between the warp and fill fibres is also important because this determines how well the cloth performs in the 'bias' direction – the 45° angle between warp and fill. The loads in a sail are multi-directional so knowing how a particular style of cloth performs in the bias direction will help determine what type of sail it's best suited to. For example, a low-aspect overlapping furling genoa will need different bias characteristics to a tall, thin high aspect mainsail or blade jib.

In the diagram at the top of the page you can see the warp fibres running upwards and the fill fibres running across. Dacron is much stronger in the fill direction –



A badly misshapen sail

across the cloth – because the fibres are straight, unlike the crimped warp fibres, which will stretch more readily under load. It's these fundamental properties that determine the cross-cut nature of the panel orientation; the stronger fill fibres are aligned to accommodate the highest loads in the sail that roughly run in a line between the head and the clew. Put



Direction of weave in a typical Dacron sail

simply, the strongest part of the cloth is coping with the highest loads in the sail with the seams running roughly perpendicular to this.

All Dacrons are not created equal, however. Each of the cloth manufacturers will make a range of cloths for different styles, end uses and budgets. What defines each one is its ability to resist stretch. This comes down to a number of qualities:

- The fibre itself – how good, or fine it is.
- How densely the fibres are woven – for example, small fibres woven tightly together will stretch less than larger fibres in a loose weave for a given cloth weight.

- The finish. After a Dacron is woven it's heat treated to shrink it slightly which pulls the fibres together into a tighter weave before being coated in a resin which stabilises the cloth and 'glues' it all together. But beware – it is possible to get poor cloth dressed up to look good simply because of the way it has been finished.

The way in which these factors combine determines the overall characteristics of the cloth. A tighter weave with finer fibres and a higher level of finishing will result in firmer fabrics that stretch less, which in turn are more suited to performance or racing applications. Other fabrics will be constructed in a way to deliberately make them feel softer and more suited to cruising.

Cloth selection matters

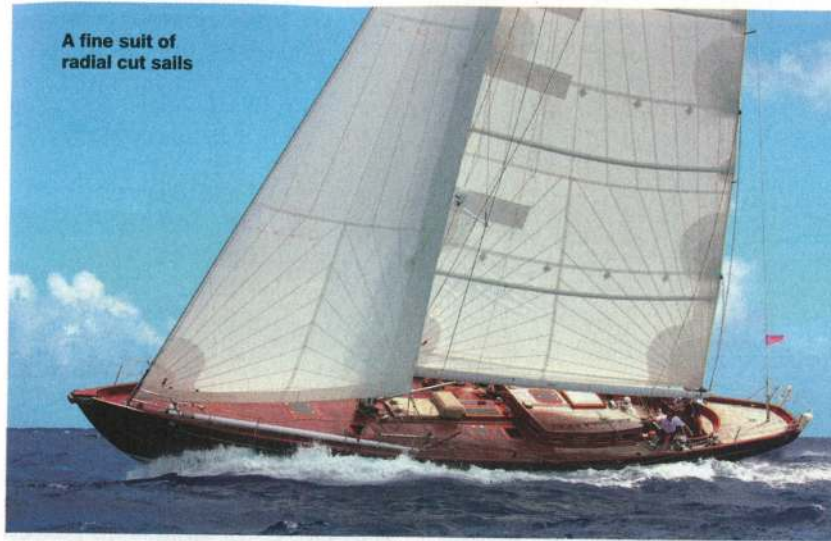
Each of the Dacron styles that cloth manufacturers produce have different stretch and performance characteristics. There can even be notable differences in stretch characteristics between different batches of the same cloth.

A reputable sailmaker will inspect the performance graphs for a particular style or batch of cloth to ensure it's suitable for its end use. Failure to do so can have some nasty consequences. An inappropriate style of cloth can prematurely distort the sail shape, which will affect the boat's handling and performance. The camber lines in the photo (left) show a sail that is badly misshapen. This is actually a fairly new sail. The excessive distortion is caused by either a poor piece of cloth or a style that is inappropriate to the end-use – an extreme example of the risks associated with buying on price over quality.

So although 'cross cut' is the simplest construction style, and Dacron is the least expensive cloth, this type of sail still needs the most attention when it comes to getting it right.

While cross cut sails are usually Dacron, nowadays there's a range of products which go by the generic name of Vectran. The sailcloth is still woven polyester but with the addition of Vectran – a synthetic, high-modulus (strong) aramid fibre – that runs in the fill direction, giving it extra strength and therefore leading to more stable shapes. Vectran sails have become increasingly popular in the last decade, though are more expensive than plain Dacron.

A fine suit of radial cut sails



Chris Sails

2. Radial cut

Radial cut constructions more closely follow the load patterns on a given sail

Radial cut sails are mostly (but not exclusively) made from laminated sailcloth – that is, any fabric consisting of two or more layers adhered together. There are perhaps dozens of products on the market, almost all of which contain three essential elements:

- One or more layers of film.
- Fibres (such as Kevlar, Vectran, Spectra, carbon or polyester) that are laid into the laminate to enhance the strength in a particular direction.
- Taffeta (a woven fabric glued to the outside of the laminate).

Initially laminate sails were used only by racing boats, because they break down much more quickly than woven products. However, in the last 20 years or so

they've become increasingly popular with cruising boats as the cloth manufacturers have made styles that are more suited to that end-use.

Essentially either a single-sided or double-sided woven taffeta backing is added to the laminate, which makes it more durable than the racing counterparts. The result is a fabric well suited to performance cruising which holds its shape better than Dacron but is more durable than a race laminate.

In the photo (top right) Ian holds a single taffeta laminate in his left hand – one of the load bearing fibre scrim in the middle is visible – and a heavier more cruise oriented double taffeta cloth in his right hand.

Unlike Dacron, radial cut fabrics are much stronger in the warp direction than the fill, which means they can be used in a

different way. The panels can be cut in long narrow triangles and trapezoids with the strong warp fibres aligned with the loads in the sail that radiate out from the corners.



One of the advantages of laminates is that they are much stronger for a given weight. A double taffeta cruise laminate might not be much lighter than the equivalent Dacron but it will be hugely stronger resulting in far more stable shapes and better performance.

The downside to laminates is that they're not as durable. All things being equal, if a Dacron sail lasted eight to ten seasons then the double taffeta laminate alternative might be good for five or six. It's not always the rule – Ian has seen laminate sails still performing at 15 years old, though this is unusual.

Until recently, radial cut sails usually meant laminates. However, the last decade has seen a range of radial hybrids enter the market such as Hydranet – a woven sailcloth with a large amount of stretch-resistant Dyneema providing additional strength mixed in with Polyester. The downside is that these hybrids are relatively expensive, but in terms of performance they are roughly equivalent to the lower end of laminates, providing superior performance to Dacron whilst retaining much of its durability. Budget-allowing, this would be a trouble-free, long-lasting option for a bluewater or retirement cruise.

Extending the life of your sails

Need your sails to last a couple more seasons? Rupert Holmes has some advice

It's possible to extend the life of sails with a bit of re-stitching and strategic structural reinforcement. While this won't restore the shape of badly stretched Dacron sails, it's certainly possible to regain much of the original strength of the sail and delay the imperative to buy new sails by a few seasons.

Most problems occur near the leech as this is both highly loaded and suffers most from flapping and flogging. The classic test is to poke a sailmaker's needle through the cloth and then trying to pull it sideways. If the cloth is too weak to resist it needs attention. Extra life can be added to a sail by adding a second layer of cloth in a strip usually around 8-12in (20-30cm) wide along the entire length of the leech.

It's also important to assess the

condition of stitching, as this is subject to the ravages of both chafe and degradation in sunlight. In some cases damage will be obvious – it often shows up as thread that looks narrower than that used elsewhere on the sail. However, it's also worth giving it a mechanical test with a fingernail or the tip of a biro pen – if either breaks the thread, or shows it to be loose and stretched, attention is needed. Fortunately it's a relatively easy job to over-stitch the existing thread. Battens can also cause problems due to flex at their forward end that progressively weakens the sailcloth. This can invariably be remedied by stitching or gluing additional reinforcement in way of the damaged area.

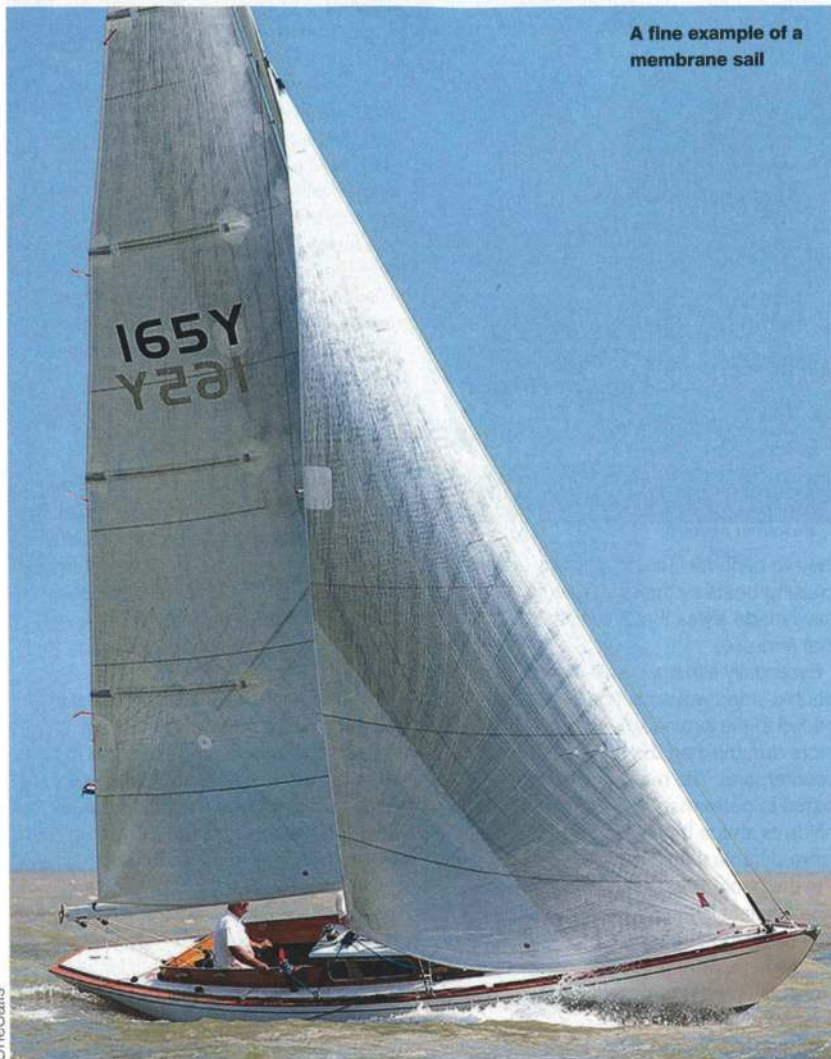
In many cases the UV strip of furling headsails does not last as long as the



This mainsail has completed 20,000 miles of offshore racing. A two ply leech was fitted when the sail had covered 12,000 miles and extra reinforcement around the first reef leech reinforcing patch after 18,000 miles.

sail, so they are a common item that requires replacement. Sailmakers generally quote for this on a per metre basis, although a useful sum can be saved by removing the old material yourself, as this represents a large proportion of the total labour cost.





A fine example of a membrane sail

OneSails

3. Membrane

The third sail construction type is a membrane or 'string' style sail.

Membranes don't exist as cloth on a roll. They're custom-made for your particular boat and usage. Individual panels are constructed on a table with the fibres being arranged with the boat owner's usage in mind.

Once complete, another layer of film is added, the air gets sucked out and the whole lot gets pressed and heated so you

end up with custom panel.

The individual panels then get glued together to make up the complete sail, with the seams being stronger than the laminate itself.

The advantage of this over radial cut sails is you can have an even more complex solution for load distribution, which means better performance.

Because the sail is custom-made you can add single or double taffetas and combine fibres, too.



The yacht on the left is a racing boat with a carbon fibre/aramid mix and lightweight construction. These sails would generally be optimal for a couple of good racing seasons. The one on the right has identical sails, but with a double-sided taffeta, making them considerably more durable and perfectly suited to performance cruising. These sails will retain a great shape and perform well across their entire life unlike the more basic laminates and wovens whose shape will go off much more readily.



The future points towards composites where significant weight savings can be made, particular on larger sails

The future

High tech sails needn't be the reserve of racing sailors – they're becoming more popular with cruising yachts. High tech sails can be durable, though that does make them heavier, so the challenge for sailmakers is to make them lighter.

OneSails has been developing a product called 4T FORTE, which is a composite rather than a laminate, with no adhesives or film incorporated in the structure. Around 16 to 18 ultra thin polyethylene-based layers are fused together to create one homogeneous structure. The absence of the weak links of laminate sails – the glue and film – means these sails should prove to be both lighter and more durable.

Another breakthrough is 3Di NORDAC, a sail by North Sails which is 100% polyester, so has all the durability characteristics you'd expect, high UV resistance and high flex resistance, but holds its shape because it's been built with tapes made from straight fibres, not woven ones.

Perfect performance

What does 'better performance' mean for cruising sailors? While racing or sailing fast might not be your goal, a boat that heels less will be more comfortable to sail, and one that points higher and sails faster will get you to your destination much sooner: an extra 0.2 knots might not amount to much, but over 8 hours it could be the difference between a missed tidal gate or restaurant sitting. Essentially, sails that hold their shape better means:

- Higher pointing
- Easier to trim
- Less heeling
- Easier handling
- The boat goes faster.

Ask the expert

What type of sailcloth would suit PBO contributors looking to replace a mainsail?



Ex-soldier John Willis regularly crosses the Channel on *Pippin*, a Francis 34 Pilothouse. Recently he sailed from Guernsey to Shetland and back in his old boat, a Sadler 290. He's currently cruising around the northern Spanish coast. John struggles with arthritis in his fingers and wants an affordable sail that's easy to handle single-handed. Budget is a priority.

Ian says: With budget being high up on the priorities list, then woven Dacron will offer the best solution. They will be the least expensive and will also prove to be the most durable and most 'trouble-free' and manageable. Ask your sailmaker to quote in two good quality fabrics and, budget permitting, opt for the better one: it will hold its shape better in the long run.



Sam Longley owns a Hanse 311 which he likes to race around the cans on the Blackwater in Essex. He races with crew but also cruises single-handed in French, Dutch and Belgian waters. Sam is in the market for a mid-range sail that will improve his boat's performance.

Ian says: There are a few more options in this scenario. With a mix of performance in mind for single-handed cruising, a radial cut Polyester cruise laminate would be a good compromise. If the owner preferred to err more on the performance side then a membrane style laminate with a single sided taffeta backing should serve him well, though with the short-handed sailing in mind, I'd certainly consider a double taffeta if opting for the membrane option.



Jan and Pete Dearden are liveaboards on their yacht *Twenty 20*, a GibSea Serena 100. They're currently cruising around the Caribbean before sailing back home to the UK. They need sails that are easy to handle single-handed on long passages – often downwind – and are durable and resistant to long-term exposure to the elements.

Ian says: For this kind of sailing, woven fabrics are likely to provide the best solution. A top quality Dacron will do a perfectly adequate job though the woven Dyneema/Polyester hybrids will offer better performance while retaining the durability, albeit at a price.

Thanks to Ian Brown of OneSails

■ tel: 02380 458 213
■ onesails.co.uk



A visit to the sailmaker

If you are considering new sails your sailmaker will want to know:

- Primary use (eg cruising or racing, inshore, offshore, short hops or long passages).
- Anticipated wind ranges for specific sails (may change subject to further discussion).
- Your budget.
- Your expectations with regards to durability – will you replace these sails when they 'fall to pieces' or when they get misshapen?
- Where you sit on performance versus durability.

In addition the sailmaker will need to know basic boat and rig data. If you have the original brochure or sail plan that's great, if not database measurements should be good enough for a quote but accurate measurements from your specific boat will be required in order to ensure a perfect fit first time.

Sailmaker directory

Banks Sails Southampton

banks.co.uk

Crusader, Poole, Dorset

crusadersails.com

Dolphin Sails, Harwich, Essex

dolphinsails.com

Doyle Sails, Solent

doylesails.com/doyle-solent

Hood Sails, Wareham, Dorset

hoodsailmakersuk.com

Hyde Sails, Hamble

hydeseails.co.uk

Jeckells, Norfolk

jeckells.co.uk

Kemp Sails, Gosport

kempsails.com

North Sales, UK-wide

northsails.com

OneSails, Hamble & Suffolk

onesails.co.uk

Quantum, Hamble & Galway, Ireland

quantumsails.com

Rolly Tasker Sails, Hamble

rollytasker.com

Sanders Sails, Lymington

sanders-sails.co.uk

Solo Sails, Penzance, Cornwall

solosails.com

Ultimate Sails, Hamble

ultimatesails.co.uk

Ullman Sails, Plymouth

ullmansails.co.uk

Typical costs, based on the sails for a Sadler 34

Prices are excluding VAT and are indicative only to illustrate the typical range of prices that might be available

Sail	Approx size	Dacron cross cut	Radial cut Polyester cruise laminate	Radial cut woven Dyneema/Polyester hybrid	Membrane style, Aramid fibre array with single taffeta
Mainsail with two reefs and short battens	24.5sqm	£1,500-£1,750	£2,495	£2,650-£2,950	£3,100
135% furling genoa including UV strip	34sqm	£1,400-£1,700	£2,400	£2,800-£2,950	£3,300