



## Mainsail Trim

Here we go, we are participating in one of our targeted IRC regattas. The weather is being kind and everything has been going well for us so far. Our fleet is well supported with several boats of our type involved.

Five, four, three, two, one, gun and you are sailing. The tactician and helmsman have made a decent start, on the line and well positioned relative to most of the fleet. There is 12 knots of true wind (12kts TWS). However there is a boat to leeward that will present a problem if our trim off the line is not perfect. The next five minutes will determine the rest of the day, and much of this will be down to the trim of our mainsail.

The mainsail is the sail that in any inventory has to cope with the widest range of wind speeds and angles. It needs to be capable of being adjusted through both tension and mast bend to cope with all conditions. Along with offering considerable forward power to the boat the sail also greatly effects the boats ability to track in a straight line. In short your mainsail set up will be the biggest effect on the balance of the boat much the same as a flap on an aircraft wing.

The leech of the main when trimmed tightly creates more side force aft on the boat and subsequently causes the boat to luff or head up. Similarly when the main is trimmed with an open leech the air flows off the back of the sail easily causing less side force. An under trimmed mainsail may sometimes result in lee helm. Knowledge of how the boat you are sailing responds to these trim changes can often be the difference between success and failure.

The relationship between the helm and mainsheet trimmer is very important. They often sit next to each other and should have the ability to talk about the boats requirements. The ability of the mainsheet trimmer to deliver what the helm is looking for at any time is key to sailing up wind fast.

To set up the mainsail there are six controls, which can be adjusted whilst sailing.

**Mainsheet:** This controls the amount of twist. A sail needs to be twisted because of wind gradient. Basically the higher up the sail you go the further aft the apparent wind angle. On a mainsail, twist is controlled by the amount of mainsheet tension, as well as the amount of vang. The mainsail leech is our best indicator of how much the sail is twisted. The front of the main is certainly a poor measure of twist because it sits in the confused airflow of the slot and directly behind the mast's turbulence.

To set the appropriate amount of twist for your boat in the conditions for the day, trim the mainsheet until the top batten is parallel to the boom. If you have a full-length top batten or fully battened mainsail, your target is to have the aft end of the batten flying parallel to the boom.

With your mainsheet sheet eased, the main has a very twisted shape, with the top batten flying very open. As you trim the sheet on, the top batten angle narrows until it is parallel with the boom. Trimming harder will take away all the twist, close the upper leech, and make the top batten poke to windward.

The best average setting for the top batten on everything from Lasers to IACC boats is parallel to the boom. It very rarely pays to sail with your mainsail leech completely shut down or over tight. One of the subtle differences on leech tension occurs between masthead and fractional sailplans. A masthead mainsail can sometimes be trimmed harder than its fractional counterpart, as the overlapping masthead genoa directs the air around the leeward side of the main and thus reduces the risk of the sail stalling. The top batten can actually be made to stand up to weather. Sailing in this mode is acceptable in light to medium air and flat water.

On a fractional rig there is no genoa at the masthead to direct flow over the leeward side of the main. Subsequently when trimming a fractional main as a basic rule more twist is needed.

Mainsail twist is imperative when sailing in light air when the danger of stalling the flow off the leech is at it highest. If in doubt always sail with more twist, at least until the boat is over target speed. Twist is needed when accelerating out of a tack and when sailing in waves.

Tell tales should be positioned on each batten end. Make sure your sail maker attaches them so that they can fly evenly on each tack. Asymmetrical tell tales are dangerous as they will lead you to set up differently tack to tack.

**Outhaul:** This is the best way to control depth in the lower third of the main. Basically, the tighter the outhaul, the flatter the bottom of the sail. In less than 5 knots of breeze do not over ease the outhaul even though you are looking for power. Too much ease will make the sail too deep and offer too much drag. If the sea state dictates that you are looking for power ease the outhaul.

Besides depth, the outhaul also changes the tightness of the lower leech. Easing the outhaul adds depth to the foot, which in turn closes the lower leech. Conversely, tightening the outhaul opens the lower leech. Always take time to assess the sail once you have made changes. The tighter the lower leech, the more windward helm you have. That's why it makes sense to tension the outhaul in heavy air to open the leech and reduce helm. A useful trick when in a tight boat on boat short term situation, where holding your lane or staying high is imperative, is to ease the outhaul slightly just enough to encourage a little more weather helm to keep your height. This is only a short-term solution, as your speed will drop a little.

**Backstay:** This controls mast bend and ultimately the depth in the upper half of the sail. Given the range of conditions that the mainsail must deal with mast bend is one of the most powerful controls. Bending the mast increases the distance between the luff and leech of the sail thus flattening the sail. Movement of the backstay in many classes is the most efficient way to sail in gusty conditions. The effect of your backstay will vary as to the type of rig you have. For instance a fractional rig with in line cap shrouds and lowers i.e. Etchells 22 will behave very differently to a fractional rig with aft swept spreaders. Be aware that when adjusting the backstay other subtle changes will be necessary to keep the mainsail at its most efficient. When the backstay is pulled on the mast tip moves aft and toward the deck, this requires more mainsheet to be used to keep the twist consistent. Be alert when easing backstay to ease the mainsheet at the same time. Be careful not to over bend the mast beyond the mainsail's designed luff curve. A tell tale sign of too much mast bend is creasing running from the clew toward the middle of the spar. Sometimes when this occurs the mainsail will invert and flog intermittently. This is rarely fast as all the pressure on the main is released and then re-applied causing the helm to load and unload. The biggest effect on performance will be a lack of height or pointing ability, do not be fooled by the boats log still reading quickly as your VMG will be suffering.

Mast bend is sometimes necessary in very light air as well as in heavy air. Aerodynamically slow-moving air remains attached to a flat, open leeched sail more readily than to the deep sail. When there isn't enough wind to fully attach the flow to your full mainsail do not be afraid to use some backstay to flatten the sail. If you have the time it is always worth making amendments to your dock settings prior to sailing to eliminate the need for use of backstay in the light. Simply induce pre-bend by moving the mast base aft, moving the spreaders aft or chocking the rig forward at deck level.

**Halyard / Cunningham:** Both control the luff tension, which ultimately moves the draft position within the sail. Set draft position with luff tension.

Once you've set the overall depth of the sail, the next step is to position the area of maximum draft. In most wind conditions, your goal is to locate the draft about 50% of the way from luff to leech. This is usually done with cunningham tension.

The cunningham applies tension to the luff of the main, and this controls draft position. Tighten the cunningham to move the draft forward; ease it to let the draft move aft. In general, the more you bend the mast, the tighter you need to pull the cunningham to get the draft in the right place. You'll also have to pull the cunningham harder on an older main, because a sail's draft moves aft with age.

In light air, keep the cunningham loose. The creases up the lower luff won't hurt. Remember you're using the cunningham to control draft position, not make the sail look pretty. In light air, you may even have to lower your main halyard (especially downwind) to get the proper luff tension.

**Traveller:** This controls the sails angle of attack and has a large effect on the balance of the boat.

The helmsman and mainsheet trimmer must continually monitor how much helm is required, so the trimmer can adjust the traveller as needed. When adjusting the traveller, you almost never want to pull the traveller so much to weather that the boom angles to windward of centreline. It's tempting to try this when you're looking for more helm in light air, but it usually stalls the main. On the other extreme, don't ease the traveller to leeward so much that the genoa backwinds the main. This may be necessary for a short time to ease helm, but it generally means that you need to depower.

The trimmer must continuously fine-tune the traveller to keep the boat on her feet and the helm in the groove. Just remember to keep an eye on boatspeed to help you find the fastest settings. Some boats will perform better with the trimmer principally moving the sheet others with traveller movement. Some such as the Farr 40 and Farr 52 need constant attention to both. The overriding factor is the feedback from the helm. Glance at the boatspeed, the sail shape and the angle of helm. There are very few boats sailing where more than 6 degrees of weather helm is fast.

Note: On many boats, adjusting the traveller automatically changes the mainsheet tension, and not always for the better! Ideally, you should set up the traveller so you can play it without affecting mainsheet tension.

**Vang:** Which controls twist once the mainsheet is eased.

Vang sheeting is popular in some classes where the traveller is inefficient or not permitted .It allows the mainsheet to be played with minimal leech tension being lost as the sheet is eased. Additional effects are the rig bending low down as the vang provides a forward moment to the boom thus bending the mast a gooseneck height.

Added to these there are additional controls such as rig tension, forestay length and mast butt position that can be adjusted on the dock or in between races should the class rules or rating certificate allow.

Back to our initial scenario of needing to live to weather of an opponent we now have the basics to achieve this. Our set should be forgiving enough for the helm to maintain target speed. This is achieved with the sail set up with medium twist, traveller 200mm above centreline and the outhaul at best speed setting. The backstay is snugged up and the top batten tell tale is streaming 60% of the time. After three minutes the breeze is seen to be lifting slightly and this presents us the opportunity sail a little faster to roll over our leeward opponent and remove the threat that he presents. The mainsheet trimmer ease the traveller to centreline and eases the mainsheet 30mm, the adjustments have the required effect as our speed builds by .2 kts.

With our leeward opponent forced to tack away we settle in on picking our moment to tack. The mainsheet trimmer has returned to our best VMG set up and the breeze has increased to 14.5 kts TWS. To counter the breeze building our mainsail has been flattened with more outhaul, the introduction of some cunningham, the backstay has been tensioned to flatten the upper half of the main and the traveller is now rarely above centreline. As we sail upwind it is clear that we need to tack, however the boat on our weather side is slow to realise the potential gains. We decide to change modes for a short while with the aim of climbing to their line and forcing them to tack enabling us to tack also and take advantage of the oncoming shift.

Our traveller is raised to 100mm above centre line and a little squeeze is applied to the mainsheet, the outhaul eased 20mm and the crew asked for that special occasion hike. Our speed drops by .1 of a kt but the weather gain is significant. Soon we are in a position to force our opponent to tack. Our trim changes have worked and we look as though we will be in strong shape at the first mark.....

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