

Balance and Tuning of Seadogs and others

Revised 2011, 2014, 2017, 2020

We have all been in the situation when you are sailing along very nicely and another yacht of the same class goes screaming past with apparently no effort at all. What is wrong? Quite simply one of three things. Either your vessel is out of balance or it's out of tune, or both.

Firstly, we will deal with balance. You have chosen a sport that requires a vessel to be driven through water and air, equally at the same time and in perfect balance with one another. Impossible.....not necessarily. When you are next in the bath and before the water gets too soapy, throw out the plastic ducks and grab a wooden twelve inch ruler that just happens to be lying nearby. Place the ruler in the water on its edge and gently hold the end between thumb and finger. By pressing the ruler between the six and eight inches you will notice that the other end moves away and the only way that you can get the ruler to move sideways equally is to press the ruler on the six inch mark. That is the centre of lateral resistance (CLR) of a twelve inch ruler. Now we go a step further. Whilst still holding the ruler but this time between your finger and thumb nail; stretch your arm to its fullest length and draw the ruler slowly towards yourself, through the water. At the same time with your other hand press the ruler at the six inch mark and you will see that the far end of the ruler moves away. The only way that you can retain equal water resistance is to press the ruler at the five and a half inch mark. When you do this the ruler moves equally sideways. You have now established one very important point. That is, as the vessel moves forward in the water, the centre of lateral resistance (CLR) also moves forward. Now you had better put the ruler away before someone sees it and believes that you had it for some other reason!.....

When your yacht is high and dry, hoist the sails and sheet in. Don't worry if there is a bit of wind, it's not likely to blow over. Lower yourself onto the putty, clutching your camera. Walk sufficiently far away on one side so that you can take a photograph of your yacht that is lying at right angles to your position. Make sure that the whole hull and sail plan are in the viewfinder. Now take the photo and lower your sails. When your photo is printed, cut in half along the waterline as painted on the hull. Then carefully cut around the outline of the hull and rudder, beneath the water line. Lay a round pencil on a flat surface and lay that section of the underwater shape upon it. Move it back and forth until both sides are balanced equally on the pencil. Very carefully mark the hull section at the exact point of balance on the pencil. Draw a line vertically from that point upto the water line. This line marks the centre of lateral resistance (CLR) of your yacht. Mark this line on the photograph as CLR.

Now regarding the sail plan, we have to find the centre of effort (C of E) of the sail plan. To do this it is necessary to divide all the angles. Starting with the genoa or foresail divide the luff between the head and the tack and mark this point on your photo. Draw a line from this point to the clew. Using this method, do the same to the other two angles at head and foot and you will see if your drawing is accurate that all three lines cross at one point. This point is the centre of effort (C of E) of the genoa or foresail. Do the same for all the head sails and the mainsail and mizzen and draw a line connecting the points (C of

E's) . Divide this line, mark it and drop a line on your photo to the water line. Mark this line centre of effort (C of E) as this line is the centre of effort of your sail plan. With the aid of some 'Celotape', attach the under water section to the remainder of the photo. In a correctly balanced boat, these two marks, (CLR) and (C of E) should be above one another or the C of E could be slightly ahead of the CLR. ...If they are a long way out you have problems with a capital 'P'. This is unlikely to happen with modern production boats. It can however occur with older boats or one offs.'

It can sometime be rather involved to make major corrections. One has either to change the position of the C of E by increasing or decreasing the size of the foresail or by reefing or re-cutting the mainsail. Whilst there is little room for movement above the waterline there is often no room for movement beneath. It is very difficult to alter the position of the CLR in a boat with a fixed keel, be it long, fin or bilge. If however you have a centre-board or lee-boards in a yacht you have infinite room for manoeuvre. With a centre-board boat it is a misconception to think that the board should be fully down when going to windward. We now know that the CLR moves forward when the boat moves forward, (remember the ruler in the bath). To keep the C of E above the CLR and so keep the boat in balance; it is necessary to move the CLR backwards. This is easily done by slightly raising the centre-board. It is not necessary to reef and the boat will go faster. Note that we are talking of centreboards not dagger boards which are entirely different.

Having dealt with the theory of balance we will now put it into practice. Imagine that you are sailing along with wind on the beam in a nice force three and with negative helm, when you suddenly get a gust of force four or five. What happens? Well the first thing to happen is that your yacht will speed up and if you don't apply any weather helm (tiller towards the wind) your yacht will come into the wind. The only way you can keep her on course is to apply some weather helm, or release the mainsheet a little. Why does the yacht do this? Remember the ruler in the bath; as the boat moves forward the CLR also moves forward. With no helm applied the boat is out of balance and the stern will move away bringing the bows into the wind. In order to keep the boat on course we have to either move the CLR backwards or move the C of E forwards. To move the CLR backwards we move the tiller or steering wheel to windward and so apply weather helm. This produces a braking effect and slows the boat down so that the CLR moves back under the C of E.

If you don't want to apply weather helm and slow the boat down as you may be racing or just wish to go faster, you must move the C of E forward so that it is above the CLR. To do this we let the main sheet out a little, and by doing so we re-balance the boat. You have decreased the area of mainsail to the wind and so fractionately made the sail smaller and therefore moved the C of E forwards, and retained the speed. But conversely, if you let it out too much you will slow the boat down so that the CLR moves backwards. It may of course be necessary to reef as the gust of wind becomes sustained. By reefing the mainsail the area becomes smaller and the C of E will move forward above the CLR, (work this out on your card-board cut out and you will see what happens) and therefore the boat is back in balance and you will go faster. We have all seen yachts heeling over with their lee decks awash. They look as though they are going very fast but in fact they have applied a lot of weather helm and they are in fact going slower as they have in effect, put the brakes on. (This is not the case in a well designed racing yacht where the hull configuration is such that at the point of maximum heel the hull shape at the water line is nearly equal on both sides of the keel. This type of craft usually has long overhangs

at either end and by heeling the waterline length is increased.) Modern racing yachts are really like fast sailing dinghies as they have a far higher ratio of sail area to wetted area of the hull and being so light in weight they plane practically the whole time. This is to say that they climb above of the forward bow wave configuration and in doing so their speed is not constricted by the speed of their wave length.

Foiling, well that's an interesting configuration but I rather think that there is insufficient sail area compared with weight of the hull in a Seadog and the foils would get in the way somewhat when coming alongside. I would advise owners to try it with a radio controlled scale model first before going for the real thing.

You must remember that the sails are your main driving force and the engine is to be used when there is no wind, or, if you wish to maintain the windward course, or in the wrong direction and you want to hurry along. A yacht will sail faster when she is upright. The flow of water along each side is equal and therefore the drag on each side of the hull is equal. However the sails will set better when the boat is slightly heeled on one side or the other. In this position the waterline length is slightly longer on the lee side and shorter on the windward side. So we immediately have more drag on the lee side than we do on the windward side. This is more apparent in light airs and it is for this reason, that in these conditions we have to be very careful not to upset the balance of the sails, and so lose speed.

Drag is an unknown factor and drag in the rigging on a cruising yacht is considerable. You may realise this more than at any other time, when you try to step the mast by hand. It is easier to step the mast, minus rigging in a wind, than it is with the rigging attached. In Rouselle which is a cutter headed ketch we have no end of wire stays, halliards and flag halliards and topping lifts, which is why a ketch attains good speed downwind with no sails set! Modern yachts have their halliards within the mast and so cut down on much of this clutter. Cyclists now wear streamlined headgear as they have found that considerable drag has been reduced by doing so. Clearing much of the clutter on our decks would have the same effect. Fenders, partially deflated rubber dinghies, sails in bags all cause drag. Windscreens and hoods have a beneficial effect as they direct the air cleanly over our heads.

Is sailing an art or is there a science of sailing? Probably both, but is it not better to know what is happening or likely to happen, rather than just sitting there holding that lump of wood and gazing out to sea? If you think about it so many different factors come into sailing. You can understand why the crews polish and burnish the underwater sections of their hulls before a race. I can remember when we used to race in dinghies; we'd sand the centreboard and rudder sections down to the shape of a jet fighter wing and polish them with bees wax. I doubt if it made much difference but we thought it did, which was half the battle.

Balance and Tuning go hand in hand. A good way to find out whether your boat is out of tune is to compare its performance with another of the same class. Of course she may just refuse to sail as my ketch did years ago after having been laid up for three plus years. It is wrong to believe that a production boat will sail correctly straight out of the box. It is easy to erect the mast, tension the rigging, stow all the gear and sail away. You may of course be happy with that; but when going on a passage is it not far better to travel in overdrive than it is in second gear? It is less tiring on the boat, its equipment and its crew.

Continuing the practicalities of balance we must make sure that the boat floats level in the water with all gear and persons on board. Do not believe that the painted waterline on the boat is the correct designed water line. On some old boats you may find the designed water line etched into the gel coat. This line should be the water line. If your present line is above the etched line; which is usually because the owner has difficulty in overcoming his hoarding habits, you will sail slower in light airs than the designed speed as you have a greater draft and therefore more drag. Very often boats will float level on their marks with no-one in the cockpit. That is OK with centre cockpits but with an aft cockpit load it with the weight of your normal crew and look again. If your stern is down and your bows are up you will have to reload the boat until you maintain the level attitude and don't drag the stern through the water, causing excessive drag. Try putting your crew on the foredeck as that would lengthen the waterline a little and increase your speed slightly. (They may object if it rains or if the sea becomes a little livelier.) It is not desirable to add weight over and above the normal load to the bows, to achieve this level state, as that will induce pitching in a head sea.

Having now obtained a level attitude fore and aft we must level the boat in the same way from side to side. This may require moving gear and ballast not forgetting fuel and water tanks. Generally with multiple tanks on either side the contents will level themselves, by leaving all the taps slightly open. The disadvantage of doing this is if on a long passage, one tank remains low and the other high, fluid will flow into the lower and out of the overflow pipe leaving the other nearly dry.

If you have now balanced your craft as well as you are able, we can now set about tuning the rigging.

The reason for having a mast in a yacht is for somewhere to hang the sails. The reason for rigging is so that we can maintain the position of the mast. The mast once set up, should not be able to move sideways or fore and aft. To obtain this happy state the stays should be tight and under tension, but not taut. The mast if stepped in a tabernacle must be supported underneath the deck. The support should either rest on the keel or on a hardwood pad glassed to the hull on or between the keels. The stays will put a considerable downward force on the tabernacle and deck and if unsupported the deck will flex causing de-lamination problems and the rig will not be able to maintain tension and the boat will quickly go way out of tune.

When I purchased Rouselle way back in 1982 the cabin roof was flexing just aft of the mast and little puddles of water appeared when she got wet. I cured this by inserting an Acro prop between the deck and the keel after first removing the head lining. I tightened this until the water on the cabin roof ran off. I then laminated a mahogany mast prop and glued an eighteen inch square by half an inch pad beneath the deck. I fitted an oak pad across the keel box and wedged this prop between the two and the Acro prop was removed. When in the final position this prop was bolted through the main bulkhead and all the bolt holes plugged. This cured any deck flexing caused by the downward force of the mast.

Assuming that all is correct we will continue. You have to decide whether you wish to tune your boat to sail as close to the wind as possible, to sail off the wind or a bit of both. Personally I always tune for windward performance. A ketch will never sail as close to

the wind as a sloop, or cutter but I have more masts than a sloop so that I can hang up more washing in the form of a mizzen staysail coaster or spinnaker, for sailing off the wind. If your boat is a poor performer when going into the wind, try raking the mainmast back a little at the top. To do this hang a weight on the main halliard so that it lays about 3 to 4 inches behind the mast at the foot. To achieve this angle, release the forestay slightly and tighten the backstay. Also if you have them, release the inner forestays and tighten the inner backstays. Don't rake the mast too much aft or you will bring the C of E backwards and that will induce weather helm. Too much weather helm is a disadvantage and there is nothing to be gained by increasing it unduly, but a little bight on the helm is a good thing when going to windward. Whilst aft mast rake will often improve the windward performance, raking the mast forward will improve reaching and running. To achieve this, loosen the backstay and tighten the forestay etc. etc.

It's a good idea to check that the mizzen mast is in line with the main mast, fore and aft and at the same rake, sideways on. The mizzen in a Seadog gives very little thrust to the forward motion except in winds above Force six when the main has been lowered. However what the mizzen really does is maintain the angle of attack to windward. If you unfortunately lose your rudder at any time which is most unlikely in a Seadog, the boat can still be steered by the position of the mizzen and used as an aerial rudder.

A cutter headed ketch will sail faster than one which has not got a staysail. This difference can be as much as one knot. With Rouselle I would bring her on to the wind and when sailing as fast as she could with just the genoa, main and mizzen. I then unrolled the staysail and sheeted that in hard. Then I found that that the genoa could be set closer and I could gain as much as five to eight degrees closer to the wind. In a good steady force 4/5 she would sail a fraction under six knots to windward and was so well balanced she would sail herself. I had set her up over a number of years to get that last bit of thrust out of her rig and she was a fast boat. I once raced with a deep keeled Seadog over a twenty five mile course and Rouselle beat the other boat by 22 minutes.

Of course you may not want to rake the mainmast backwards but you still want to improve the windward performance. In this case try bending the top section of the main mast only. By doing this you will not bring the C of E back as far as you would by raking the whole mast and you will have less weather helm. To do this with the conventional set up, loosen the forestay and tighten the backstay. Maintain the tension on the inner fore and the inner backstays. That way the mast should only bend in the top section. Don't forget that a Seadog Mast is not made to be bent however slightly and in doing so you will put a lot of strain in the area around the crosstrees, so be very careful. I wouldn't recommend it in an older Seadog unless you have had a look beneath the crosstrees to see the state of corrosion at that point.

One of the advantages of aft mast bend is that when in moderate or fresh winds the mainsail can be flattened with judicious control of the boom vang or kicking strap.. This has the effect of speeding up the airflow on both sides of the mainsail and will give more boat speed to windward. Think of a jet fighter. They have a thinner chord section wings whereas the slower passenger carrying aircraft or freighter has a thicker or deeper chord wing to obtain maximum lift. However watch the leach of the sail as too much bend will lower the clew end of the boom and could clobber the helmsman when going about! With roller reefing, this droop can be removed by rolling in two long pieces of wedge shaped wood at the clew end with the thick end aft on each side of the boom. When

sailing to windward in stronger winds it is necessary to increase the tension accordingly in the luff of the sail, whereas this tension is eased when in lighter winds or when reaching or running.

The boom at the foot of the sail also plays a big part in tuning. If the foot of the sail is attached to the boom for its entire length by slides or rope, the lower part of the sail, up as far as the first sail batten will have a different curve to the rest of the sail. Therefore remove all the sail from the boom except for the outer end or clew and tack. This has the effect of creating an equal curve to the whole of the sail by tensioning or releasing tension of the clew according to the wind strength. This one control makes an enormous difference to boat speed.

Of course with all this frigging with the rigging it is possible that the angle of the fore triangle sails will change as the position of the mast head will change. This will mean that the sheeting position of the Foresail, Jib or Genoa will change. The new sheeting position and the set of these foresails is VITAL. The reason for having a foresail is that the sail will speed up the flow of air passing over the lee of the mainsail. This is more pronounced in a cutter where there are two headsails. If the air flowing off the leech of the foresail is interrupted in any way, the airflow around the lee of the mainsail will be disturbed and boat speed will be lost.

The sheet position of a foresail should be ten degrees below the mitre line on the foresail. It is advisable to have a length of track securely mounted on the deck around this point so that the sheet position can be moved forward or aft. If when on the wind, the leech of the foresail flutters, the sheet block should be moved forward. If the foot flutters the block should be moved aft. If you arrive at a point where it would appear that the sheet is in the correct position, but the leech still flutters or 'motorboats', then it will be necessary to slightly increase the tension of the leech line. Don't tighten it too much or you will increase the curve of the sail, and slow down the wind speed on the lee side of the mainsail. To do so however, can be advantageous in light airs.

Needless to say sail condition is of great importance. You cannot effectively tune a boat with old baggy sails. However a boat with old baggy sails that has been tuned will often outperform a boat with new sails that hasn't. However sails in good condition that are not unduly stretched are an advantage. Modern materials such as Terylene, Dacron and Dyneema do not need careful initial stretching and are less fussy about tension applied to their edges. If you are having new sails made, do not select the cheapest, but as with insurance, it pays to shop around.

Stipulate to your sail maker the features that you require, depending on the type of mainsail. Good cruising sails are usually triple or double diagonally stitched, with head and clew boards sewn in as standard. A leech line is required with a Cunningham hole in the mainsail to remove any slackness in the sail in that corner. It is also advisable to let your sail maker know whether you have an aft bend in the top section of your mast as the area of sail effected by the bend will need to be cut flatter.

Make sure that batten pockets are double stitched and that the ends are heavily re-enforced. It will be necessary to provide information on the type of size of boom and mast luff grooves so that the correct slides are provided. These should not be sewn directly onto the sail but should fitted with an extra link. This is to avoid the sail jamming in the luff groove.

When deciding on a foresail or genoa, information on the type of roller reefers will be required and the diameter of the forestay, so that correct piping or piston hanks are fitted. If using a roller it is desirable to have a shaped foam tapered sleeve stitched into the rear of the luff so that when the sail is reefed, the centre section of the sail, lies flat. A leech line is required together with coloured tell tails so that the airflow across the sail can be checked.

These are the basic requirements of tuning a sailing yacht. However several other points should also be mentioned. Make sure that sheet winches are correctly placed together with cleats of whatever sort to secure the sheet. Everything that enables the boat to tack quickly should be streamlined. A lot of valuable time can be lost when sheeting tackles are not well placed. Do not forget the hull. Whilst it may not be necessary to polish the hull beneath the waterline, it should however be free of growth and mud and slim removed. Propellers should be clean and their blades true. I have always found that spinning or revolving propellers will cause less drag than those which are stationary, unless they are two bladed or folding and can be aligned behind the deadwood. Before deciding, consult the makers of the gearbox as some do not advocate spinning for more than a couple of hours. If they should be fixed, leave in gear if the box is mechanical, or secure with a shaft brake if it's hydraulic.

By and large everything that comes into the efficiency of sailing your boat should come into the tuning program. Even your clothing as you cannot perform if you are wet and cold. Ease of movement is important and do not forget those little extremities such as toes and fingers. Apart from ensuring that your boat has a better performance, the knowledge that she is in tune will be good for your moral and help you to sail with more confidence. A highly tuned boat inspires confidence in you and others. Take her out often in similar conditions and squeeze every last bit of energy out of her and make a note of what you have done so that when she goes out of tune, you know how to correct the problem.

Around our coasts you will find despondent owners whose boat did not perform as desired. Even by equipping them with new sails they do not perform. The most likely reason is because they are out of balance and not tuned. You do not necessarily have to spend large sums of money to get them to move, just play around with what you have got. Don't forget that once you have reinstalled your masts having lowered them for some reason you will have to tune the boat all over again.

You get a wonderful feeling when you know that your boat is fully tuned; it's a little like driving a very fast sports car for the first time.

Brian Jones Ex (Rouselle)