

On Dynamic Balance of the C-15

One of the best ways to obtain better boat speed is through better understanding of dynamic balance and then applying these principles while racing. Dynamic balance is a fancy way to say that the sails, centerboard, skipper and crew are all set up and adjusted to the prevailing wind and water conditions such that the rudder need not do the steering. One of the first indications that one of these factors is off or needs changing is right in your hand. The other indications such as your position in the race are effects preferably shut out of your mind. An article on rudderless sailing by the UCLA sailing club has a few good ideas about balance which I will pass on and hopefully will help you gain respect for the great braking power of a misused rudder.

The sails are a significant turning factor and greatly influence the amount of rudder you need to apply. As the wind increases this becomes apparent when you try to bear off quickly without easing off the main. In lighter airs the rudder is more dominant but should not be considered the "steering wheel." Perfect balance necessitates the use of two other factors in addition to the sails, one the position of the centerboard and two, the heeling angle.

1. The centerboard, when down, acts as approximately the center of lateral resistance to the water or center of pressure below the waterline. These terms mean that it is more or less the pivot point around which the boat turns. The further aft the centerboard is swung the further aft is the pivot point. Moving the board aft decreases the weather helm (tendency for the boat to swing up into the wind). As the board is moved considerably aft, the area diminishes and more leeway and less steerage ability will result, so

don't overdo. The centerboard should be all the way down when trying to sail to weather. However, it may be moved aft slightly for better balance in high winds, all the way up when sailing directly down wind and part way down when reaching or tacking down wind. A neutral helm is essential for all reaching and running.

2. The heeling angle of the boat is very critical for best boat speed and minimum rudder steerage. As the heeling angle increases, the boat does much more than just tip further. The boat turns to weather because the turning moment increases. The turning moment is the force causing the boat to pivot about the centerboard and has two very large contributors. The center of efforts above the waterline is usually located aft of the center of pressure below the waterline. This means that the wind on the sails will naturally turn the boat to weather because most of the sail is behind the centerboard pivot point. This exists even when the boat is very flat (mast straight up and no heel). Now if the boat is allowed to heel, the turning moment increases further because all of the forward sail forces are now helping to turn the boat on its pivot point. The turning moment forces must be countered by the rudder to keep on course and too much of this is bad. The heeling angle is controlled by the sail setting and the skipper and crew positions. The main sail may have to be luffing in very high winds to keep the boat flat. The crew should hike out as far as possible with the trapeeze to help counteract the heeling forces. The more the boat heels, the harder the crew hikes out; the skipper may contribute here also. The most effective position for the skipper and crew is one that gives the best fore-aft balance and depends upon their rela-

tive size. The crew should be quick to respond to wind velocity changes and prevent capsizes.

To sum it all up, the boat must be balanced to have maximum speed. This is best achieved with (1) a flat boat, fore and aft as well as side to side, (2) a balance between the upper forces (wind on sails) and the lower forces (water on centerboard). On the first count, we hike out or ease the sails to stay flat. On the second count you can move the board slightly aft (by raising it). The proof of thee pudding is that the rubber does not have to work extra hard to keep the boat moving in a straight line. If it pulls too hard, something is out of balance and you are moving slower than necessary.

Roll tacking is one of the most efficient methods of changing tacks and further demonstrates the need to maintain dynamic balance throughout all points of sail during racing. The roll tack is generally used in moderate to light air when loss in speed is very difficult to recover. This maneuver is not difficult but does require a team effort and coordinated movements of skipper and crew. The principle is to heel the boat to windward just prior to tacking and as the tack is completed the new angle of heel will have been set early. The centerboard motion aids also in providing a lift to weather. A smooth no-rocking motion will result in a new tack with a minimum of effort and little lost energy. Practice this and you will save several boat lengths in the next race.

*Good luck,
Dick Ohst*

North Sail Report

At North Sails we are continually involved in developing fast Coronado 15 Sails. This is an on-going and costly process, but one which, we feel, pays off greatly in race results and personal satisfaction.

In our last report we discussed the development of our fastest C-15 sails, the SB 2 main and LL 1 jib. In this, and the next few issues, we would like to discuss other elements which, combined with fast sails, can help you go faster.

One area which affects many C-15 sailors is sailing in the windier conditions against the heavier crews. If you are in the light-weight category, there are things you can do so you don't get "blown away" when the wind blows.

One thing which can greatly help the light-weight crews close this "weight gap" in the heavier conditions, is, of course, sail shape.

We could devote this report to the discussion of the effects of leech twist, sail shapes, halyard tension, etc. But that's not the purpose of this report (we may get a chance to do this later).

Basically, the main outhaul should be pulled all the way out, closing the shelf and flattening the bottom one third of the main. The cunningham should be used to keep the draft in the main from blowing aft in the sail. The vang should be set snug to control leech tension and the traveller and mainsheet should be played to keep the boat from being over-powered. Carrying the traveller three fourths to one half way down the bar and easing the mainsheet in the puffs is an effective way to do this.

Depending on the conditions, it is probably a good idea to tighten the jib halyard/headstay which pulls the mast forward, reduces weather helm and flattens the jib. You may also want to move your jib lead aft a bit to flatten the bottom of the jib and twist-off the top of the leech.

Steering your boat effectively will also help your heavy air speed. Concentration is the key word here. The ability to steer the waves and keep the boat moving is a matter of concentration and practice. Feathering the boat to weather in the puffs is a very effective way of keeping the boat from becoming over-powered and stalling

out. Effective steering equals concentration and practice.

Another must for heavy air sailing is that the skipper must give an all out effort in hiking. An adjustable hiking strap in the aft end makes this job much easier and more comfortable. This allows the skipper to make adjustments in the length of the straps during the race as conditions dictate. A small and efficient block and tackle system (3:1) will accomplish this task and let you get the weight where it belongs.

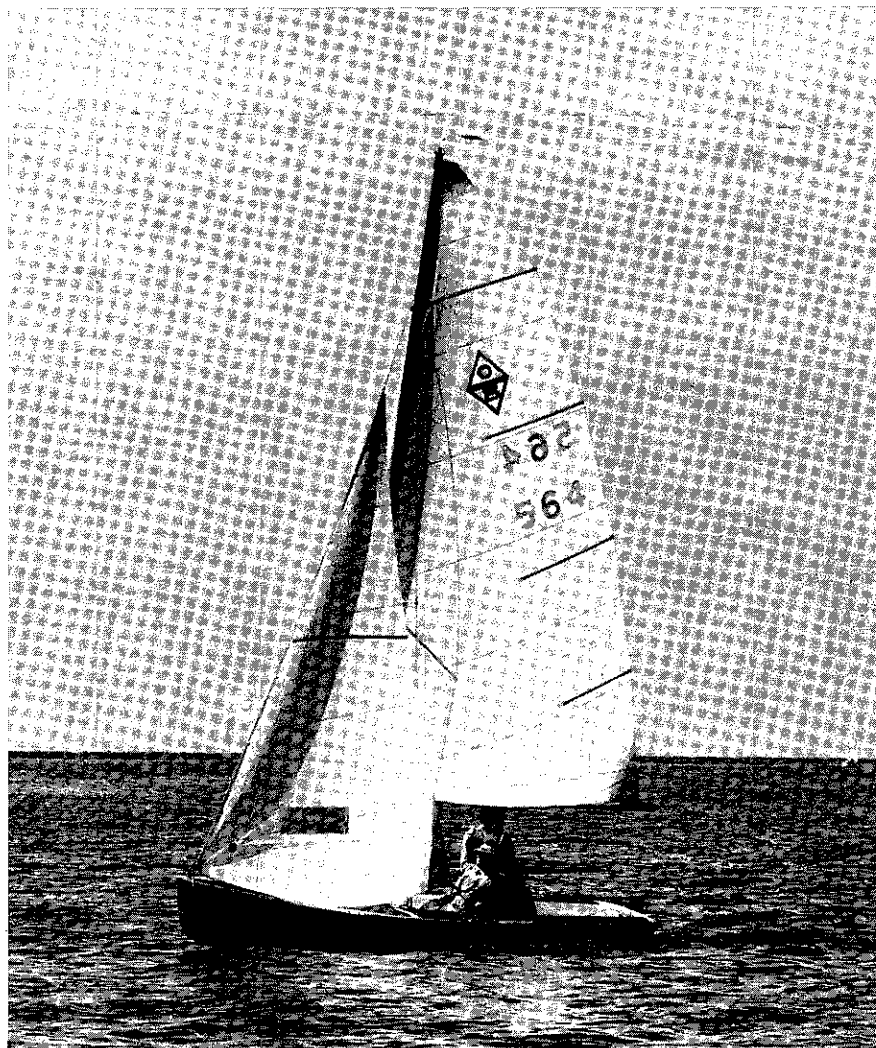
If you have a light crew it is a good idea to have an adjustable trapeze. The reason for this is that a light crew can lower him/her self down closer to the water. The lower you get the more efficient your weight becomes. The

adjustable trapeze allows the lighter crew to gain weight efficiency quicker and the "weight gap" closes.

These are just a few ideas that we thought might help your individual performance in heavy air sailing. North Sails is continuing to help improve individual performances. Bob and Bert Lowies and Rich Caley have upgraded their Alamitos Bay Yacht Club performances tremendously with their new North Sails. If you would like to pursue some of these ideas in greater depth, drop us a line or come by to see us.

We're here to help.

*Bruce Golison
North Sails*



Using his new North Sails, Bert Lowies looks back at competition during a recent ABYC regatta. Note dark stripe near top of jib.

POINTING

The ability to point higher and work to weather of your competition is perhaps the most important aspect of sailing the C-15 upwind. This tactical weapon allows you to recover from poor starts and lift out from boats tacking close on your lee bow as well as gaining valuable boatlengths to weather on legs in open water. Even in smaller closed course racing, like Westlake, more pointing ability will very often allow one to clear a bend or just skirt a shoreline without tacking, thus staying on the lifted tack and gaining distance on the boats that were forced to tack out into a header. What makes one boat point higher than another: The four areas to concentrate on in your upwind tuning program are the centerboard, the mast, sails, and, of course, your sailing technique.

The centerboard should be of maximum thickness and fit tight in the well. If it's not tight glue battens to the bottom and top of the well where the aft edge of the centerboard rests when it is down. The board should be maximum depth from the hull and the leading edge must be 90 degrees to the hull bottom when all the way down. After you have these things right you must check the most important part — the jibe. It is best to pin the aft edge of the board solid in the well at both

top and bottom and let the forward edge (by the pivot hole) flop from side to side a total of $\frac{1}{4}$ ". The hole in the board must be slightly larger than the pin in the hangers so that the board can tack back and forth at the leading edge. Slip a short piece of $\frac{1}{2}$ " brass tubing in between the hanger pivot pins to open them up tight against the inside of the well. If you can't get $\frac{1}{4}$ " gybe after doing all this it may be necessary to grind down the board in the area of the pivot hole. Ideally, the board should be $\frac{1}{4}$ " thinner at the leading edge than the trailing edge where they bear against the bottom of the well. Now the board is set up.

For maximum pointing the mast should be as stiff as possible sideways. This means a tight mast partner and spreaders at least 18" long. Reducing sideways mast bend cuts down jibstay sag and twist in the mainsail leach, both detrimental to pointing. The jib leech should be tight; to do this move the jib fairlead forward until the leech appears to be a straight line from head to clew. You can check this by looking at it from the leeward side while your crew is on the wire. If the leech is too loose or twisted the boat will feel okay but will not point. The main should be set flat (outhaul tight, mast bent to flatten luff) and sheeted harder than

normal to point high.

The most basic thing to remember when sailing to weather is to sail the boat really level. Often it feels like the boat is pointing better with a slight heel but you will find that the boat is making too much leeway and will end up further to leeward on a long tack. The key to sailing the C-15 flat is to have the mast raked far enough aft so that the boat will develop too much weather helm if it is allowed to heel — thus you are constantly forced (re-minded) to sail the boat level so the helm feels good. Try sailing your boat really flat and *feel* your helm. If you can heel to leeward and not get excessive weather helm, your mast is standing too upright in the boat. Rake it aft until it passes this test.

Next in importance to sailing the boat flat is to follow every little gust and shift in the wind, keeping a small luff almost constantly in the jib. You may need to bear away now and then to gain speed back but always head back up just as soon as you can. Think of working to weather as walking a tightrope between pointing to high and sailing too low. Work at the "point high" end of the scale and you will be surprised at how much higher you will be able to point than before.

Tom Linskey

Alamitos Bay Yacht Club site of the 1977 Nationals.

