Checking Trim on the Wind

"Arvel Gentry Outlines a Useful System"

By Arvel Gentry

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Sailing fast to windward involves a complex interaction of sail shape and trim, boat balance and helm, and how the tiller is moved in response to each wave or cross-chop. There are optimum trade-offs for all these sail trim factors and they must become almost an automatic reflex.

Making a boat go fast usually comes with experience, but this learning process can be shortened by developing a sound approach to trimming the sails and for steering the boat. This month I will describe my own personal approach to making a boat go fast to windward by discussing the basic sail trim settings for the genoa and mainsail.

Obviously, no single article can possibly cover every aspect of sailing to windward, and I'll just try to touch on a few aspects of the problem that I think are particularly important. I will assume we are sailing a keel boat of MORC size or larger with a masthead rig and overlapping genoa.

As I proceed with the various steps in trimming the genoa and mainsail, keep in mind the following basic interaction effects that occur between the two sails.

First, the genoa causes a slowing down of the slot air flow over the forward lee-side of the mainsail. Just the right amount of slowing down of the slot air will be beneficial for it permits the mainsail to be sheeted in at a tight angle without stalling. Thus, the genoa helps keep the mainsail lee-side from separating.

However, if the genoa is sheeted too close (or the main let out too far), the pressures will become the same on both sides of the mainsail. It will then start to shake (commonly called backwinding) and its contribution to the total driving force will be reduced.

A properly trimmed mainsail creates an upwash flow field in front of the genoa (a wind shift corresponding to a lift) which allows the boat to be sailed closer to the wind without the genoa's luffing.

The high velocities created by the mainsail in the region of the genoa leech cause increased velocities and reduced pressures all along the lee side of the genoa. This gives the genoa its great drive and also helps keep the lee-side genoa flow from separating. Proper mainsail trim is very important in getting the most out of the genoa.

I described all these effects in more detail in past articles (*SAIL*, April-August 1973).

As we search for proper sail trim, we attempt to find the best compromise between all these effects. We want the genoa to help the mainsail without pushing it to the point where the mainsail's contribution to the total driving force is reduced. And we want the mainsail to be trimmed tightly enough so that it gives the maximum help to the genoa leech velocities without reducing its drive.

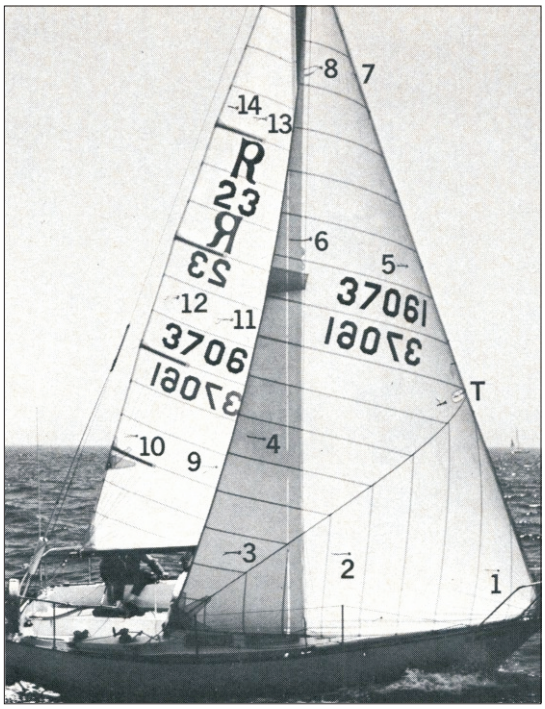

Photo 1. Telltale and tuft arrangement.

In practice I find that flow separation on the leeward side of the sails is the key factor that controls what we do in trimming them. Separation on the windward side is not nearly so important. While we can't see air, we can see what it does to our sails and to pieces of yarn or ribbon telltales that we attach to them. But where to put these telltales and how to use them are questions that are worth studying in detail.

I'd like to do two things in the following discussion. First, help you establish your own systematic approach to trimming the sails. Second, help you learn what the different sail adjustments actually are doing to your sails.

Photo 1 shows the telltale system I use. I've numbered each telltale on the photo for easy reference. The telltales are made from 1/2" by 6" strips of 0.5 oz. spinnaker cloth. The strips are cut with a pointed soldering iron using a metal straight edge; plastic tape is used to attach them to the sail. I find these ribbons more responsive in light winds than telltales made from yarn (although they do tend to stick to the sail when wet). Each of the numbered telltales has its own purpose in achieving the proper sail trim.

To aid in steering the boat, I've developed a system of short (4") ribbons that are placed near the luff of the genoa. This system is marked with the letter T in Photo 1. I refer to these as "tufts" and to all of the other ribbons on the sails as "telltales." The tuft system (*SAIL*, May 1973) consists of one short ribbon right on the rope luff, two more in a plastic window, and one just aft of the window. The port-side

tufts are red and the starboard ones green.

The plastic window is put as close to the luff tape as is possible, for it is important to be able to see the first two tufts. The tufts are attached to the window with transparent tape. The same tuft arrangement can be used without the window but it may be difficult to see them under certain lighting conditions.

The lee-side telltales tell when the air has separated from the surface of the sail. The air in these separated regions is rather mixed-up and unsteady and causes the telltales to twirl wildly. When the air is completely separated from the lee side of a sail, it is stalled and its forward driving force is greatly reduced. However, separated flow on only a portion of a sail can be almost as bad and will put you out of contention quickly.

This partial separation occurs most frequently on the after-half of a sail and is particularly important on the mainsail and on the genoa under certain conditions. When a sail is not generating lift because it has too low of an angle to the wind, it will shake or luff. However, when it has too high an angle you can't tell from the sail shape; you must look at the lee-side telltales.

When I start sailing on a new boat I first install the telltales and tuft system shown in Photos 1 and 2. Next, with a label maker, I put numbers by each genoa track screw, on the traveler, outhaul, and on the mast for halyard tension. I also wrap a piece of tape around the spreader six inches in from the end, and another twelve inches in. These help me judge the distance the genoa is lying off the spreader.

Next I begin to check sail trim while beating (I'll assume about 8 to 10 knots of wind). To begin, I guess at genoa halyard tension and fairlead position. The genoa is trimmed so that it lies three to four inches from the spreader, and the mainsail is set so that it is not luffing. All are just approximate positions.

The first task is to check the genoa car location. The usual way to determine this is to sail close hauled, luff the boat up, then adjust the genoa car so the genoa luffs evenly all along the luff.

However, I have a different approach that I believe is a bit more precise. First, sail the boat precisely on the wind by making all the leeside tufts at T lie down. The part of the genoa at T is then just on the verge of luffing. Now look at telltale 7 (Photo 1) at the top of the genoa luff. If it is twirling, the sail needs to twist off more so move the jib fairlead aft a bit. If the sail is luffing at 7, it has too much twist up high, so move the fairlead forward. Again sail precisely on the wind with all the tufts at T lying down.

Now have the helmsman start to bear off slowly and, from the pulpit, watch both the first leading-edge tuft at T-1 and telltale 7. As you start to bear off, both these ribbons will suddenly twirl as a small separation bubble forms all along the luff. The sail is not stalled, it only has this small separation bubble all along the luff (SAIL, May 1973).

If the twirling starts at 7 and T-1 at the same time, the wind is coming into the sail at about the same angle all along the luff. Again, this use of telltale 7 and tuft T-1 at this time only gives the approximate genoa car location, for overall sail shape is frequently even more important.

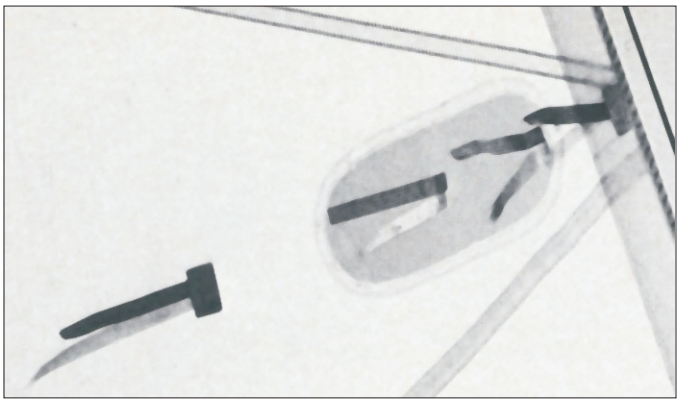

Photo 2. Tuft system. Headstay and jib luff are at far right.

Write down the genoa car location number; then observe telltale 7 as the car is moved way forward, and again when it is moved too far aft. Always sail with tuft T -1 just lying down smoothly but the sail at T not luffing. From this exercise you will see how different amounts of twist affect the flow over the luff of the sail.

Now return the genoa car to the location you have marked. Sail with the first tuft at T -1 showing just a slight amount of agitation. Check all the lee-side telltales on the genoa. If any of the leech telltales, (3, 4, 6, and 8) are twirling, then try increasing the halyard tension and letting the sheet out a bit to maintain the same distance off the spreader. At this point we still may not have exactly the correct genoa car location or halyard tension. But before we spend more time on the genoa, let's switch our attention to the mainsail.

The mainsail has a strong influence on the flow over the genoa and we should be sure it is trimmed properly before we worry further about the genoa. The mainsail is controlled by the mainsheet, traveler, outhaul, cunningham, vang, leech chord, batten stiffness, and mast bend. The mainsheet and traveler, however, are the key adjustments for they affect mainsail position and twist.

To start, set the traveler on the centerline. Let way out on the mainsheet and then pull it in as you watch the top lee-side telltale, 13. Stop when 13 twirls, and let the sheet back out until it lies down.

Now check the lower part of the main near the mast to see if it is being ***backwinded*** by the genoa. Personally, I don't like the term "backwinding" for it seems to imply that the genoa is throwing air against the lee side of the main, and this is not what is happening at all. The mainsail is just reacting to an increase in leeside pressure resulting from the genoa's slowing down of the air in the slot (*SAIL*, August 1973). However, everyone does seem to use the term and therefore I will, too.

If the main is being backwinded, move the traveler to windward until the backwinding stops. Now readjust the mainsheet again until the top telltale 13 twirls, then just lies down again. Repeat these traveler-mainsheet adjustments until the sail is not being backwinded and the top telltale is just lying down.

If the genoa has a large amount of overlap, a 180% genoa, for example, it may be difficult to stop the back winding without pulling the mainsail so tight and so far to windward that the mainsail leech hooks sharply to windward. To fight this problem, first try tightening the outhaul. If this doesn't work, try increasing by an inch or so the genoa's distance off the spreader.

Now check the mainsail leech telltales, 10, 12, and 14. If any of them is twirling, and 9, 11, and 13 are not, you have a leech flow separation problem because the leech is hooking too far to windward. First tighten the outhaul and then the cunningham to let the leech fall off some. Remember, when you apply tension to one edge of a sail, the other edge will falloff some. You also may have to move the traveler down a bit.

If the bottom row of telltales (9 and 10) are twirling, the lower part of the mainsail is either in too tight or the genoa is not trimmed in enough. Move the traveler to leeward until they settle down and adjust the mainsheet until the top row of telltales again are lying down. Your main purpose in all this is to learn how to coordinate the traveler and mainsheet tension to get the proper twist in the sail.

After a few repeated cycles of these adjustments, write down or mark the traveler position so that you can return to it. Now observe the mainsail lee-side telltales as the traveler is moved further to windward. The leech telltales, (10, 12, and 14) will twirl about the same time followed quickly by 9, 11, and 13 as the complete sail stalls. This tells you that all parts of the mainsail are working equally hard in generating lift ***and in helping the genoa***. Now return the traveler to its proper best position.

Sight up along the mainsail and see if the top batten is hooking to windward of the centerline of the boat. If it is, then you may not be getting maximum forward drive out of the upper part of the sail, even though telltales 13 and 14 are lying down. Let the leech fall off, so that it does not hook to windward, by letting out the mainsheet a bit and moving the traveler slightly to windward. If this causes telltales 10 or 12 to twirl, then increase the cunningham tension and again adjust the mainsheet and traveler to get all of them to lie down.

Whatever you do, always trim the sail so that telltales 13 and 14 are lying down; sometimes if you trim the main so that the top battens are pointing straight aft, telltales 13 and 14 will be twirling and the upper part of the sail will be stalled; so using just the batten alignment procedure may lead to bad mainsail trim.

After the mainsail is trimmed, turn again to the genoa. Watch the genoa tuft system at T and telltale 7 first as the boat is sailed precisely on the wind, and then as you bear off slightly to see if the mainsail adjustments have had any effect on proper genoa settings. If they have, then repeat the genoa trim procedure.

As an experiment, try sailing only with the T -1 tuft twirling in steady wind and smooth water. Then let the traveler way out and move it all the way windward to stall the sail and watch what happens to the T -1 tuft each time. In this way, you will see how mainsail trim does affect the air flow over the genoa.

You should have the two sails trimmed pretty well by this time. However, a number of questions are yet to be resolved. How good is the boat's balance? Is there too much lee or weather helm? How is the shape of the genoa? Should we barber haul it, and how much? What about sail trim in very low or very high wind conditions? And finally, how is the tuft system used in steering the boat to windward? Next month's article will pursue these questions.