

Fast Thoughts on Reaching Speed
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At the UK Nationals in Lyme Regis in July, 2010, we didn't always round the weather mark first, but had better off wind speed than other boats and won almost every race. Our off wind speed is the culmination of over a decade of work with the Albacore. In this article we explain how to make an Albacore go on a reach. In a second (future) article we will explain down wind speed.

To make an Albacore go on a reach requires rig controls with adequate range of adjustment, a few tell tail yarns, and some practice. This article attempts to address both fixed and adjustable rigs.

Rig Controls

In the UK the Albacore is sailed with on-the-fly adjustable shrouds and jib halyard. For UK racing, the rig must be capable of rake settings from 4 – 12 inches. For the purposes of this article “rake” is the measurement from the shear mark on the headstay to the upper tip of the boat's bow with the slack just removed from the rig. In addition one must be capable of releasing the leeward shroud an additional 5 or so inches. As a point of reference, normal upwind sailing requires a rake of around 6.5-7 inches.

For sailing in North America, the shrouds are fixed and the minimum value of rake is constrained by where the shrouds are pinned. The minimum value of rake varies boat to boat but should be on the order of 6.5 to 7 inches. In higher winds Albacore sailors in North America often pin the shrouds down to increase rake and decrease power.

Almost all racing Albacores have adjustable vang, outhaul, mainsail cunningham, and jib cloth tension. Fast reaching requires all of these in addition to some form of mast ram. This can be as simple as blocks to constrain the mast's forward motion. We have a strut type mast ram installed. This is capable of pushing or pulling the mast over the full range of motion permitted by the class rules via a rope tackle system lead aft to the helm.

Just about all racing sailboats have tell tail yarns installed on the main sail leech and jib luff. To these we add three sets of yarns in the middle of the main, about mid chord and at the $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ heights.

One additional control is the headstay. The vast majority of Albacores have the headstay hanging slack or tensioned by a short length of elastic. Our head stay is connected to the jib halyard tackle via a short length of elastic and to a 2:1 tackle to a cleat on the fore deck. It's attached to the jib halyard tackle so the tension remains constant as the halyard moves. Class rules require that the headstay support the rig in the event the jib halyard is released, so ours is fitted with a stopper ball on the 2:1 tackle such that it prevents the mast from tilting aft of the aft partner even if it is uncleated.

Sail Design

The RacerX sails we use have lots of molded shape and moderate luff curve. We, like everyone else, use mast bend to alter the curvature, increasing power on the reaches by straightening the mast and decreasing power (and improving efficiency) by flattening the sails up wind. I believe that the fuller sails enable us to extract more power from the wind when reaching than flatter designs. Like all things this does come with a price – and the downside is that we must use a large amount of pre bend in light to moderate conditions to pull all of that fullness out and open the leech. Sailing upwind in higher winds with featherweight crew

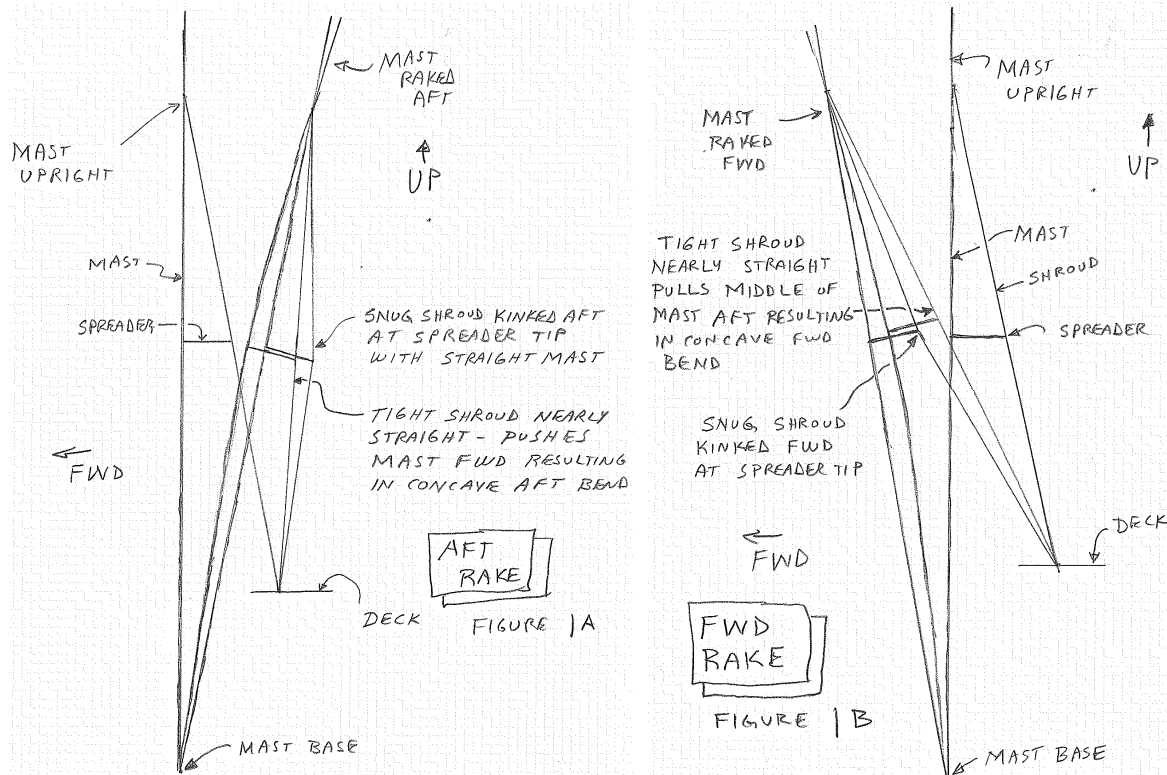
is problematic as well, particularly in choppy water. Flatter sail designs work better in this case and in some ways are more versatile.

Adjusting the Rig

Frank Bethwaite's second book High Performance Sailing says in regard to sailing on a reach, that a boat going to windward is all about aero and hydrodynamic efficiency – and that means achieving a high ratio of the lift from the sails and foils to the induced drag – since with the sails close to centerline the induced drag is in a direction to slow the boat. For best performance we flatten the sails and place the centerboard all the way down. When reaching the sails are eased far from centerline and so the induced drag, which could be considered roughly in line with the boom, is primarily pulling the rig to leeward. The added speed we get from the increased lift far outweighs the loss incurred from the added drag in doing so. Albacore reaching is all about maximizing the magnitude of lift from our sails. We accomplish this by adjusting curvature of the sails by way of mast bend and jib luff sag to wring the maximum power from the sails.

To clarify, the word “curvature” refers to the deviation from a straight line connecting the luff and leech, as if one were looking at a cross section of the sail formed by the intersection of the sail and a plane at a right angle to the mast. “Bend” refers to the mast and its deviation from a straight line connecting its base and the hounds.

First a quick review of rig mechanics... At a nominal up wind rake setting (6.5 to 7 inches) we have our rig configured such that the shrouds, hounds and spreader tips are all in the same plane when viewed from the side, so shroud tension has no effect on mast bend. Now, if one were to rake the mast aft by easing the jib halyard say 4 or so inches to a rake setting of 10 or 11 inches and take up the slack in the shrouds, one would see, when viewed from the side, that the shrouds are pushed aft of the plane described by the hounds and shroud attachment locations on the hull by the spreaders as depicted in Figure 1A. If one were to increase tension, the shrouds go straight, pushing the spreader tips forward, resulting in the mast bending concave aft a small amount. With a sail hoisted the aft bend pulls cloth from the middle and reduces the curvature. Conversely if one were to rake the mast forward to a setting of, say 4 inches, the spreaders pull the shrouds forward of the above described plane. Tighten the rig and the shrouds straighten and bend the mast concave forward a small amount as depicted in Figure 1B. A sail hoisted has more cloth pushed into the middle, increasing curvature. In general, a flatter sail has less power and is more efficient whereas a fuller sail has more power. This is one of the reasons that increasing rake reduces power while reducing it does the opposite and why Albacore sailors rake the mast aft while sailing upwind and ease the shrouds and rake forward when sailing down wind.



A ram or restrictor arranged to push the mast aft or pull the mast forward at deck level has a similar effect: pushing the mast aft tends to increase curvature in the sail. Conversely pre bending the mast by pulling the mast forward at deck level decreases curvature.

Setting the Main with Adjustable Shrouds

When reaching in the UK we ease both shrouds to around a 4 inch rake setting. We then blow the leeward shroud off completely. The mast hangs on the windward shroud. The jib halyard no longer controls the mast rake. The leeward shroud is slack and the leeward spreader has folded forward and totally clear of the main. We ease the Cunningham and out haul. We then ram the mast aft at the deck to increase the main sail curvature and power. Sounds simple – but if the mast is too straight the cloth piles up at the luff and it creates too much curvature in the front of the sail. Trimming to fill a main with excessive luff curvature results in most of the sail being stalled. When optimally set the mast is rammed such that the main sail has the greatest amount of curvature that is evenly distributed from luff to leech. Reaching this threshold is the key adjustment and, like many things in sailing, it does not lend itself to numerical calibration. This must be set each time while looking at the sail's shape and the boat's speed.

The second facet is the vang. Our vang setting is heavily influenced by our years spent competing with (following) Michael.McNamara. He always is so annoyingly fast on the reaches. We have watched him sail past and away from us many times...trying to discern what was making his boat go so much faster than ours. We finally got our opportunity one afternoon in Looe in 2000. Michael had just stitched up his umpteenth UK Nationals win (with a race to spare) and asked if I'd like to go for a sail. We launched 6493 and 8011 into the remainder of a fresh afternoon sea breeze. The entire story is posted online on the USAA web site, so I won't repeat it here, but I can still recall to this day Mike's calm, Socratic questioning leading me to correct the mal adjustments I had made while steering his boat. The issue here is twist. The top of Albacore main sail is in relatively clear winds 20 or so feet above the sea surface while the middle is affected by the diverted air from the jib. It makes sense that this sail should be twisted, since the jib outflow is diverted aft, so that the angle of attack is optimal from top to bottom. In practice, to get the vang correct one must look at the luff and yarns on the leech and in the middle of the sail. When correctly set on a reach all yarns are streaming and the luff is not backed. I have found that it is possible to

stall those yarns in the middle of the sail while the leech yarns stream and the luff is filled – and that typically the fix is to ease the vang a small amount. As with the ram, the vang setting must be done in real time. We typically made 8 to 10 small vang adjustments on each off wind leg at Lyme Regis this year.

Setting the Jib

For the jib we have the sheet, jib stick, halyard, cloth tension, and headstay. Easing the halyard and sagging the jib luff is roughly analogous to straightening the mast in that the greater luff sag creates greater curvature in the jib – but, as with the main, this has a limit. If the jib luff sags too much the luff hooks, requiring the crew to over trim the sail to keep it full. As with the main, getting the greatest amount of curvature in the jib evenly distributed from luff to leech without over curving the luff is the key to maximizing the power, and also like the main, this is also not amenable to a numerical setting.

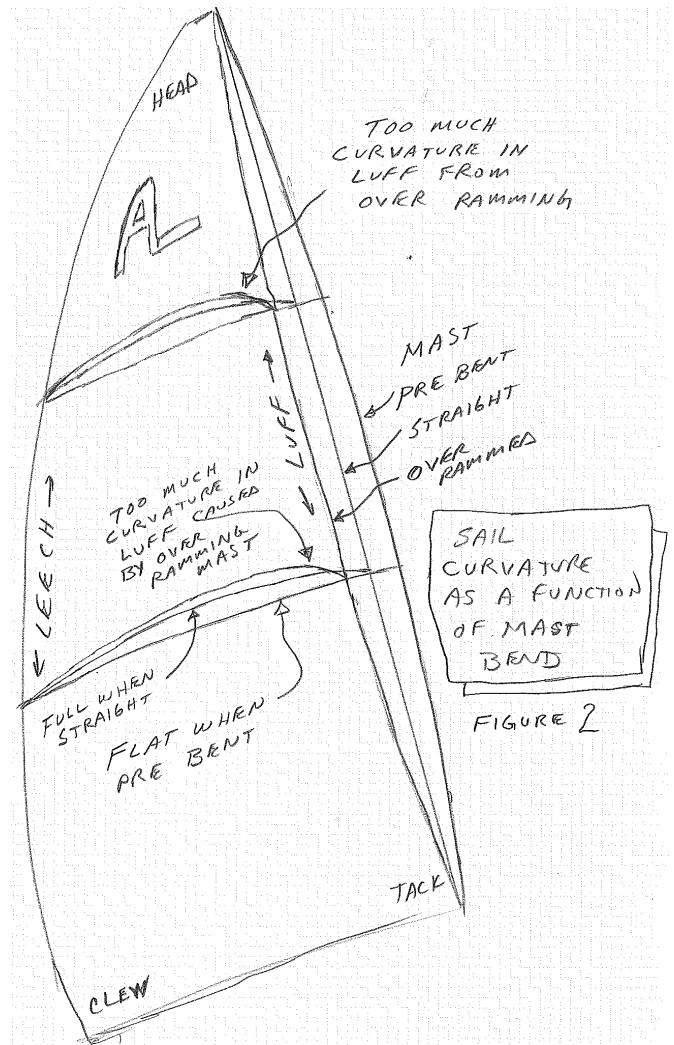
Ease the luff cloth adjustments for the jib until horizontal wrinkles just begin to appear. Any excess tension in the cloth in the sail’s luff tends to reduce the overall curvature and bring it forward towards the luff, both of which we seek to avoid.

We use the adjustable headstay in light to moderate conditions, applying just a small amount of tension. This holds the rig forward and de couples the mast ram adjustment from the jib luff sag, allowing us to optimally set both sails. In windier conditions, like those we enjoyed at Lyme Regis this year, the rig is sufficiently loaded that both sails can be set independently without applying any headstay tension.

When sailing with a low aspect jib one should extend more jib stick than one would think. This keeps the jib out and away from the main and with roughly the same curvature from top to bottom and only a small amount of twist. This may apply with a high aspect jib as well, but we’ve never tried it so we don’t know. While sailing the crew must continually hand trim the jib sheet, particularly when reaching in a dynamic situation of waves and gusts where the helm must steer way up to get to new pressure and then way down while catching a wave. The jib stick control can be cleated at times, but requires frequent adjustment. Practice makes perfect here – as correctly setting the jib requires the crew’s total attention.

Setting the Main and Jib with Fixed Shrouds

When racing in North America it is not legal to adjust the shrouds while racing – and so we have developed a work around. In this case we ease the jib halyard about 2 inches and ram the mast aft in the boat. This causes the leeward shroud to go mostly slack and the spreader to fold forward mostly out of the way. Meanwhile we use the headstay to hold the mast forward against the ram. With the mast sprung between the step, ram, and headstay, the mast bend and therefore main sail curvature can be adjusted with



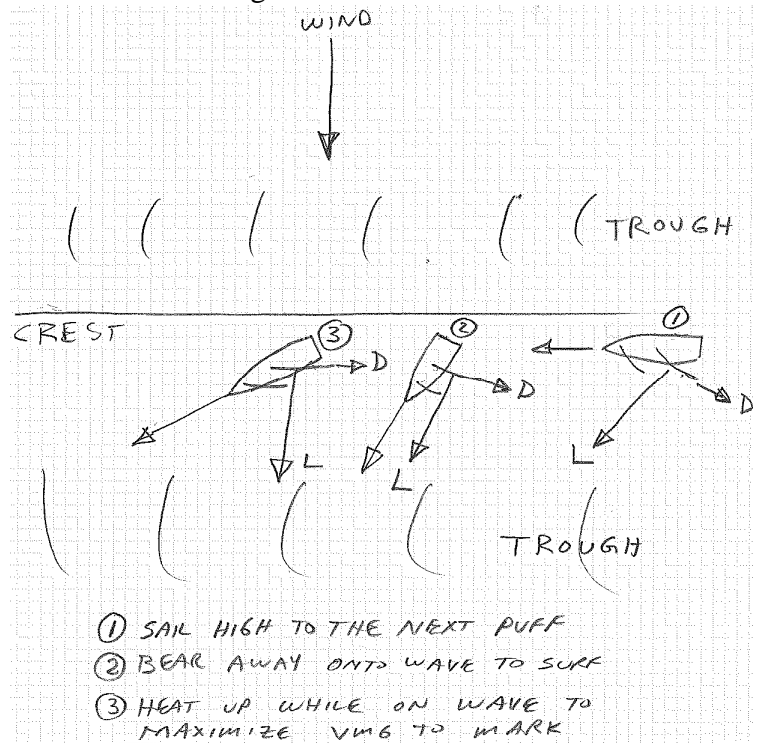
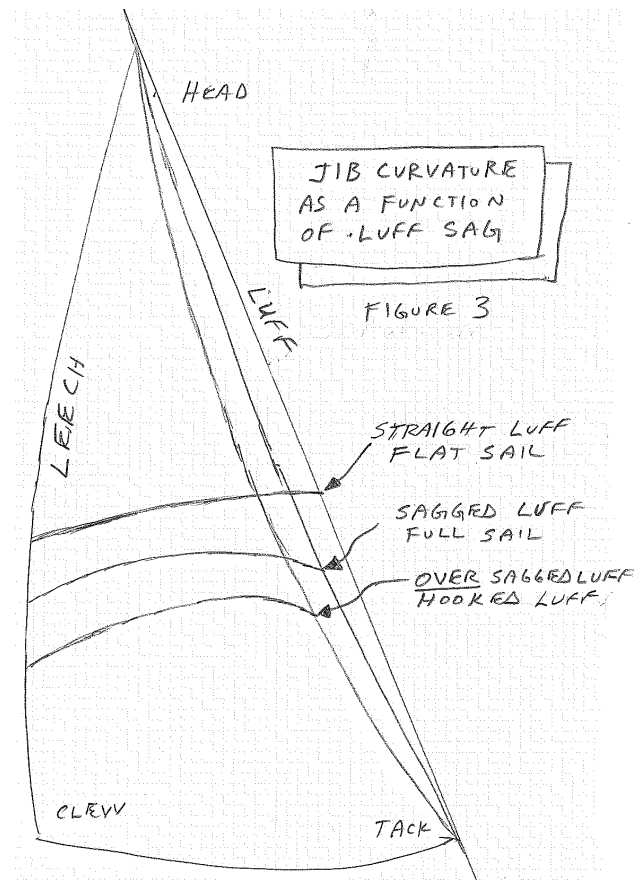
the ram. We seek the same situation of maximum curvature without hooking the entry or luff. Setting the jib in North America is identical to sailing in the UK.

Sailing Offwind

We were chasing Mike Holmes and Colin Smith at the UK Nationals in 2003 down one reaching leg in an 18-20 knot breeze. As I recall we were sailing outside the break water at Portsmouth in the open sea. I remember thinking to myself, "Where's he going?" as he alternately sailed way above the rhumb line to get to the next puff and then way, way below the rhumb line, extracting all there was from the waves they were planing on – and further into the lead away from us. The key lesson here is that the fastest route to the wing mark isn't necessarily continuously towards it.

As for the racing at Lyme Regis this year, I noticed that if all one did was point at the wing mark one would occasionally catch a nice wave and have a short ride. The pressure was on and off with new puffs coming across the course. We would sail just a touch above rhumb line to the next pressure with the sails sheeted in to a beam or tighter reach and hiking hard to keep the boat flat. The waves are passing underneath with little effect as the boats course is close to right angles to the wave propagation and so the slope of the sea before the boat is mostly flat. At this point the sails lift, which could be considered to be at right angles to the boom and drag, which could be considered to be in line with the boom, are at roughly equal angles to the boat's heading.

As we reached the next puff, we would bear away as our righting moment was saturated by the additional wind, while simultaneously looking for a wave to burn down on. When the next nice looking wave came through we would simply bear away – to a course slightly to moderately below rhumb line and ease the sails some. With the sails eased the lift will be more nearly aligned with the boat's course and the drag only pulling to the side. Even though we would frequently bear away 20 or 30 degrees we often would have to re sheet the sails as the boat accelerated – heck some times it seemed like it fell - down the face of the wave bringing our apparent wind forward. As we surfed down the wave we would heat up and sheet in just before the bow reached the wave trough to stay on the face and surfing at higher speed. As we heat up the apparent wind increases in strength and goes way forward, and requires both sails to be sheeted in and the crew to hike harder. As the boat's course is



now closer to the direction to the mark, the VMG goes up. Everything is good – but the slope of the water in front of the boat is not as steep, and the boat's speed must remain even higher to stay on the wave since its course and the wave propagation are now mis aligned. Sail and boat handling here are critical - one sheeting, weight placement, or steering error can drop you off the plane / force you back down below rhumb line to regain speed.

Often we would encounter another wave behind the first and never leave a full plane for periods that seemed like minutes but were probably under 30 seconds. Eventually the wave and puff subsides and boat falls off its plane and slows to displacement speed - at this time we heat it up to get to the next puff and repeat the cycle.

This was even more pronounced on the bottom reach – where simply sailing the course meant displacement mode almost the entire way. We sailed above the rhumb line to the next gust and bore away sometimes steering through 45 degrees down the face of a nice wave to get planing and either heat back up or hold a low course to maintain the plane. In this case the wind did not support planning at the high course, and required on the spot decision whether to bail out and go high in the hopes for new wind or stay surfing at a too low angle.

Weight Placement

I'd say by far the most common error Albacore sailors make while reaching is to sit too far forward, particularly in light to moderate winds: we try to keep the weight as far aft as we can without overly dragging the stern. That said, often having one's weight slightly forward helps initiate surfing. In these conditions we may momentarily trim our weight forward a small amount. Once surfing, one must trim aft to keep the boat on its lines and the bow out of the water. Be careful to not violate rule 42 while adjusting fore-and-aft trim; the adjustment must be smooth and without an abrupt stop. Attaining the correct fore-and-aft trim is not amenable to a numerical setting – in fact EVERY time we are on a reach we are constantly making small adjustments to our fore-and-aft trim until the boat lights up. A small, say 3 inch change in where the helm sits can make all the difference.

Centerboard

The centerboard is a pretty basic control, but there are some nuances. First, our centerboard is adjustable from the rail via a rope and tackle system with a 2:1 purchase going down and a 3:1 purchase to raise. It also tapers to a very sharp edge at the bottom – since the tip of the board is the trailing edge when raised on a reach. We generally use the smallest amount of board possible when sailing off wind consistent with good control. If we are going slowly, we raise the board a small amount.

Practice and Persistence

The techniques I have outlined are not something people can just go out and do – getting the sails set just right is daunting – and one only has very subtle cues to go on. My two final and probably most important points are that you need to practice setting up the boat, adjusting the sails, and sailing, all outside a racing situation. We've spent countless days sailing side by side with other boats trying out different things. One can not expect to simply read an article and instantly go faster without investing time on the water developing one's own skill. Second is that many times when we sail it seems like we'll have the boat set up to what we believe are correct settings and yet we are not going well. Often we must refine to get just the correct combination of trim and sail adjustment to go well in that day's particular conditions. So the message here is don't give up if the boat speed doesn't immediately improve, the Albacore is a sensitive and responsive creature - keep working to refine the set up until it happens.