

***ANOTHER NEW APPROACH TO CRUISING SAILBOATS -
FAST, SAFE, LONG-DISTANCE CRUISERS***

*- Lars Bergstrom
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For many years the B & R Designs team of Sarasota, Florida have been working with single-handed 'Transatlantic' and 'Round the World' racing sailboats. Recently a new range of cruising sailboats have been developed. The first boat built using this new philosophy is 'Route 66' - a fast 68' sailboat that is safe and simple, at present the couple who own 'Route 66' are on an extended sail around Europe. Neither a large crew or strong muscles are required to manage the boat.

Most fully crewed racing boats and their cruising offspring are 'poisoned' by 'human-written' rules - rules that are created for the 'handicap' measuring systems where allowances are given for anything that slows the boat down and where designers try to create a 'slow' boat that is 'faster' than the speed allowance given - what if, for instance, before the 100m sprint in track and field competition, the athletes go to a doctor to get time allowances for personal deficiencies! For a knee injury perhaps a 2 second allowance; a sore foot, a 3 second allowance and so on. After the race the athletes time's would be adjusted for each persons' condition and then the winner would be announced!

The single-handed races (Transat, BOC, etc.) follow, more closely 'nature's rule' - these boats need to be strong enough to sail in severe conditions; easy enough for one person to handle and if the boat is fast enough it will do well. This type of boat can set a good standard for cruising sailboats and as there is no need to build to a rule, a cruising boat can be much faster and safer.

Some rules for short-handed racing sailboats have to be accepted to limit the size and costs of a boat and accordingly make competition a sporting challenge. However, as the boat size limitation is defined by the present rule in terms of maximum overall length, this rule contributes to a tendency for competitors to choose a plumb bow. A plumb bow can produce a wet boat and this together with a rounded blunt stem can cause, at high speed, a sudden deceleration when the bow goes down in the water. This type of bow is most undesirable for a cruising sailboat. The new designs feature a sharp, sloped bow shape which reduces resistance. 'Route 66' and the new cruising designs feature spray deflectors which are incorporated as part of the deck joint on the forward section of the hull and these divert the spray away from the hull. Diverting the spray helps to keep the boat dryer and also gives a lifting force that, at speed, helps prevent the bow from diving.

Racing rules generally ban the use of electrically or hydraulically assisted winches. Powered winches are great for cruising as they give the smallest and possibly least strong crew member an opportunity to manage the boat unassisted.

Water ballast is a good, safe and inexpensive way to achieve stability. The amount of water ballast is calculated to be the primary contributor to stability when the angle of heel is between 0 - 20 degrees. Twenty degrees is the cross-over point where water ballast and the inherent stability produced by the keel and hull should be about equal and above twenty degrees the inherent stability should be the major contributor. Using water ballast adds greatly to the safety of the boat as the keel can be lighter and in the event of a 90 degree heel, there is less stress on all parts of the structure. With water ballast the point of gravity is unsymmetrical in relation to the center line. This means that the boat is

incapable of remaining upside-down if it should be unfortunate enough to be rolled.

In extreme conditions the negative side of water ballast is if the boat experiences a 90 degree heel so part of the deck is underwater and if the wind is strong enough to push the boat sideways, the heeling moment created by the wind force on the hull that is above the water and the resistance from the water on the submerged part of the hull, means that it can take some time for the boat to self-right. If a sea anchor can be deployed off the bow, this will assist the bow to swing into the wind and then the boat will self-right.

After the successes of 'Tuesday's Child' and 'Thursday's Child', Warren Luhrs of Hunter Marine commissioned B & R Designs to conceive a new 60' single-hander. A hull was calculated for minimum resistance and a towing tank model was built from these calculations. At the same time a model of 'Thursday's Child' was built as she had known performance. The tank tests were done at the Royal Institute of Technology in Stockholm. The results showed that the new hull shape had about half the wave resistance as the hull shape of 'Thursday's Child'. 'Hunter's Child' was the first boat built using the new hull shape, she was built in the United Kingdom and has been sailing now for a number of years. 'Hunter's Child' has recently undergone changes in preparation for the 94-95 BOC Challenge.

During the tank testing the new hull shape was weighted down in increasing increments and the results showed that even with considerably higher weight there was a smooth transition from displacement speeds to more planing speeds and that performance was less affected than would have occurred with a conventional hull form.

After 'Hunter's Child' B & R Designs' next project was a thirty foot sailboat to fit the Ultimate 30 rule using the same hull lines as 'Hunter's Child'. This boat with maximum crew weight corresponds, weightwise, to a sixty foot sailboat of 26,000lbs., a good overall weight for a cruising sailboat. The thirty foot boat, 'Benz Express' has shown great speed potential - speeds in excess of 30 knots. 'Route 66' has the same hull lines as both 'Hunter's Child' and the 'Benz Express'. In relation to it's size however, 'Route 66' is lighter than both of these boats and has, comparatively speaking, less sail area but potentially a higher top speed. One interesting aspect of the hull designs of 'Route 66' and 'Benz Express' is an air outlet slot which crosses the underbody about two thirds of the way along the waterline back from the bow. It is a groove across the hull approximately 4" wide covered with a plate that is flush with the hull on the forward end and angling down at the rear creating a slot of measuring about 1/4" between the hull and the plate. It was found during the tank tests that the surface friction and wave resistance for this hull appear to be of the same magnitude. When sailing 'Benz Express' at around 10 knots an area of lower pressure is created on the hull at the location of the slot strong enough to suck air from inside the boat. As the air, together with the water, travels over the rear part of the hull the surface friction in this area seems to be greatly reduced. When hull resistance is reduced, boat speed is increased. The air outlet slot was adopted for 'Route 66' it also serves as a seachest dump for the water ballast system and the cockpit drains. One of the changes made to 'Hunter's Child' has been to retrofit an airtslot.

Long-distance cruising sailboats are often on the same tack for extended periods. The transom of this type of hull is rather wide and would require a long rudder blade for good control when heeled. On 'Thursday's Child', 'Hunter's Child' and 'Route 66' a pivoting rudder is used that can be set vertically

for most heel angles. This allows for a smaller rudder blade to be used which reduces resistance while maintaining control because when the boat is heeled with the rudder in a vertical position the sideforce from the rudder is horizontal. Along the trailing edge is a trim tab and an autopilot is connected to the trim tab for steering. There is less load on the autopilot when it is connected to the trim tab and the rudder is controlled by adjusting the trim tab. The connection between the autopilot and the trim tab is independent of the steering cables so if a cable should break the autopilot can be engaged and steering control maintained. Sailing 'Thursday's Child' from New York to San Francisco when she broke the Clipper Ship Record, a steering cable broke whilst sailing in strong winds with a spinnaker set, immediately the autopilot was engaged and there was no loss of control.

B&R are working on a new keel/rudder configuration for cruising boats, a shallow draft blade with a bulb to which the rudder is attached. This protects the rudder from damage that could occur if the boat runs aground. Over the years many repairs have been made to free standing rudders on shallow draft boats as the rudders are easily damaged if run aground. Extensive wind tunnel tests were carried out on this keel/bulb/rudder combination and the results showed that the performance was suitable for a cruising boat. On the trailing edge of the rudder blade a trim tab is fitted which is operated by an autopilot.

A problem often experienced by a sailboat fitted with a backstay or running backs when sailing on the same tack for extended periods is the leeward rigging slackens and as it is constantly moving, rigging fatigue can occur. In the late 60's the B & R rig was developed which triangulates the rigging in such a way that the shrouds remain fairly taut. This rig is safer and more suitable for cruising sailboat. Running backstays are not required as swept-backed spreaders are

used to support the mast. The diagonals, (rigging wire or rod attached at the tip of one spreader and down to the base of the lower spreader or the base of the mast) eliminate the need for inner forestays. This type of rig was used on many IOR racing boats in the 70's and early 80's. IOR boats as well as most other sailboats use overlapping foresails and have a narrow base for staying the masts. Cruising boats with no rule restrictions can choose more efficient alternatives. A sail area based on foresails that only come to the spreaders means the base of the rig can utilize the whole beam of the boat. On 'Thursday's Child' and 'Route 66' this principle was used - a rig with no running backs or backstay. 'Hunter's Child' is now fitted with a B&R rig. This allows for the use of a fully battened mainsail with an increased roach. For light-wind conditions there is a masthead forestay on which a much larger foresail, in very light cloth, can be set. One criticism sometimes heard of the B & R rig is that it is difficult to sail downwind because of the swept-back spreaders. In fact when using a downwind spinnaker the wind is directed into the spinnaker by the angle of the main. With cruising spinnakers it is usual to 'tack' downwind and therefore not necessary to let the main all the way out. Another concern sometimes voiced about the rig is that the main cannot be let all the way out when the boat is close to broaching - broaching mostly occurs with racing boats that have proportionally more sail area to the size of the hull. As the new cruising boat hull shape has more inherent directional stability it does not have the same broaching tendencies. As an example 'Thursday's Child' has been sailing for over 150,000 miles with no sign of a tendency to broach.

On both 'Thursday's Child' and 'Hunter's Child' the masts are deck stepped and have struts that are attached to the mast about 7' above the deck and at the lower end to the chainplates. The struts support the mast so it is the equivalent of a keel-stepped mast that is supported by the deck. This makes it

possible to use a smaller mast section and gives a very rigid point for a spinnaker pole attachment. Using a smaller mast section creates less drag and minimizes disturbance on the mainsail. With 'Benz Express' and 'Route 66', B & R Designs has gone one step further and incorporated a third strut which angles forward, forming a tripod for the mast to be stepped on. All of the mast load is taken up by these three struts. The shrouds and forestay are attached to the lower ends of the struts. This method allows the major forces to be retained within the rig structure which greatly reduces the load on the hull. Using the tripod system means that only the heeling moments from the keel and the slamming loads from the water need to be considered when calculating the dimensions for the lay-up of the hull. Since the hull loads are considerably reduced the construction of the hull can be lighter without sacrificing safety.

An additional safety factor is the rigid boom system which has been used very successfully on 'Route 66' - this allows the boom to swing only from side to side. The 'barn-door' boom is calculated and dimensioned to take the entire load from the mainsail with no help from a mainsheet. The loosefooted mainsail is stretched along the boom with an outhaul and even when the boom is let out the mainsail retains a good shape. This system has similarities to a sailboard, where the sail is sheeted without using a mainsheet or traveller. On 'Route 66' the sheeting angle of the sail is controlled by a line running to the windward side. A fully battened mainsail is used and a single line reefing system; the same line controls the tack and clew of the mainsail. This makes reefing simple and easy to control even when running downwind. (see illustration)

The philosophy behind 'Route 66' and the new long-distance cruisers is that the boat should be simple to sail, safe and fast. Managing a sailboat should be enjoyable and possible for any family member.

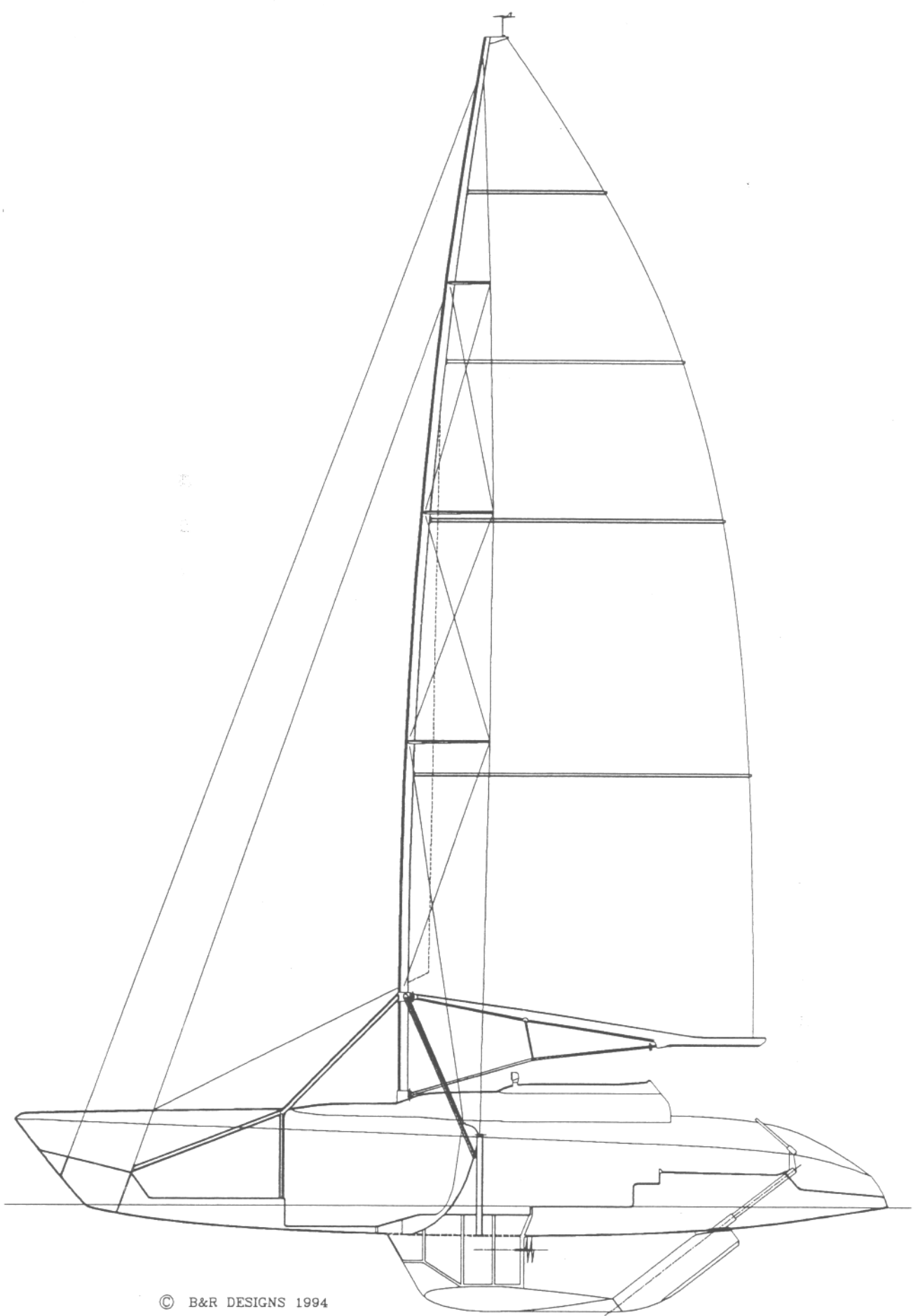
The cockpit of 'Route 66' is equipped with hydraulic and mechanical winches. All the lines lead aft to the cockpit area.

At present the possibility of using an electrical motor for auxiliary power is being investigated. A diesel generator will be used to charge the batteries and run the water maker. The fuel is used as tackable ballast.

The interior of 'Route 66' is laid out for comfort and good visibility. There is a fully equipped forward facing navigation/steering station and wrap around windows. The decor is simple and clean, all parts made from foam-cored fiberglass with a white gloss finish. Using the tripod mast support system allows the windows to be large as the loads on the deck are reduced and the mast base is eliminated from the interior.

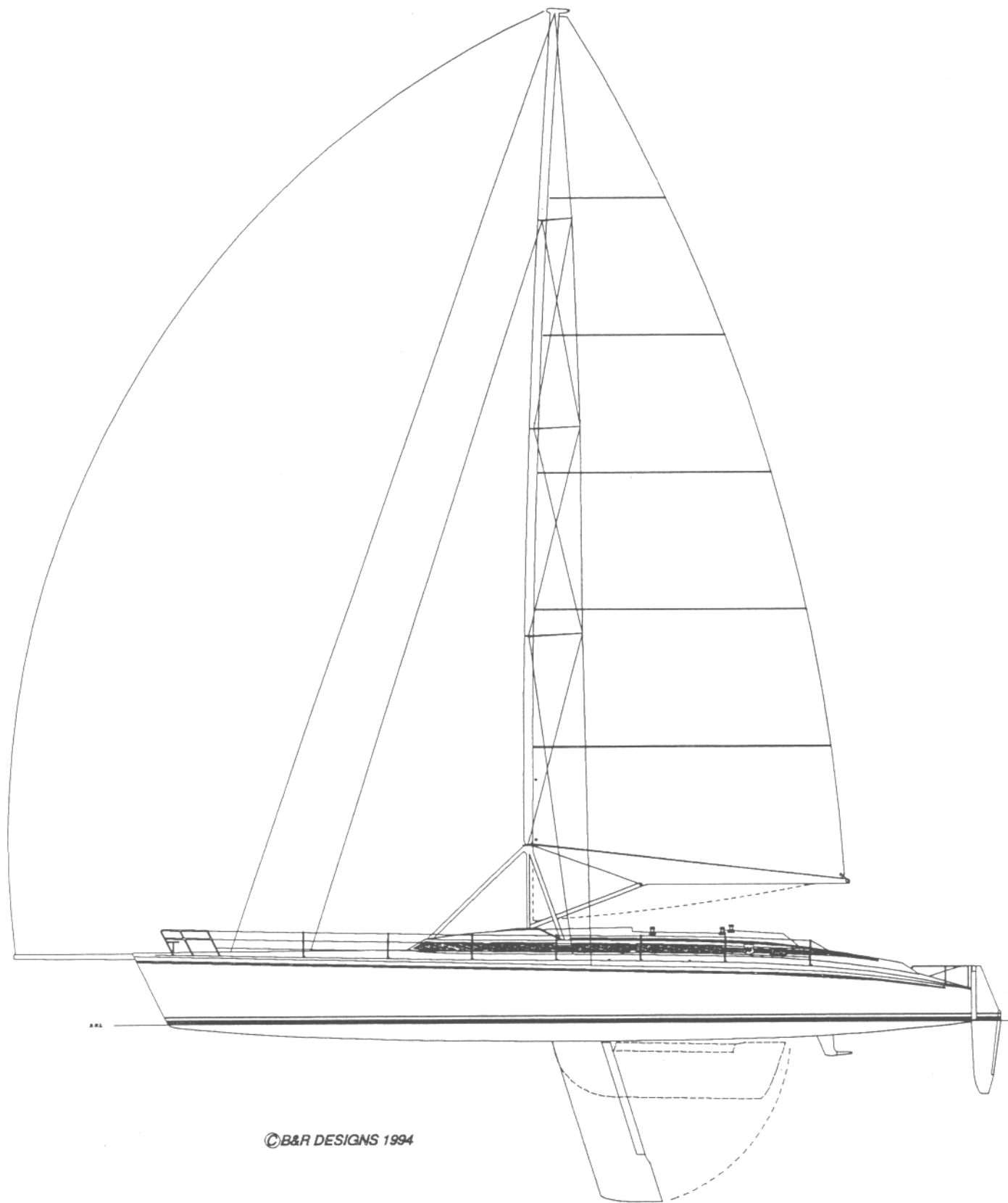
Sheeting points for the foresails are led aft to the rear part of the cockpit and this gives a good shape to the sails for more open winds. For upwind sailing there is a line over a block on the mast at the top of the tripod. This line controls the angle of attack for the foresail and is operated from the cockpit. The line flips over when tacking. No tracks are used on the deck for sail handling.

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