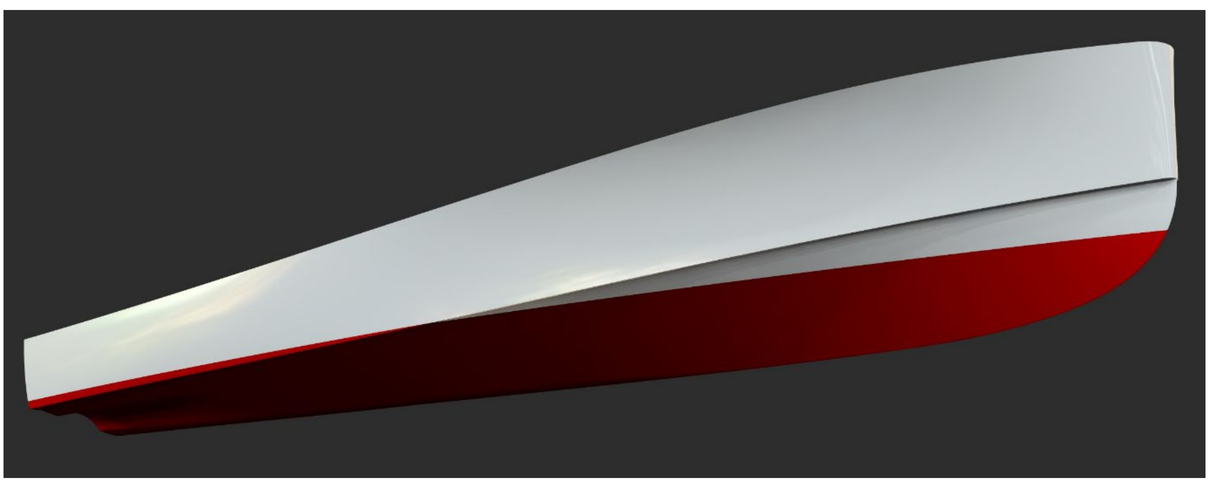
RAY HUNT DESIGN HIGH-EFFICIENCY V HULL

There is a growing market for yachts operating beyond displacement speeds (Speed/Length = 1.34), but not completely into the planing speed region. Owners are requesting speeds that wind up in the awkward Speed-Length Ratio region of 1.5 – 2.0. Full planing is typically defined by S/L = 3.0 or greater. As an example, a 100 ft. WL yacht will have theoretical maximum displacement speed of 13.5 knots. At 16 it is operating at S/L = 1.6 and seeing high resistance. At 20 kts. the 100 ftr. is trying to get on plane. A displacement type hull cannot cope with these speeds. A different hull is needed.

STATE OF THE ART:

Several builders are promoting what are essentially modified traditional displacement hulls characterized by round bilges, sharp bows and flat sterns. Various skegs, bilge keels, bulbous bows and other appendages are added to enable the displacement hull to break the hull-speed barrier and to improve handling and stability at higher speeds. We think these modified displacement hulls have a lot of drawbacks. In particular a hull with a sharp-bow, round-bilges combined with a flat stern is not a very stable shape statically or dynamically. These designs employ bilge keels and fin stabilizers to compensate. They will roll outward in a high-speed turn and have poor directional control in following seas due to flat sections aft in combination with ultra-sharp bows. This handling may be aggravated by a bulbous bow that will plunge in and out of even moderate seas, and so is only partially effective in bow wave mitigation and resistance reduction. And of course, these add-ons are complicated and expensive to build.



Balanced V Hull:

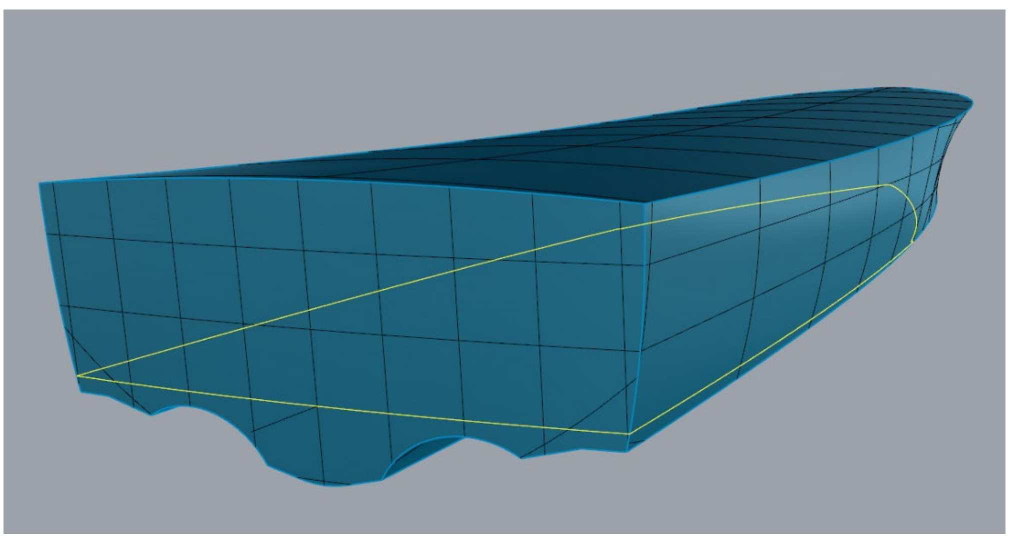
We advocate a balanced hard chine V hull. By balanced we mean a hull with some dead rise throughout its length. Substantial dead rise forward combined with narrow waterlines creates a fine entry for low wave making resistance and low impact accelerations. This is balanced by moderate dead rise aft, thus distributing displacement more evenly along the hull, and moving the centers of buoyancy and effort aft towards amidships or just aft of amidships. This builds in good directional control.

Improved Stability:

Importantly, dead rise enhances stability. As the boat rolls, the V hull gradually puts more volume into the water creating a stronger righting force. As speed increases and lift develops under the bottom, this force acting normal to the hull bottom has a righting effect due to the dihedral angle of the V hull. On a flat-bottomed hull, the force will act normal to the bottom also, and therefore parallel to whatever angle of heel the boat is in. So, unless the boat has zero heel angle the planing force adds to the heeling of a flat-bottomed boat.

Furthermore, the full-length hard chine resists rolling better than smaller shorter bilge keels without any of the added drag of an underwater appendage. At speed the chine flat adds a dynamic lifting force at maximum waterline beam where it can most effectively augment transverse stability.

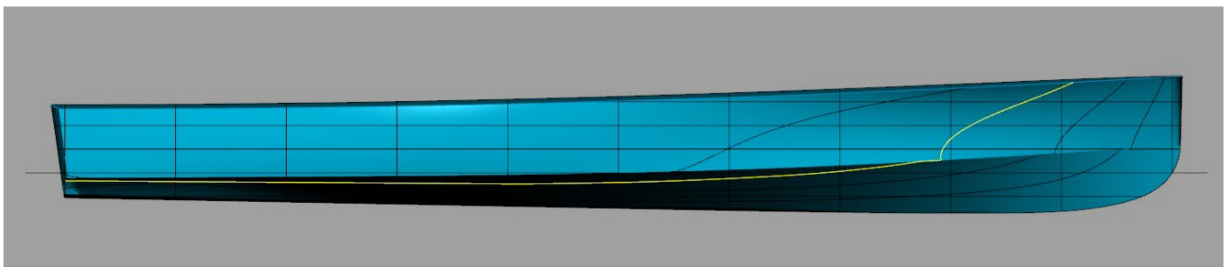
The full-length dead rise also ensures the boat will heel into a turn at speed, a much safer and more comfortable attitude for crew and guests. This most desirable behavior alone is sufficient reason to opt for a V hull.



Reduced Resistance and Improved Efficiency:

Another benefit of the hard chine hull is that water is peeled off the hull by the chine. Wetted surface drag is reduced, the bow wave is diminished, and the boat is drier.

Another factor in resistance at lower planing and semi planing speeds is running angle. As a boat approaches planing and the hull tries to climb the bow wave, running angle increases as the planing force begins to lift the hull. Resistance spikes. There is general agreement that a low running angle has lower resistance at low-planing and semi-planing speeds, so it is important to shape the hull to achieve lower running trim. Also, the inclusion of trim control via trim tabs or interceptors allows trim to be optimized for a range of speeds and sea states. In addition, the lift contribution from these devices further reduces resistance.



Bottom Loading:

Bottom loading is a concept we widely apply in our faster planing hull designs, and it is very applicable to the semi-planing region also. The concept is quite simple. It is merely a measure of the load to be supported by the planing hull area. It is very analogous to wing loading in aircraft design. The design challenge is to match the hull to the anticipated load. We have trial data from hundreds of designs and tailor each of our new hull designs to match the load. High bottom loading means higher power requirements, more wetted surface, a wetter ride and higher running angles. On the other hand, low bottom loading allows a boat to plane sooner, at lower speed and lower running angles with less power and fuel consumption while running drier. We would tailor a new hull carefully to match the anticipated weight to achieve maximum efficiency.

Propulsion:

For speeds in the semi-planing region, conventional propellers offer the best propulsion solution for larger yachts. Properly designed propeller tunnels are beneficial for a few reasons. They allow a lower shaft angle, less draft with larger more efficient propellers, and less transom immersion for reduced resistance at displacement speeds. Finally, to optimize performance and efficiency at all speeds, a controllable pitch propeller system might be a desirable option.

LOWER COST:

A hard chine hull is a simpler and less expensive shape to build than a round bilged hull, and it also does not need the various complicated and expensive add-on appendages. The argument of round bilged hull advocates is lower resistance at displacement speeds, and while that may be the case, the increase in low speed resistance due to the hard chine is relatively small while the overall seakeeping and efficiency benefits over the operating range are considerable.