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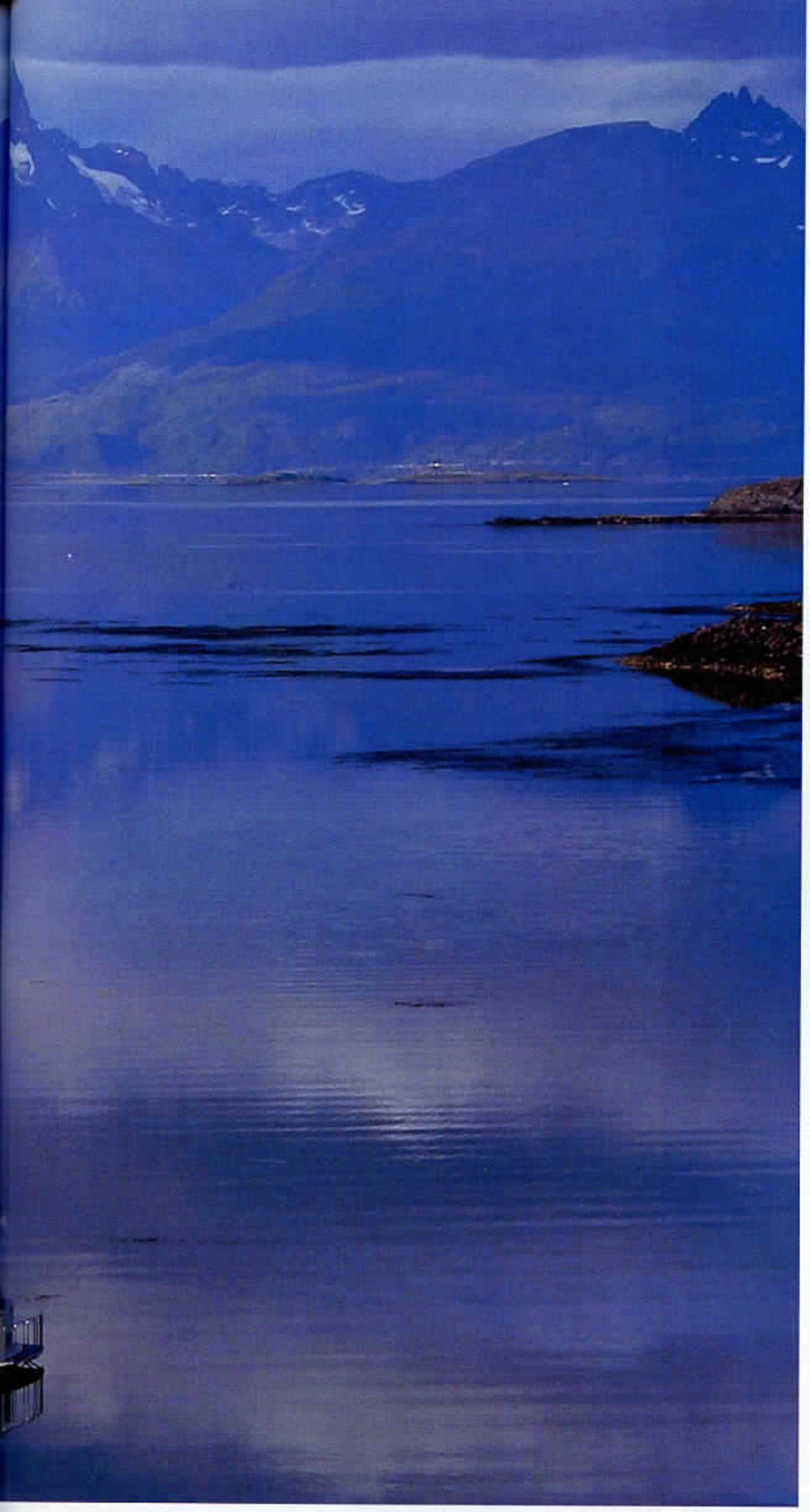
Beyond Expectations

Long-distance cruising yachts are evolving with faster forms to fit new functions

With the proliferation of yachts that combine long distance capability with volume and various other usage subtexts, many terms are creeping into the nomenclature: explorer, expedition, semi-displacement trawler, etc. At the end of the day, most of those words are more about marketing than design.

By Marilyn Mower

Known for long-distance passagemaking, with a deep, rounded hull form, the Nordhavn 57 Ice Dancer chills out in Argentina after rounding Cape Horn. While round bilge boats have long been respected for their impressive passagemaking capabilities, cruisers craving more speed can now find long range capability in some semi-displacement hull forms.



It used to be that all trawlers were slow, round bottomed and single screw, owing to their origins as fishing vessels. Some of the masters of this craft are Nordhavn (40' to 120') and Kadey-Krogen (39' to 58') whose vessels routinely cross oceans or make long passages. When trawler owners wanted more speed, the first answers were pairs of engines, then pairs of bigger engines, to allow lumbering displacement hulls to exceed the laws of physics.

Yacht designers and builders saw the change in cruising habits and began to explore new designs for different cruising styles. In so doing, they brought about the ongoing dialogue with the boating public that begins with the question: How and where do you want to cruise and how fast? Pinpointing the answer leads to, theoretically, a boat optimized for its intended purpose by being at the right point along the graph from displacement to planing and from round bilge to hard chine.

Conversely, some builders have been making changes to lower the cruising speed of their vessels. AGYG, importer of Outer Reef yachts, recently introduced power packages to deliver coastal cruisers fuel-miserly 9.5 gph at 10 to 12 knots.

When we asked David Marlow of Marlow Marine about the theory behind the development of his line of 53- to 86-foot Explorers, his response was an eloquent description of why long-distance cruising boats vary as they do. Some excerpts from his treatise about the development of planing trawlers help reveal the evolution of the genre.

"Normally, a displacement hull is restricted in its maximum speed by its overall length. Its speed is maximized when the boat sits between bow and stern waves, with no intervening self-caused waves along its length. While a slender, double-ended craft has very low hull resistance at slow speeds, it will show enormous drag and poor handling as it approaches its theoretical speed limit, generally accepted as 1.34 times the square root of the waterline. Its miserly fuel consumption at slow speeds will triple or more to reach hull speed.

"At the other end of the spectrum, nothing can outrun a perfectly flat-bottom boat. On the other hand, at low speed, that flat bottom will have high drag due to its box-like shape and additional wetted surface. As a practical matter, its ride is too punishing for ocean travel.

"Shooting for a yacht that can move well at both speeds, designers adapt the hydroplaning (semi-displacement) hull form that at low speeds acts as a displacement hull. As more power is applied, its special

A few well chosen words on bulbous bows

By Roger McAfee

Bulbous bows have been around at least since 1910 when one was fitted to the USS Delaware, a 20,000-ton Navy battleship. In Europe, during the 1920s and '30s, many of the famous liners from that golden age of transatlantic passenger ships incorporated a bulbous bow. France's Normandie, with her sophisticated hull design incorporating a bulbous bow, reached speeds in excess of 30 knots. Her great rival, Queen Mary, with her traditional hull, achieved the same speed, but she required almost 43 percent more power to do so.

In the 1950s, research on bow bulbs began in earnest and the designers found that oceangoing freighters incorporating bulbous bows had a five percent reduction in drag. This resulted in substantial fuel savings. During the 1980s, the advent of more powerful computers enabled computer modeling, which led to more focused research and experimentation on bulbs in test tanks. That research confirmed a well-designed bulb typically will result in a five percent reduction in drag. It also confirmed bulbs are useful only on continuous speed displacement hulls and are not particularly effective in vessels less than 45 feet and only at 60 feet and longer do the bulbs reach maximum effectiveness. Naval architects calculate that the drag reduction in a well-designed bulbous bow hull can lower fuel consumption by as much as 12 to 15 percent.

As research progressed, a couple of other features of a bulbous bow were confirmed in actual use. The first was a dampening of the pitching motion of a bulb-equipped vessel. This resulted from the extra buoyancy in the bulb as well as the increased vertical drag caused by the wetted surface area of the bulb itself.

The second feature noted was a slight increase in speed that was brought about because the bulb, in effect, extended the water line length of the displacement hull. A 60-footer with a three-foot bulb could see an increase of .27 knots.

Bulbous bows are sometimes used to rescue faulty hull design or outfitting that placed too much weight forward. Well-known builders have been known to rectify lack of buoyancy in the bow by addition of a simple bow bulb.

As research and applied experience grows, bulbs, which are still mostly cylindrical in shape, are changing to more oval, shovel or even triangular shapes, depending on what the owner wants the bow to do.

shape forces it to climb its own bow wave. When it reaches a speed where it overtakes the bow wave, the bow resumes its normal attitude and can leave its stern wave some distance behind. Beginning to plane is the nautical equivalent of an airplane breaking the sound barrier. Resistance at that point is greatly reduced, in the case of the vessel, because it no longer has to pull the stern wave with it.

"Near the center of the graph is the V-bottom craft. The bottom will typically be drawn with clean, straight lines and well-faired buttocks for minimum parasitic drag. If speed and economy are paramount, the design will generally favor flatter sections aft. For more well-rounded performance, buoyancy, with deeper sections that do not suffer from rapid deceleration upon impact with the sea would be desirable. I am firmly convinced there is a middle ground for high-performance cruising yachts, where the yacht will sacrifice some top speed, which is seldom used, for a substantial gain in fuel economy at speeds in both the displacement mode (0-11 knots) and the semi-displacement mode of 12 to 17 knots."

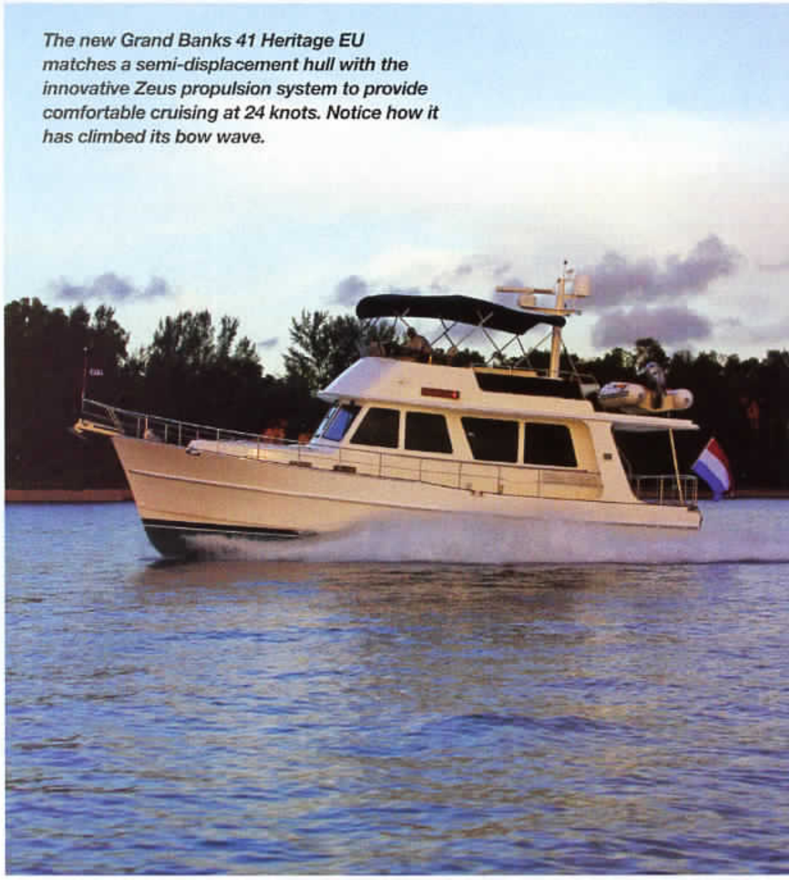
Marlow's hulls begin with a V and transition to flatter sections aft but with a combination of hard chines, smooth tunnels and twin strut keels to both enhance tracking and eliminate the Magnus effect drag of exposed shafts.

"On a recent offshore passage we had the opportunity to stretch the legs of our design, *Rebel Yell*, a 72ELR Command Bridge yacht powered by two 1,015 horsepower C-18

Marlow's Rebel Yell *features a hybrid wave piercer bulb that helps calm vertical acceleration while it begins deflecting oncoming water.*

For long-range cruisers, the thrill is in both the journey and the destination. Marlow's 72ELR Rebel Yell *at anchor, after voyaging as far as 300 nm offshore in winds up to 46 knots.*

Bulbous bows come in various theories such as on this Hood 86, pictured at top. Breaking the wave and dampening verticle acceleration are two of the jobs of a bulbous bow shown in action on this Nordhavn above.



The new Grand Banks 41 Heritage EU matches a semi-displacement hull with the innovative Zeus propulsion system to provide comfortable cruising at 24 knots. Notice how it has climbed its bow wave.

Caterpillars," David says. "Her wide-open speed is 21 knots loaded with 3,400 gallons of fuel and 500 gallons of water. At Caterpillar's recommended engine load she produces between 18 and 19 knots cruise. Setting out from Tampa Bay we carefully set the engines to a speed that would produce one pound of turbocharger boost and give us a speed of just over nine knots. In 169 hours, we dropped the hook in Nantucket Harbor averaging a bit over ten knots for that leg, courtesy of a favorable Gulf Stream on the lower one half of the trip. Our fuel tanks still contained nearly 1,600 gallons of fuel, proving I have the ability to run over 3,200 miles."

In refining his hull theory, David also investigated wave piercing, where a much smaller surface area makes the initial point of impact by the hull on a wave. "This allows the yacht to respond to the oncoming wave a bit sooner. At the same time, the wave is shaped more gently to meet the wider portions of the hull as it proceeds aft. In real time testing, though we were never able to verify any speed increase by the installation of a common bulbous bow, the waver piercer produced verifiable improvements and reduced pitching with gentler acceleration-deceleration in waves." The modified piercing delta bulb fitted on *Rebel Yell* is pictured on the preceeding page.