Design Brief

MOLOKA'I STRAIT MARINE

Modeled and Tweaked

A Moloka'i Strait motoryacht is steel (hull only), round bilged, expedition style, and series built. As a bonus, the quintessential design also lends itself to enlargement.

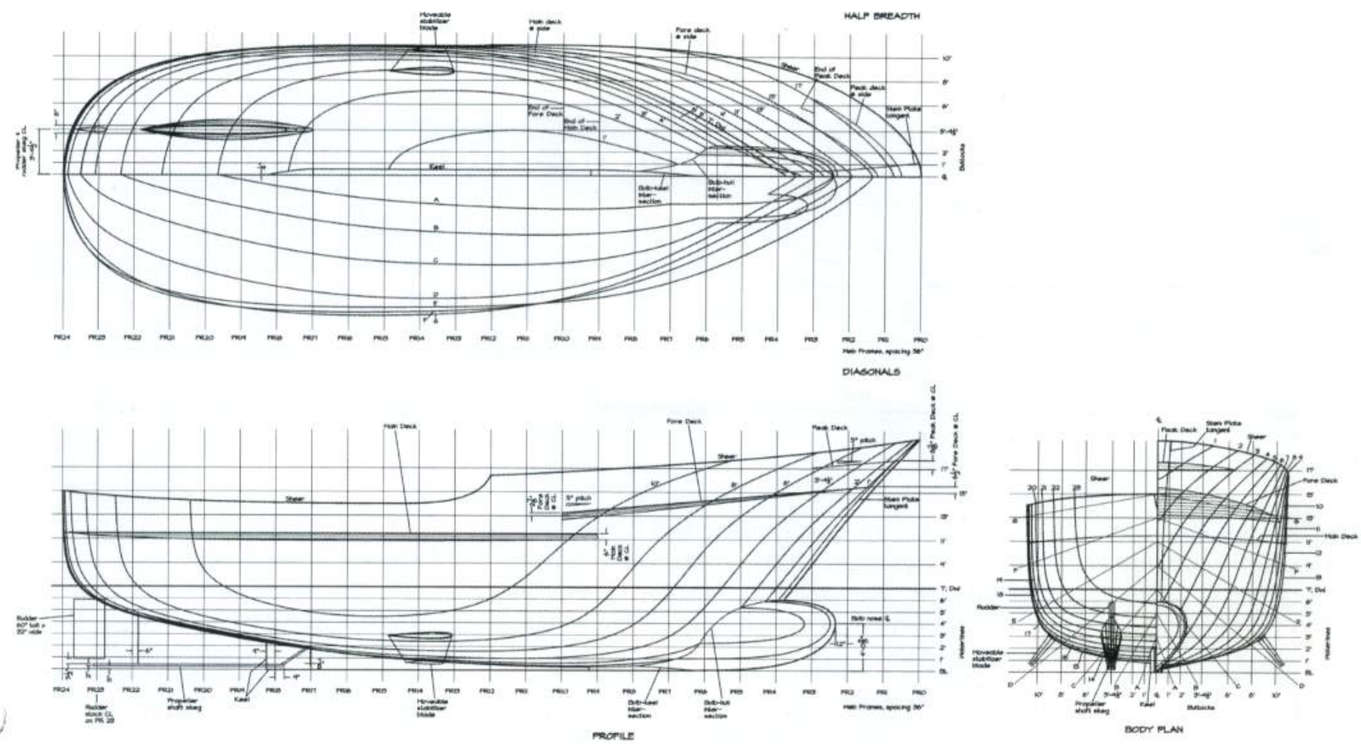
by Eric Sponberg

***Above**—Hercules is the 75' (22.9m) model of the Moloka'i Strait line of long-range motoryachts, designed by the author.*

The Moloka'i Strait concept is the brainchild of Geoffrey White, a former owner of Hans Christian Yachts in Taiwan. Traveling nearly every month for years between Annapolis, Maryland, and Asia brought him through the Hawaiian Islands, known for their boisterous waters—especially around the island of Moloka'i.

To Geoff White, an offshore-capable motoryacht built of steel that can get to and through the waters off Moloka'i would be just the ticket for a proper semi-production passagemaker. The brand name for the boats he envisioned? *Moloka'i Strait.* There is, by the way, no actual strait with that name.

Here's some further background. White had previously partnered with Lee Cherubini to build a composite trawler yacht called the Independence Cherubini 45, the molds for which White retained from Hans Christian Yachts. *[See* Professional BoatBuilder *No. 112 for a full account of the Cherubini boatbuilding clan—Ed.]* White and Cherubini hired me to lengthen their 45-footer (13.7m) to 50' (15.2m), and a number of those boats were sold. White then told me about his vision for a Moloka'i Strait series of motoryachts, and in January of 2000, we started a preliminary design for a 60-footer (18.3m) that evolved into the Moloka'i Strait 65 (19.8m), of which two were built.



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We did preliminary designs for other models as well: the two-deck MS 58 (17.7m), its three-deck MS 60 sistership, and the MS 85 (25.9m). We found a customer for an MS 72 (22m), and that model later became the MS 75 (22.9m). The first 75, christened *Hercules*, is owned by Jeff Druek, managing director of Moloka'i Strait Marine.

All the MS motoryachts are round-bottom steel-hull designs with rounded sterns reminiscent of so-called Romsdahl (Norway) trawlers—vessels noted for their seaworthiness in the North Sea. MS superstructures are aluminum.

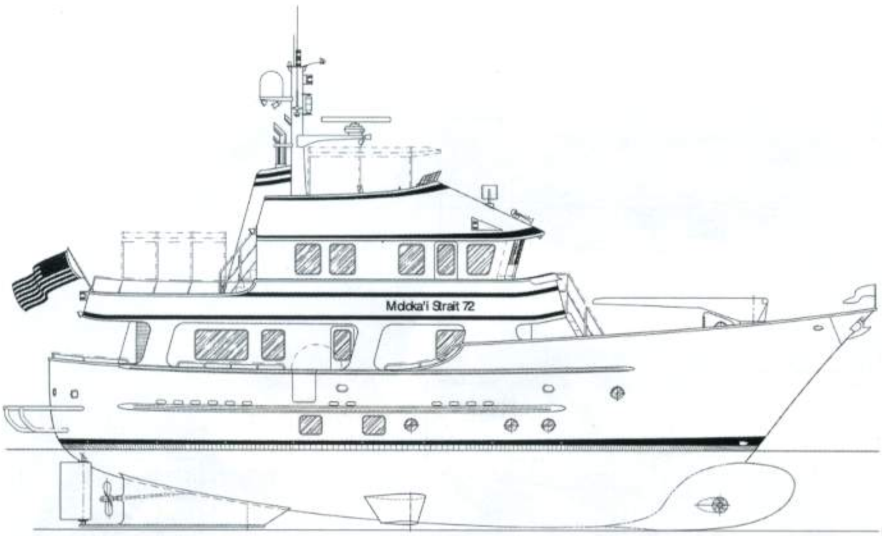
Moloka'i Strait motoryachts also have bulbous bows. To make sure we got the shape of the bulb right, we went to a towing tank for a comprehensive resistance analysis, testing the MS 65 with and without a bulb.

About the Bulbous Bow

Bulb design is tricky. The only way to determine a bulb's correct size and shape is to conduct model tests. A bulbous bow creates a second bow wave that is directly out of phase with the normal bow wave. The two cancel each other out, hopefully with little to no bow wave remaining. This of course reduces resistance, and that fact translates into less installed horsepower, or faster speed. The absolute best resistance reduction that you can expect is 12%–15% for a well-optimized bulbous bow design, but this usually works only at a narrow range of speeds. The norm is probably 6%–10% resistance reduction.

The primary determinants of bulb design are: its cross-sectional area longitudinally and transversely; the

Top—*The lines of the Moloka'i Strait series (here, a 72'/22m) were inspired, in part, by Norway's round-sterned Romsdahl offshore fishing trawlers, but with relatively large volume to accommodate modern amenities and lifestyles.* ***Above***—Atlantic Ranger, *65' (19.8m) LOA, was the first Moloka'i Strait motoryacht built. Whereas* Atlantic Ranger *is a single-screw design,* Hercules *is twin-screw. (Customers tend to like the reliability and built-in redundancy of two shafts and props.)*



The original sheer on Hercules *(and the MS 72, shown above) had the break placed farther aft than in the early drawings of the Moloka'i Strait 65. Shortly after construction began on* Hercules*, the sheer break was returned to the more forward position, and this sheerline has become a trademark of the MS series.*

length, breadth, and depth of the bulb; and its location in proximity to the waterline. If you don't get it just right, the bulb can actually *increase* resistance. In 2001, we tested an MS 65 model in the Institute for Marine Dynamics' tank at the Memorial University of Newfoundland, through Oceanic Consulting, the commercial arm of IMD. The result? Thanks to the bulb design, we achieved about a 6% reduction in resistance on the basic MS 65 hull.

The other important purpose of a bulb is its effect on pitching motion. MS motoryachts have a nabla-style bulb, so named because the transverse sectional shape of the bulb resembles the symbol nabla, ∇, from the Greek name for a Hebrew harp, which has a shape similar to an inverted delta. As the bow pitches down in a seaway, the V-shaped bottom cleaves through the waves, lessening the shock of impact. On the upward return motion, the broad top of the bulb has much more drag, and the boat pitches up more slowly than when it pitches down. This difference in pitching speed between the upward and downward motions is called the damping effect. The greater the damping effect, the more quickly the pitching motion disappears, and the more comfortable is the ride. In the real world, this works really well.

During the preliminary design phase for the Moloka'i series, we examined the bulbous bows on similar expedition-style motoryachts. Most were simply round barrel shapes with spherical caps stuck indiscriminately onto yacht stems, sometimes accompanied by grandiose claims of 20%–25% resistance reduction. Since then, such hype has toned down, claims of resistance reduction appear to be more realistic, and I am seeing nabla-style bulbs cropping up more often.

Model Testing

The major benefits of model testing are the data you acquire; in our case, it was for power prediction and accurate propeller specifications. With the MS 65 project, I programmed the model test data—resistance coefficients, to be specific—into NavCad, which I consider to be the premier speed/power/propeller software. The program gave me full-scale predictions on power requirements, and matched the propeller characteristics to the hull and engine. This is not second-guessing; to the contrary, it's spot-on accurate.

With the MS 65, we discovered that we would need the higher-rated version of the 3406C Caterpillar diesel; instead of 400 hp (300 kW) at 1,800 rpm, we went for 440 hp (330 kW) at 2,100 rpm. The propeller spec'd out at 38″ (97cm) diameter by 24″ (61cm) pitch. During sea trials, the MS 65 met her predicted speed of a little over 10 knots at full power. A perfect match.

Most useful about the MS 65 model test data is that the data are scalable to a larger version of this hull, the MS 75, since these are geometrically similar hullforms. With full-scale MS 75 dimensions and new engine-power curves—here, twin Cummins 350C diesel engines at 350 hp (263 kW) at 2,500 rpm—we came up with propeller specs of 35″ D x 21″ P (89cm x 53cm). Again, we achieved our spot-on speed prediction with that power

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Left—Hercules*, finished out by St. Augustine (Florida) Marine, is shown here in primer. Note the nabla-style bulbous bow.* ***Above***—*Model testing at Oceanic Consulting and the Institute for Marine Dynamics, in Newfoundland, was one of the most worthwhile and important exercises in the design process. It clearly defined the resistance characteristics of the Moloka'i Strait hullform, which translated directly to the MS 75* Hercules.