Performance Cruising Parameters

by - Rodney S. Johnstone

What is a performance-cruising sailboat? Positive responses to each of the following questions define the answer.

1. Is the boat seakindly - does it have an easy motion in a seaway?
2. Can one person or a couple handle the boat and achieve good performance without the weight of a lot of crew on the rail?
3. Does the boat perform well enough so that its crew will prefer to sail rather than power or motorsail?

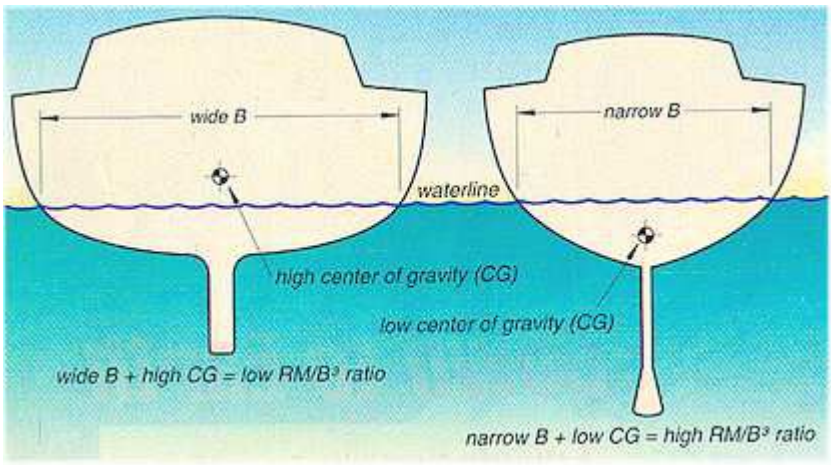
In my admittedly subjective view, for my wife Lucia, and me, sailing aboard Pipe Dream IX on the three-day Ecuador-to-Galapagos leg of the EXPO ’98 Round-the-World Rally, the answers to the above were in the affirmative. Lucia and I were together on watches, 3,000-square-foot spinnaker and all, and off-watch we slept in comfort in the double berth in the forward owner’s stateroom, air-conditioning and all. Pipe Dream, loaded with necessities and spares to last to Australia and beyond, crossed the finish line second in the seven-boat non-motoring division, corrected out to third, and won the American section of the cruising division , which allows powering with a time penalty. Sailing upwind in the prevailing light air, most of the boats in the rally had to crank up their diesels to keep up with us.

When considering any performance-cruising boat, it’s worth asking two questions: Will I feel safe and comfortable going to sea in this boat? Am I going to have fun sailing this boat in the cruising mode? Speed is desirable when cruising, simply because going from point A to B under sail is what it’s all about. If you tack up a shoreline at the same speed as those plodding under "iron geona" into the wind, waves, and current offshore, then you have a performance cruiser. If you enjoy the serenity of broad-reaching down the coast at nearly the same speed as boats that are motorsailing, then you are on a performance cruiser. But if you have to crank up the engine, even when there is breeze, to make a decent day’s run, you are on a slow powerboat that happens to have sails-in my opinion.

Where does performance come from? Length is most important. Average speed in knots for the typical sailboat is roughly equivalent to the square root of its waterline length. Hence a boat with a 36-foot waterline length should sail at about 6 knots under "cruising canvas"; a performance-cruiser should be able to exceed this pace in all but very light winds.

True performance-cruisers most often have fin keels and spade rudders. This underbody configuration provides many performance advantages, including less wetted surface (and thus reduced drag), greater efficiency sailing to windward (in the form of better pointing), and greater steering control and maneuverability. Reduced drag means the boat does not need as much sail or as large a rig to achieve speed under sail, and upwind efficiency means faster passages.

Traditional heavy-displacement cruisers with full-length keels can overcome their speed disadvantage only with a much larger sailplan. More sail requires heavier deck hardware for the higher rig loads and more hands on deck in heavy weather-just what cruisers don't want. A sailplan that can be handled by one or two people in any condition is crucial not only to passagemaking performance but to crew comfort-otherwise sailing can become an unwanted chore. On most performance-cruising boats under 60 feet in length, a sail area-to-displacement ratio of 16 to 22 can usually provide the required power and an easy to handle sailplan.



A cruising sailboat's performance also depends on stability, or "stiffness"-the ability of the boat to resist the heeling force of the sails. Good all-around speed is possible only if the boat is stiff; a stiff boat can carry more sail and heel less in a breeze than a tender boat. Stiffness can be achieved through a wide beam at the waterline or through a low vertical center of gravity (VCG). If stiffness comes from a wide waterline beam, the boat's motion tends to be bouncy and abrupt in waves; as soon as this type of boat heels, it usually exhibits excessive weather helm and may be difficult to steer. Because such a boat tends to have a high center of gravity, good speed can be achieved only by placing crew weight or movable ballast, such as water, to windward to reduce heel.

The most important characteristic of a performance cruiser is that its stiffness be derived from a low center of gravity. This is indicated by a simple ratio of righting moment (RM) at 1 degree of heel to the cube of the greatest beam at the waterline (B). The RM/B^3 ratio indicates whether the boat derives its stability more from its low VCG (RM) or from its large beam, or waterplane inertia (B^3). The greater the number yielded by this ratio, the greater the stability, seakindliness, sail-carrying ability, and potential performance of the boat. Boats with a high RM/B^3 tend to be longer, narrower, and faster than boats with a lower RM/B^3. Based on a sample of 219 different IMS-rated cruising boats in the United States from 22 to 81 feet in length, the median value of RB/B^3 for the

stiffest 50 boats is 1.7. The median value of RM/B^3 for the most tender 50 boat is .89. The average length/beam (LWL/B) ratio for the top group is 3.82, and only 2.96 for the bottom group.

A high or low rating on this index is independent of a boat's displacement/length (D/L) ratio. The 50 boats highest on the RM/B^3 scale have a D/L ratio ranging from 55 (light) to 339 (heavy). (In modern terms, a D/L ratio of less than 180 is light, 180-280 is moderate, and above 280 is heavy.) Thus, 16 of the top 50 boats on the RB/B^3 scale are heavy, 16 are moderate, and 18 are light. At the bottom of the scale half of the bottom 50 are heavy, 19 are moderate, and only 6 are light.

The preponderance of heavy-displacement boats at the low end of the scale reflects a modern trend in cruising sailboats toward increased accommodations and decreased ballast/displacement ratios-a trend that has raised the height of the center of gravity of this type of boat. Forty-two of the 50 stiffest boats on the RM/B^3 scale, (but only 22 of the less-stiff boats), have sail area-to-displacement ratios of over 16-what I consider to be a minimum for performance cruising speed under sail.

Finally, the RM/B^3 ratio is an excellent predictor of "big-boat feel" and motion in any size boat- the quality is just harder to achieve in a smaller lighter boat. Whether light or heavy, a narrow boat with a low center of gravity will have a rock solid feel, an easy motion, and positive control-the unmistakable aura of power, stability, and passagemaking speed.

-Rodney S. Johnstone