BOATSPEED BY DAVID FLYNN

Code Zero—The New Way To Close Reach

LOOK OUT, HERE COMES THE LATEST BUZZword: Code Zero. The sailmaking industry has introduced yet another new product with a clever name and a must-have endorsement. Haven't bought one yet? If not, your hesitation is understandable; sailmakers have produced a host of forgettable products with equally forgettable monikers. Anybody remember the Frisbee Mainsail?

Although many versions of this colorful new breed of sail have drifted in and out of the limelight, the Code Zero, an asymmetric spinnaker designed to act like a large, loose-luffed genoa, could fill a void in your sail inventory that you didn't even know you had.

The beginning

During the 1998-99 Whitbread Race, Code Zero was coined to define what was basically an upwind asymmetric spinnaker, its shape and geometry born from the limitations imposed by a class rule. Although every team had their own version by the end of the race, Paul Cayard and the winning EF Language team first realized the sail's potential and get the lion's share of the credit for its development.

For many syndicates, the spinnaker designed for the tightest wind angles was designated as the Code 1 Reacher. Codes 2, 3, and 4 were used at progressively broader angles. Thus, Code Zero was the perfect name for a sail that could sail at closer angles than any spinnaker in the inventory.

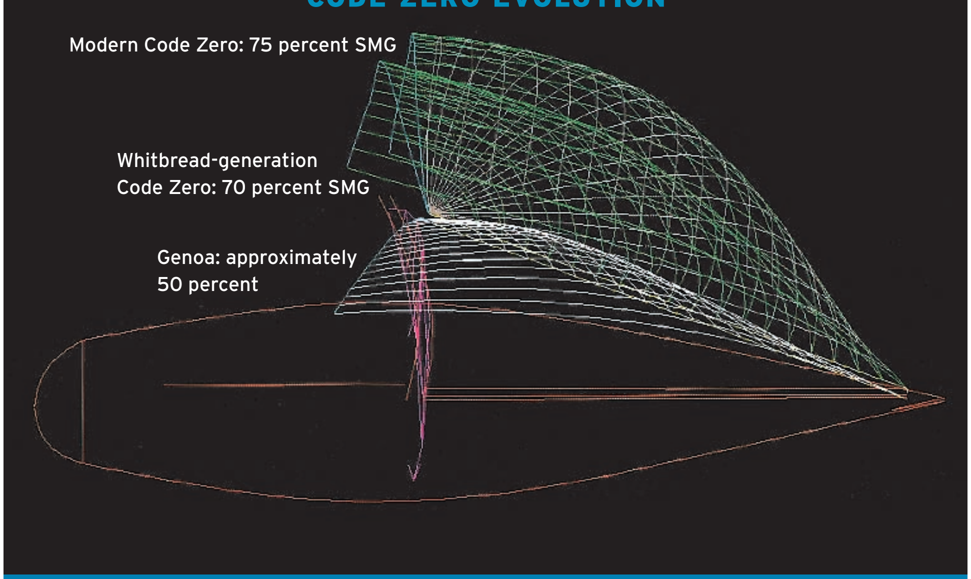
Whitbread rules didn't allow masthead genoas but permitted masthead asymmetric spinnakers. So, naturally, creative minds wondered if it was possible to make an asymmetric spinnaker that could sail upwind, or at least nearly upwind. Asymmetrics function well at relatively high angles. But could they be pushed further? The problem was that the spinnaker mid-girth (SMG), or the width of the sail at its mid-point, didn't meet the Whitbread rules, which stipulated the SMG could be no less than 70 percent of the foot length. A normal genoa, by comparison, typically has a mid-girth of 50 percent or less. The fundamental dilemma was that shaping was needed to support this extra area. The wider and larger a sail, the more overall camber it needs. Could a sail this big be made flat enough to sail at very close angles and still fly?

The first sails flapped and tended to carry large amounts of curl in the luff, but gradually the shapes were refined. A fully developed Code Zero could be used at 25 degrees apparent in 8 knots of wind. While unable to attain closehauled angles (a Volvo 60 can sail at 19 to 20 degrees apparent, depending on wind velocity), the sails were a vast improvement over a fractional jib in the same conditions.

There were other problems to overcome. Not only did the sail work like a genoa, but the loads were genoa-like as well. The sail challenged the strength of the entire rig. In addition, traditional nylon spinnaker materials were too elastic to allow the sail to remain flat, and it was necessary to use composites with high-modulus fibers like Spectra and Kevlar. That made the sails difficult to douse and hard to stow. Most of the time they ended up lashed to the deck. Specially developed furling systems eventually made them more practical, but they were difficult to furl evenly because of their extreme girth; often 90 percent of the sail would roll, and the remainder would be left hanging. Despite their problems, Code Zeros were so effective in the right conditions that, by the end of the last Whitbread, every syndicate carried them.

It makes perfect sense that the Volvo 60s were the birthplace of the Code Zero. With their fractional rigs and nonoverlapping headsails, they were somewhat underpowered sailing upwind in light air. But with water ballast, deep keels, and huge bulbs, Volvo 60s have tremendous stability, and are capable of handling the huge loads of the Code Zero.

CODE ZERO EVOLUTION



Development of powerful "upwind" asymmetrics has only been limited by rules on spinnaker mid-girth (SMG) measurements. In the last Whitbread, a 70-percent SMG was allowed. Under PHRF, IMS, and MORC, it's generally 75 percent, which requires a deeper, less close-winded sail.

COURTESY QUANTUM SAIL DESIGN GROUP

Back to the real world

Is there a Code Zero in your future? If you're planning to race with a sail that meets the definition of the original, check the rules. Currently, many handicap rules, including IMS, MORC, and PHRF require a minimum girth of 75 percent. The rule makers want to prevent the development of a sail that alters performance so much it becomes a necessity. It's nearly impossible to expect the close-windedness of a true Code Zero with a sail this big. This is not to say that a sail capable of performing at very close angles isn't possible. An asymmetric that can sail at close angles can be built within the 75-percent-minimum-girth limitation. Forty degrees apparent with an acceptable trade-off between power and drag is a reasonable expectation in light conditions. As velocity increases, so will the drag created by a sail this big, and at some point a jib (or a high-clewed specialty reaching jib) will be better.

If you're planning on doing a lot of distance racing, a close-reaching asymmetric—go ahead, call it a Code Zero—is a potent weapon. Between upwind headsail and spinnaker, there's no sail that has the same ability to supercharge your performance. In light air, this sail can make a significant impact on boatspeed.

A close-reaching asymmetric can also be used in heavy air when it would be tough to carry a symmetric spinnaker, or a bigger, fuller asymmetric. The extra weight required to make the sail stronger doesn't have much of an impact on light-air performance, since there's still plenty of apparent wind at these angles.

Handling a close reaching asymmetric is difficult. However, improved freestanding roller-furling and specially designed luff-rope systems have made it easier. There's still the issue of creating enough room in front of the headstay to tack the sail and fit the furling drum. It's also a good idea to make sure the mast can support this much sail, particularly if you're setting a masthead sail on a fractional rig.

Taming the Zero

For the most part, a close reaching asymmetric behaves like any other asymmetric. It's tacked to the bow or sprit, hoisted on a spinnaker halyard, and sheeted aft. Roller furling helps on sets and takedowns. If furling isn't used, it's smart to band the sail with yarn. Just like a freestanding staysail, a Code Zero wants to blow back into the rig as it's set. A crewmember needs to pull the sail forward and feed it as it's hoisted. In windier conditions, a quick bear-away will usually produce clean hoists.

The Code Zero jibes just like any asymmetric sail. If used on a sprit, the sail is jibed inside the tack. If it's set on the bow, it's jibed outside the tack. Start with the sail fully loaded and then bear away smoothly. Ease the sheet rapidly, so that the sail will blow far enough forward to clear the headstay.

To trim the Code Zero, ease the sail until it curls, and then trim in an inch. A fair amount of curl can be carried in most designs, and, as always, avoid overtrimming. When the sail is loaded, let the helmsperson drive to the sail instead of making the trimmer constantly work. The apparent wind strength builds and moves forward quickly, often faster than a trimmer can react, so the driver must help out.

The only non-standard trimming issue is luff tension. Two types of close-reaching asymmetric designs are possible: a straight or loaded luff, and a relaxed luff. Today's most successful Code Zero designs use a relaxed luff. Experience with other types of spinnakers (and intuition) would argue for getting the luff as tight as possible to minimize sag to leeward, but a relaxed luff allows material to project forward of the straight line between head and tack and flattens the entry, which maximizes pointing. If the luff rope is pulled too tight, the luff of the sail will become knuckled, creating a deep entry. If the entry is too open, ease the halyard. But don't get carried away.

Typically, the cloth tension along the luff is adjusted separately, and the normal rule applies: Tension the fabric just enough to remove horizontal wrinkles. Make sure the cloth is not over-tensioned; the primary loads should be on the rope, not the cloth.

It doesn't cost zero

It's important to carefully consider the decision about whether to buy a Code Zero. Can your mast handle the extra load? Is it legal in your fleet or class? Do you sail often in distance races? A large sail made of high-modulus fibers can be an expensive proposition. However, the benefits at the finish line may well make it a worthwhile purchase.

David Flynn, a sailmaker with the Quantum Sail Design Group in Annapolis, Md., helped the Quantum design team develop and implement the first U.S.-based wind tunnel testing program for off-wind sails. The program was conducted at the University of Maryland's Glenn L. Martin Wind Tunnel, which has been instrumental in the development of the Code Zero.