

FAST

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Optimist Team Blue Two-Boat Sail Test

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Miami, Florida

Report by Garth Reynolds

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One Design

INTRODUCTION

North Sails Optimist expert Brian Bissell and sail designer Garth Reynolds ran a Team BLUE Two-Boat Sail Test for several days in Miami, Florida. Christopher and Duncan Williford fresh off of a two-week long training session in Argentina skippered the Optimists during the testing. Christopher and Duncan just finished 1st and 2nd respectively (of 130 boats) at Semana de Mar del Plata in Argentina. The twins combined to win 5 of the 8 race series. We couldn't ask for a better pair of sail testers; not only are they two evenly matched sailors, they have the same DNA!

Watch brief video of the sail testing at:
www.youtube.com/watch?v=6ObGYbxl3rc



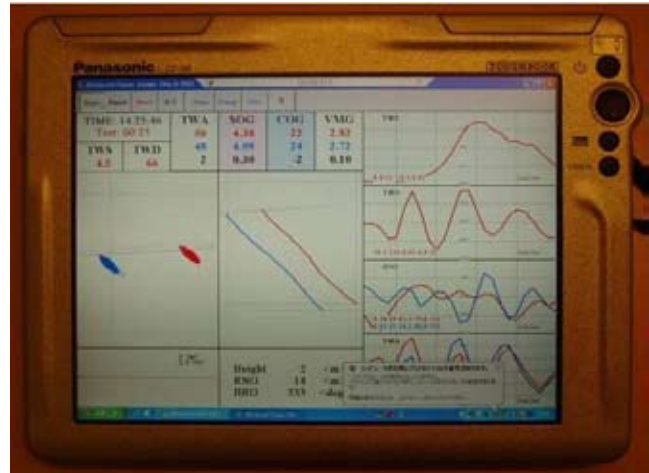
The sail test was conducted on Biscayne Bay using the [North Two-Boat Testing System \(N2BTS\)](#), along with our brand new North Cross Cut. The Two-Boat test system utilizes Global Positioning System to track each Opti's velocity (boat speed and heading). We also used an onboard camera system to photograph the sail while testing. The Optimist skipper has his hands full with driving, trimming, and bailing; so there is no way be able to take good sail shape photos too! The cameras were mounted on the sole of the Opti next to the dagger board trunk aimed up at the sail. The photos are taken ONE-PER-SECOND on board each Optimist and sent to the designer's computer on board the chase boat. The Wi-Fi signal for the photos also allows Brian and Garth to view the Opti's speed and track through the water during the testing. This is similar technology known as "Virtual Eye" shown in the recent America's Cup matchup of the super-multi hulls. Wind instruments are mounted on the chase boat so that we always know the wind speed and direction during the testing as well. Here is a photo of one of our many upwind lineups. Garth would follow closely in the motor boat aft of Duncan and Christopher. You can see the wind instruments atop the mast in the back of the motorboat.



The N2BTS allows us to see Duncan and Christopher's tracks on a wireless (and waterproof!) monitor on board the chase boat. We can see, in REAL-TIME which boat is gaining, the wind-speed and direction, and if the gains are due to a wind shift. You can see a photo of the head's up display below, to the right.



Camera (white box) at the bottom of the boat. The position of the two cameras were the same.



Wireless/waterproof monitor on board of the chase boat

OPTIMIST CALIBRATION

Before hitting the water, we calibrated both sets of MKIV spars used by Duncan and Christopher. We would be changing rig set-up during the test, and we needed a simple way to know where the rake, outhaul and sprits were set while sailing; and we wanted to be able to repeat fast rig settings easily. This is a common procedure used in many other One Design racing boats and was vital for us to know exactly where to set up from day to day. Duncan and Christopher have such a great feel for the boat; they always gave us feedback on what they liked or didn't like about each setting.

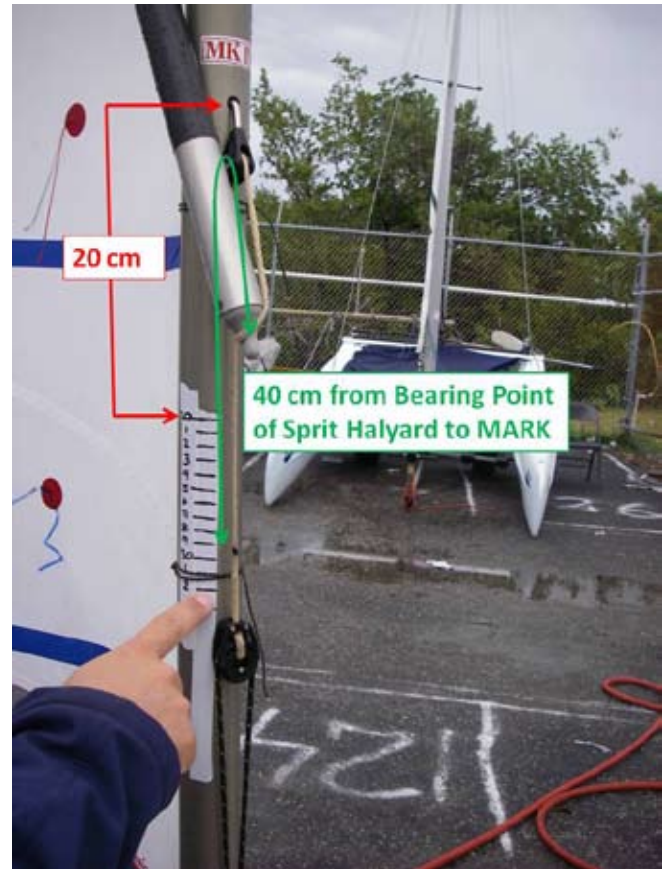
We used the Opti Parts sticker on the MKIV boom to know exactly where the outhaul was set for each test run. We also documented the rake for each boat, as well as for sprit halyard tension. The outhaul setting shown below would be at "3".



For sprit halyard tension we used a scale on the mast to measure how tight the sprit halyard is pulled. Duncan and Christopher have a very good feel for how tight the sprit should be in each wind and wave condition. This new calibration method will help you find your favorite settings easily!

Sprit halyard calibration will let you know exactly where your sprit is set, so that you can tighten it accurately as you round the leeward gate every time. Setup is easy.

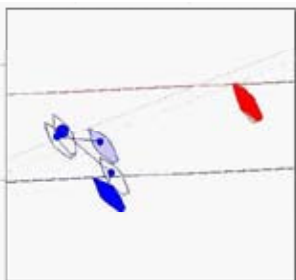
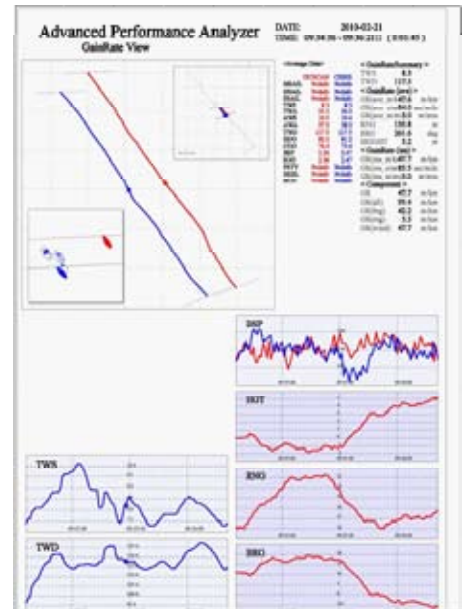
1. We use a mark on the primary part of the sprit halyard (the 'primary' part is the vectran line that attached to the sprit). Use a sharpie marker to make a mark on the vectran line 40cm from the bearing point where the halyard fits onto the sprit. This mark will move up (as you ease the sprit) or down the mast (as you tighten the sprit).
2. We put a metric (cm) scale on the masts (MKIV). The first mark is located 20cm down from the halyard hook hole. This mark is noted as "20". From there, make marks 1cm apart straight down the mast. We made marks down to 33cm from the halyard hook hole.
3. Now, when you tension the sprit, you can see where your mark on the halyard lines us to the scale on the mast!



TESTING PROCEDURE

Our sail testing consisted of lots of upwind and downwind sailing. We had 4-22 knots, ranging from flat water to steep chop. North Sails Japan has developed some really fast radial sails in the new P4 and P5, so we were concentrating on testing our newly developed North Cross Cut sail. Christopher was our "rabbit" for the testing. He was instructed to go as fast as possible in his regular gear so that we could gauge the new North Cross Cut against a very, very fast Christopher. Duncan definitely had his work cut out for him using a brand new sail that no one had ever sailed! If one boat seemed to gain more often in a particular condition, we would have Duncan and Christopher switch boats to determine how their individual sailing technique could be resulting in better performance.

The N2BTS could show exactly which sail was faster, which sail was pointing higher, and which sail was gaining VMG! The N2BTS cameras captured the flying shape of each sail all day during the testing. After sailing we could look at all of our tests and determine which sail performed the best at each condition and rig setting. Then we could analyze the flying shapes to see how the sails flew at the times when they performed the absolute best. From there, we can develop a precise tuning guide for each of our sails! This is a system never before seen in the Optimist class.



Here is an example of one analyzed test run. There is lots of information, but the important stuff is to see the boats tracks and speeds, as well as who gained in VMG. For the testing, Duncan was always the **RED BOAT**, and Christopher was always the **BLUE BOAT**.

This "relative view" shows how CHRISTOPHER changed position relative to DUNCAN. DUNCAN gains 5m of VMG for this test run.

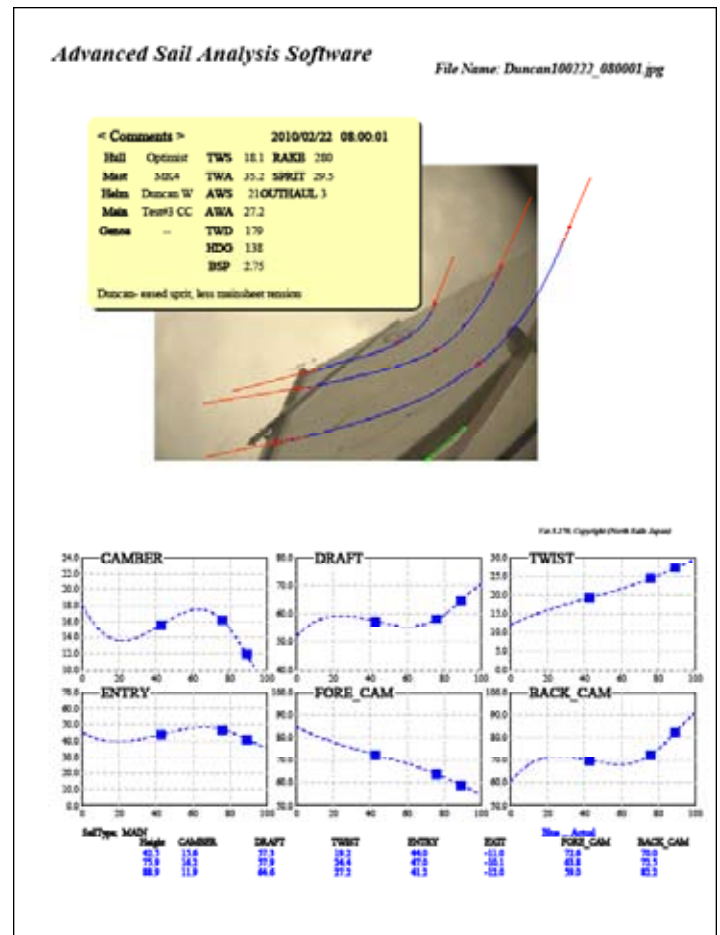
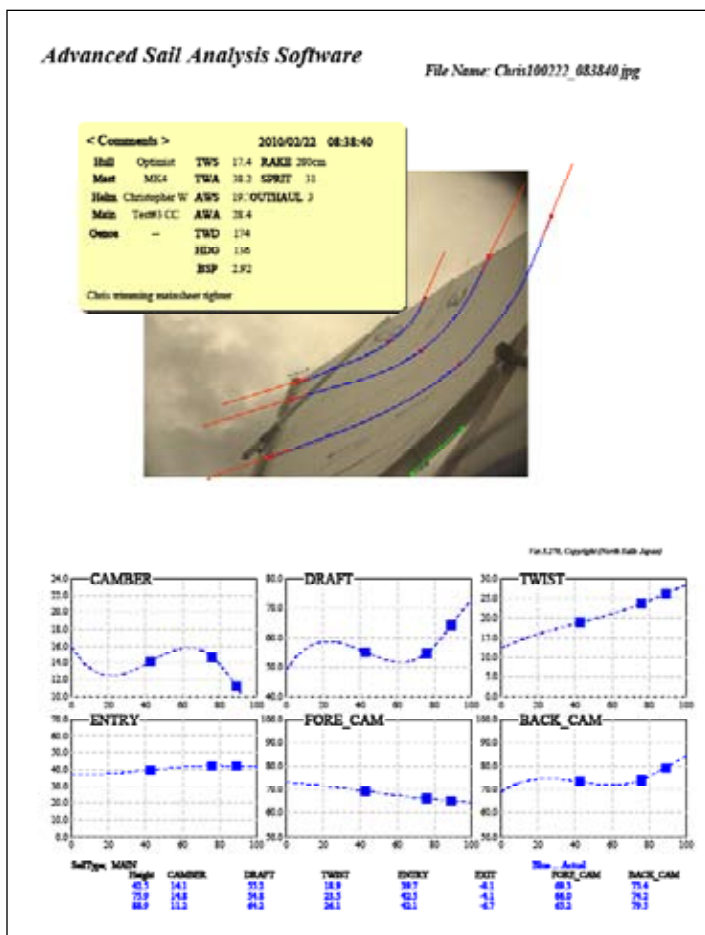
For the entire sail test, we analyzed over 150 upwind test runs! Furthermore, our system tracks and logs the True Wind Speed (on the chart as TWS) and the True Wind Direction (TWD). So we can easily determine if a boat gained/lost based on a wind-shift. Try doing that with just a notebook and pencil.



Our next step is to analyze the photos captured from the onboard cameras. We usually mount the cameras on the tops of the mast for boats like the Snipe, 470 and Finn. But we didn't want to add any weight to the Opti sprit that could accidentally alter the sail's flying shape. So we mounted the cameras in the boats. Here's an example of an onboard photograph (with Duncan making a guest appearance!).

Lots of photos are measured for each sailing condition. The characteristics of the flying shape are analyzed and compared to the Performance Data to see the flying shape during tests when the sail performed at its best. We then correlate that information to the tuning of the boat to develop a complete tuning guide.

We had Duncan and Christopher switch boats to see how they each trim the new North Cross Cut. This was very important, especially for the final day of sailing where we had winds from 14-21 knots. Check out these two flying shapes on the new North Cross Cut :

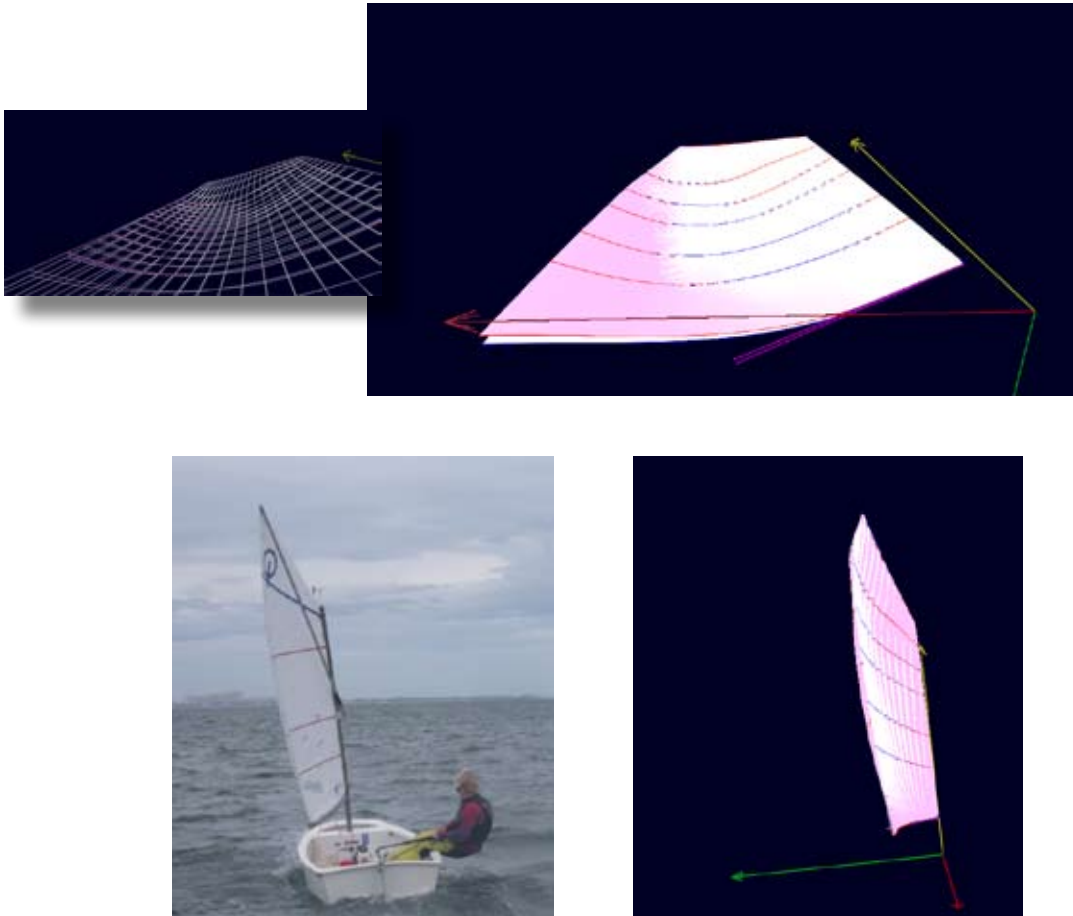


- Christopher is trimming the North Cross Cut on the left in 17 knots.
- Christopher is trimming with more mainsheet tension, flattening the sail resulting in increased performance.
- Duncan is trimming the North Cross Cut on the right in 18 knots.
- Duncan's trim is slightly eased resulting in a fuller sail making it difficult to go upwind in the breeze.

Our software can compare 3D images of the two sails shown above, measured from the onboard cameras:

- The two "Boom Up Views" show how the **BLUE** sail is flying flatter, with more twist in the breezy conditions. This helps the boat stay flat and in fast forward mode. The **RED** sail shape with a more closed leech tested slower and more difficult to sail in 17 knots, as it flew deeper.
- The "Coaches View" below show how the flying shapes match the photos from aft

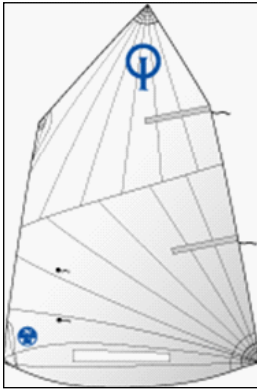
The ability to show the sailors and coaches how the sails are flying differently is so important to increasing performance!



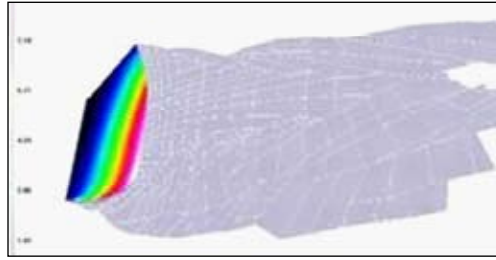
RADIAL or CROSS CUT???

The debate continues in the Optimist Class; which is better, radial or cross cut? We have the answer, and it depends on your sailing style. This is the only reason we are continuing our ongoing development of BOTH radial and cross cut sails.

Our P4 and P5 sails are radial cut and developed using a very stable sail cloth designed for radial cut sails. This cloth is very strong along the warp. For the P4 and P5, the warp of the cloth is the long side of each radial panel, where the cloth is the strongest. The panels radiate out of the clew and head to align the strong sail cloth with the primary load path the sail experiences while sailing. The radial panels allow the sail designer to lock in the shape. America's Cup and Grand Prix sails use carbon fiber in their sails for no-stretch to lock in the shape. This is the same idea for the P4 and P5 with a radial cut sail.



P4 and P5 Radial Cut



North Sails FLOW calculating pressure map over Optimist design mould



North Sails' MEMBRAIN calculated strain over Optimist

The cross cut sails work a little differently. We actually use a slightly different cloth in our new Cross Cut sail than in our radial cut sails. This cloth is a little more forgiving, and will really help make the leech of the sail “come alive” and automatically depower in the puffs. The reason for using a different sailcloth in the Cross Cut sail is simple. The cross cut sails are designed very deep with lots of shaping. When it gets windier, the cross cut sail will stretch more than the radial cut sail. Wait... isn't stretch considered BAD? Not necessarily because we know how the cloth will stretch because we work with the sail cloth companies to develop the best cloth needed for this application. We also use the North Sails Software Design Suite to design and test the sail before we even build it. Our Finite Element Analysis software tells us how the sail will stretch in the different wind conditions before we even build the sail. Pretty advanced stuff!

WHICH NORTH SAIL IS RIGHT FOR ME?

Again, that depends on your sailing style, as each sail has its advantages. Long-time Optimist sail choice is based on your weight... where the fuller sails are used by the heavier sailors, and the flatter sails are used by the lighter sailors. Most regattas in the US are sailed in light winds under 12 knots. Small sailors have been using deep sails for more horsepower in light sailing conditions. This is great, until you get caught out of range on a windy day!

The deep cambers of the new North Cross Cut make it powerful in light to moderate conditions, however this sail can be a handful in over 14 knots for a sailor under 95 pounds (43 kg). We are continuing to develop a Cross Cut sail that will be suitable for the lighter sailor so that you can get the most from your North Sail regardless of the wind and sea conditions you may find on the race course. The new North Cross Cut responds very well to an aggressive hiker, especially in a big chop. Watching Duncan and Christopher work the boat in the breeze during the testing showed how hiking hard and a tight mainsheet really help to bend the mast (fore-aft and sideways) and allow the top of the mast to fall off to leeward, thus flattening and depowering the sail. The sail cloth in the cross cut allows it to depower by twisting open the upper leech. The bottom of the leech will remain slightly closed so your pointing does not suffer.

Our P4 radial sail offers very balanced shaping to cover the wind range with a very stable sail. This sail is suitable for the lighter sailor (under 95 pounds). The designed twist in the P4 makes it easier to trim than other radial sails on the market. The sail cloth and radial layout help to minimize stretch, providing the sailor with ultimate in sail shape retention further up the wind range.

Our P5 radial sail offers slightly more depth in the top providing more power to the heavier sailor. The designed twist in the P5 is similar to the P4, making it an easier radial sail to trim. The sail cloth and radial layout help to minimize stretch, providing the sailor with ultimate in sail shape retention further up the wind range. The progressive mould shapes of the P4 and P5 make them easier to depower in lots of wind when you follow the tuning schedule developed by North Sails Japan.

Stay tuned to onedesign.com as we post more information on the development of our new North Cross Cut Optimist sails!

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