

CARBONICS

Advanced Composite Engineering & Manufacturing for Marine & Industrial Applications



GOETZ MARINE TECHNOLOGY PRODUCT BULLETIN • NUMBER FIVE 1994

CARBON SPARS COME OF AGE

For the last four years we at GMT have felt like we have been pushing and prodding the sailing world into realizing the many benefits of the carbon fiber revolution. It seems as if we have succeeded. This past year has been a record setting one for GMT. Recommendations from owners are convincing people a carbon mast may be the best investment they can make to improve the safety, comfort and performance of their boat.

This increase in production and experience has helped to improve the product while prices have come down. GMT has once again led the

way. Having built more carbon masts for cruising boats than any other company, we have had the opportunity to investigate various construction techniques. All our spars are made from uni-directional carbon fiber pre-impregnated with a toughened epoxy resin. With this material, we can make a light spar that is strong, impact resistant and has uniform, predictable properties.

The one drawback of pre-pregs is their cost. We have been testing other systems to see if there's anything better. Braiding is one way to cut costs. In this method dry carbon bundles are dipped in resin and woven around a form. As the fibers are woven, they

Continued on Pg 4

ROUTE 66 UPDATE:

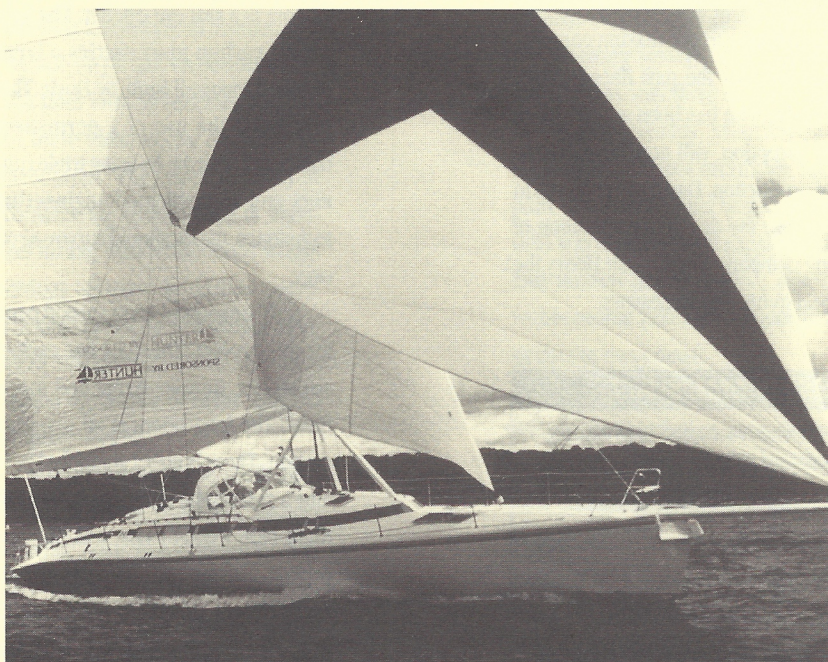
If you have picked up a sailing magazine in the past few months, you have probably come across an article about this radical 68' cruising yacht. Perhaps high performance, eye-grabbing appearance and innovation combined to pique the interest of the sailing community. We are happy to report that, for once, a boat with this many new ideas has lived up to its potential.

The success of this Lars Bergstrom design is largely due to the collaborative effort by Eric Goetz Custom Sailboats and GMT. Goetz Custom built the boat out of carbon and epoxy. The techniques they perfected building the last three America's Cup boats, allowed them to build Route 66 light, strong and durable. Light and strong were also the engineering criteria for the GMT supplied tripod mounted mast, hinged boom and lifting keel. GMT's experience by building thousands of composite parts along with close cooperation between the two companies, resulted in a smooth integration of the complex rig and keel systems into the boat.

The owners of Route 66 are extremely happy. It is fun when they call to tell us of another speed record or to share their delight in the boat's performance. This husband and wife team have cruised from Nova Scotia to

Continued on Pg 4

PAGE 1



Billy Black Photo

ROUTE 66 showing her stuff on Narragansett Bay

SUCCESSFUL REFIT REJUVENATES CLASSIC YACHT

This past summer GMT teamed up with Manchester Marine and Doyle Sailmakers in a combined effort to bring new life to Edgar Crocker's 35 year old Concordia 39. CROCODILE, a stately guardian to the entrance of Manchester MA harbor, is a 7/8 rig yawl. One of Edgar's desires in the refit was to increase upwind performance without having to convert to a masthead rig. His other concern was to ease mast induced strains on the hull, which can be a problem for a wooden boat that has been sailed hard over many years. Lightening the rig would address these two concerns and enhance the overall sailing characteristics of the boat. The original wood spar weighed 200 pounds, while the new carbon main mast tips the scale at a mere 80 pounds.

After a successful outing at the annual Concordia Rendezvous in

Padanaram, Edgar reported that "the results of fitting the GMT carbon spar have been spectacular, both from a racing and cruising point of view. It is a real thrill to add a knot or two going up the breeze."

Lest there be any detractors crying "sacrilege" at potentially harming the aesthetics of a classic Concordia equipped with wooden spar, CROCODILE's new mast was designed and built to mirror her original mast. The graceful top panel taper, fared winch bases, and white polyurethane paint along with original bronze mast track, wooden cleats, and new bronze plated winches all combine to keep this Concordia's traditional integrity intact. As John Winder of Manchester Marine explained, "Our mission from the owners was to produce an identical rig in appearance and dimension. This we accomplished through an exhaustive specification stage with GMT where we duplicated the rig almost fitting for fitting."

GMT NEWS

Ben Sprague has been named Director of Marketing at GMT. Ben, who comes to us from six years' selling Hood Stoway Masts, began leading our sales effort in September.

While Ben was settling in, **Henry Elliot** was moving on. Henry, who was an equal partner in the company with David Schwartz and Eric

Goetz, has decided to look for new challenges. Henry has been a major contributor to the marine composites field for the past decade. Gary Crosby, who has been at GMT since its inception, will now be in charge of production. David will continue to manage the day to day operation of the company. We all wish Henry the best in his new endeavors.

WEIGHT SAVINGS DUE TO HIGH FIBER (CARBON THAT IS) DIET

We continue to receive rave reviews from owners sailing with GMT carbon fiber spars. Less pitching, healing, and easier motion in a seaway combine to make sailing safer and more enjoyable.

BOAT	WEIGHT SAVED	BOAT	WEIGHT SAVED
Crocodile.....	120 lbs.	Spring Moon.....	222 lbs.
Hinckley 43	200 lbs.	Soliloquy.....	275 lbs.
Westri	220 lbs.	Judith Ann.....	350 lbs.
Alexandra	165 lbs.	Chanty III.....	490 lbs.



Art Paine Photo

Apogee 50, WESTRI, built by Able Custom Yachts and designed by Chuck Paine, will circumnavigate South America with a GMT furling mast.

A BOC BOMBSHELL

When Andy Upjohn goes rock climbing, he chooses the equipment he will be trusting his life to with care. Andy has approached his BOC campaign with the same concern for safety and reliability. That's why he came to Goetz Marine Technology for the carbon spars for his new open class 50 footer.

This innovative boat designed by Peter Ebbutt and built by Concordia Custom is a real eye catcher. The light weight carbon mast carries a large roached mainsail built by Doyle. This precluded the use of a permanent backstay. However, by using triple runners and sophisticated engineering techniques, the rig should survive a roll over.

GMT provided a lot of carbon parts for this project. The mast has carbon spreaders, jumper struts and masthead. The long boom is all pre-preg carbon. There is also a spinnaker pole and a retractable bow sprit. With all these light weight parts, it is not surprising that the boat flies. Having already shown speeds in excess of 20 knots, it looks like Andy is in for a fast trip around the world.

HINCKLEY AND GMT: PIONEERING NEW CONCEPTS FOR THE CRUISING SAILOR.

You would expect one of the leaders in custom built boats to want to continually search for the newest and most proven technology available. That's exactly what the Hinckley Company has been doing since the early 1960's. They helped introduce the use of fiberglass molding in hull construction, popularized center-board, shoal draft cruisers, and incorporated both headsail and main-sail furling systems. Hinckley recognized the importance of the ease and safety afforded by these new sail handling systems and to this day installs hydraulically operated furling on most of its larger boats.

Hinckley also realized that furling spars added weight aloft thereby compromising the comfort and performance of their boats. At the same time, we at Goetz Marine Technology were developing light weight carbon furling spars. We all put our heads together and realized that carbon could offer serious cruisers the sail handling advantages of in-mast furling with no penalty on performance. The sales force at Hinckley presented these ideas to two Sou'west 59 customers. They both decided to combine the convenience of main-sail furling with tremendous weight savings afforded by carbon spars. The GMT spars, the first of their kind, were installed in 1991 and have logged thousands of miles with exemplary service.

Prompted by these early successes with new Hinckleys, owners of older boats began to see carbon masts as a way to dramatically enhance all around performance. George Carter, owner of a 19 year

old Bermuda 40 commented, "The boat has a new feel and sails better in all conditions. Most noticeable is that it accelerates faster and hobby-horses less. The lighter mast makes the boat stiffer and more powerful." Since then two Hinckley 41's, a Pilot 35, and a Sou'west 42 (all between 5 and 30 years old) have switched to

"The weight savings of carbon fiber is most effective in the rig where the increased stability and lower center of gravity truly make for a better boat."

carbon spars. Hinckley Service Manager Rusty Bradford says customers view carbon masts as a good way to make their sailing more enjoyable.

CHANTY III

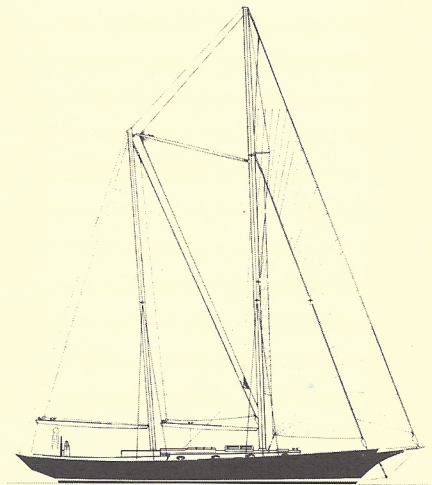
When first viewing the 52 foot Bruce King wishbone ketch Chanty III the impression is one of grace and beauty associated with a bygone era in yachting. The boat, nearing completion at the Zimmerman Marine yard was designed with short handed sailing in mind. To meet this requirement it was decided to design the sailplan with five sails all on mechanized furling systems. Once again, carbon fiber was there to allow the best of both worlds, affording in-mast furling without sacrificing stability due to additional weight aloft. GMT was called upon to supply main and mizzen masts, booms and a wishbone that were light, elegant and perfect in every detail.

Dividing the sailplan in the interest of short handed manageability made sense from a practical point of view. Designing the spars to accommodate all the necessary sheets, halyards, fittings, and attachment points was a challenge. David Schwartz said of the project, "Because of the unusual rig configuration, nearly every

This past Spring GMT shipped four masts, two rudders, and spinaker poles to Southwest Harbor for both new boats and retrofits. Peter Smith, who heads up the Hinckley design team, reports that the weight savings of carbon fiber is most effective in the rig where the increased stability and lower center of gravity truly make for a better boat. To underscore this, Peter pointed out that of the boats commissioned last year, all but two installed carbon spars. Goetz Marine Technology is proud to have been part of yet another Hinckley innovation and we look forward to future collaborative efforts with our friends in Southwest Harbor.

fitting required a new design. We have worked closely with the boat's project manager, Rupert Lyle, to make sure the fittings would not only be functional, but complement the elegance of the boat."

The ability to reduce sail partially or completely by the push of a button will meet the owner's require-



Bruce King Yacht Design

ments and help to make Chanty III a pleasure to sail. We'll be going to Virginia in the spring to install the spars, rigging and furlers. Be sure to look for pictures of this classic in the next issue of Carbonics.

CARBON GOES RACING

The International Measurement System has taken a bold leap into the carbon fiber revolution. They have decided to allow the use of carbon in rudders and boat hulls. The IMS finally realized something that GMT and many others have been saying for the last few years:

"Carbon fiber construction has come down in price. Parts made from this material can actually be less expensive than parts made from S-glass."

Rudders are a good example of this. We have made hundreds of rudders with carbon stocks. When carbon was banned by the IMS, S-glass became the material of choice. Raw S-Glass is less costly than carbon. However because it is weaker and much bendier, a lot more S-glass had to be used. Rudders built from it were actually costing more than their carbon cousins.

A carbon rudder can do a lot to improve your boat's performance. A new rudder can be made thinner causing less speed robbing drag. More modern shapes can result in a rudder that actually turns the boat faster and is more resistant to broaches. Finally, carbon rudders are very light. This weight reduction in the stern helps reduce pitching.

GMT has been making rudders for racing and cruising boats for 9 years. We use a computer controlled milling machine to insure that the blade is fair and symmetric. In-house engineering allows us to make sure that the rudder will withstand years of severe use. A new rudder can make your boat faster and more enjoyable to sail. Give us a call to discuss the possibilities.

Route 66 *Continued from Pg 1*
Florida. Their next trip will be across the big pond to Europe. At sea, Route 66 easily averages over 10 knots and has sustained speeds of more than 22

HUNTER'S CHILD ENTERS THE BOC

Goetz Marine Technology recently received the contract to build the new carbon mast and boom for this Hunter Marine sponsored 60 HUNTER'S CHILD footer. The boat will be skippered by Steve Pettengill in the upcoming edition of the solo circumnavigation race. After looking closely at all the US spar builders



CHILD

the Hunter Marine Racing Team realized a GMT spar represented the best value. They could be sure they would get a mast that would be well engineered, carefully built, and highly reliable in the severe conditions they would see as they raced around the world. Production is underway and a March commissioning date is expected. Be sure to look for Steve and HUNTER'S CHILD at Sail Expo in February.

Carbon spars come of age *Continued from Pg 1*

are crimped over one another. These bends result in lower resistance to local buckling and failure. Maybe this is why a high percentage of braided spars have suffered total failure at sea.

Resin transfer is another construction technique we have tried. In this method, resin is injected into a dry fiber layup. To allow paths for the resin, woven material must be used. This again yields a mast with built in structural failure points. It is very difficult to insure that the resin wets out all the fibers uniformly. If it hasn't, and you can't tell without cutting the mast up, weak areas will be incorporated into the mast. In addition these spars tend to be heavier than those made of pre-preg. Since the whole reason for going to carbon in the first place is to save weight, this is a bit self defeating.

Although our research hasn't turned up a better system than pre-pregs, it has led us to improvements in how we use this material. By using special compacting techniques, pressure intensifiers and epoxy resins designed for vacuum consolidating, we produce laminates with void contents of less than 1% without adding the complication of an autoclave. Our current masts are highly engineered and have finished laminates with minimal fiber distortion. The masts we deliver offer good value and add the appropriate elegance to any boat they are put on.

Route 66 *Continued from left column*

knots. Not bad for a comfortable cruising boat. All this is the result of a good design and the proper use of light weight materials. The Goetz team is proud of everything we have done to help make this owners dream come true.

GMT Response Card

Name

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Please add my name to the Carbonics mailing list.

Please send me more information on the following products.

Composite rudder Carbon spinnaker pole

Carbon fiber mast

Boat type



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