

CARBONICS

Advanced Composite Engineering & Manufacturing for Marine & Industrial Applications



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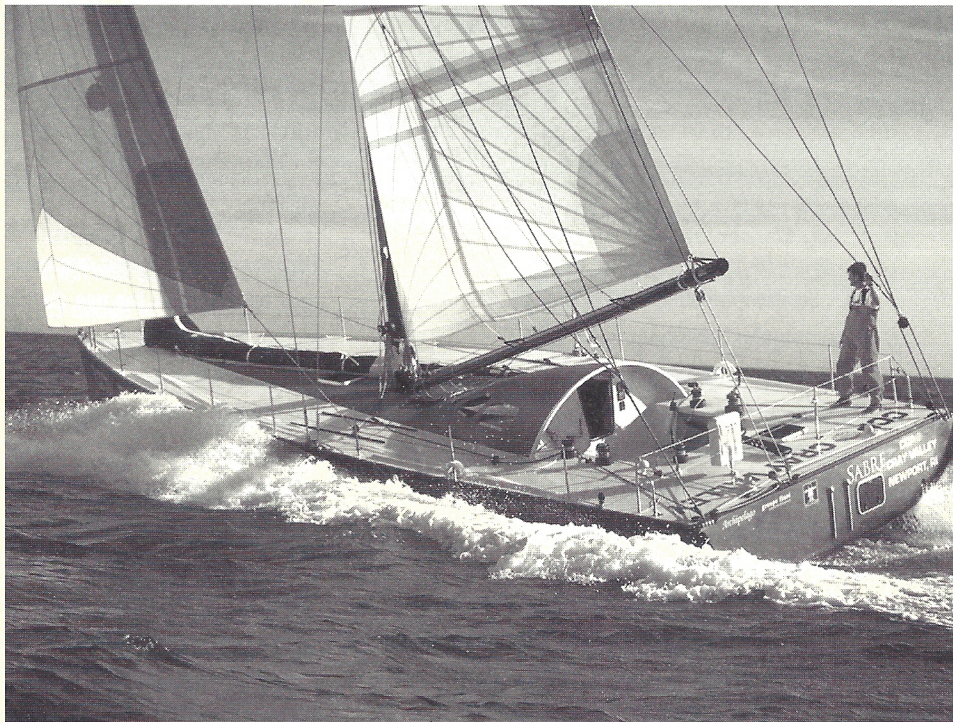


Photo: Billy Black

Goetz Marine carbon spars and rudders helped CCP Cray Valley shatter the Newport to Bermuda record.

JP'S WILD RIDE TO BERMUDA

November, 1996 saw Rhode Island's Jean-Pierre Mouligne set sail in his new Finot designed 50 footer in hopes of setting a new record. It took him two tries, but set the record he did. J.P. and crew made the passage in 2 days, 5 hours, 55 minutes, 55 seconds, eclipsing Goetz Custom built BOOMERANG's record set 4 months earlier in the Newport to Bermuda Race by over three hours. The speed of the trip belies the extensive planning and preparation that went into the successful effort.

During construction of his 50'

foot Around the World Single-hander, J.P. Mouligne came to Goetz Marine president David Schwartz for his advice on the carbon rig and steering system. Of primary concern to J.P. was that he have a mast that was light and strong, simple to maintain, but that would also fit into his budget, modest compared to that of many a corporate backed solo circumnavigator. The solution was a two spreader section providing simplicity in the standing rigging and strength due to its larger spar geometry. "For boats doing the BOC/Around Alone race a carbon spar is a must." J.P. asserts.

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THE BEST MATERIALS MAKE THE BEST SPARS

For years we at GMT have been touting the advantages of carbon pre-preg for use in mast construction over the less costly low-tech process of wet laminating. After more than seven years of building spars from pre-preg without a single mast failure, the advantages this material offers over wet laminating have never been clearer. If you want the strongest, safest, lightest mast, carbon/epoxy pre-pregs are the best materials for the job.

RESIN CONTENT CONTROL is crucial in all composite parts. Too much resin adds extra weight without increasing strength. Too little resin creates dry areas in the laminate which weaken the finished product. By having the epoxy resin precisely applied at the pre-preg manufacturing plant, we are assured of two things. First, the ratio of fiber to resin is exact. Neither too much nor too little is used. Second, we know that the coating is uniform. All fibers in the rolls are completely coated with an identical amount of resin. Since the resin is not wet and runny like epoxies you may have used, when our technicians apply it to a mast, they know they'll produce a part with a 65% by volume fiber to resin ratio throughout. In contrast, when carbon is wet out with epoxy

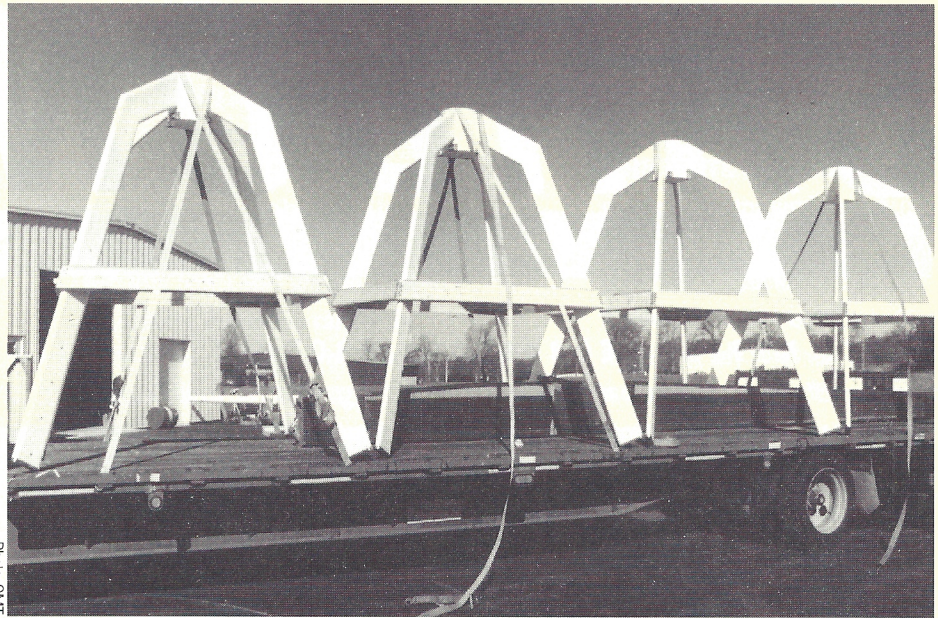
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EXPERIENCE MAKES THE DIFFERENCE-

GARY CROSBY PUTS THE "SPECIAL" IN GMT SPECIAL PROJECTS

Over the years (14 to be exact) Goetz Marine Technology has built a wide variety of composite parts besides its well known spars and rudders. The driving force behind much of this has been Gary Crosby. As Director of GMT Special Projects, Gary uses his computer, design, and lofting skills to manage the construction of a range of parts to the most exacting standards. Goetz Partner and President David Schwartz said, "Gary's craftsmanship and knowledge of what works in composites have helped GMT forge a strong reputation in over a half dozen different industries". GMT Special Projects built support structures for the Smithsonian Astrophysical Observatory for their 6 meter radio telescope array, part of a multi-million dollar government research grant. SAO chose carbon for the job

Photo: GMT



GMT built quadrupod leg assemblies for radio telescopes utilize all uni-directional carbon pre-preg

due to its low coefficient of thermal expansion, which minimizes deflection in the radio telescope. "They chose GMT because they knew we could produce these parts to their stringent requirements," Crosby said.

Other projects Gary has led include robotic arms and machine tools for the paper cutting industry, towed submersible components for

defense contractors, and neurosurgical head frames for use during surgery. Back on the marine front, GMT Special Projects, has built carbon propeller shaft struts and rudders for high speed power boats and recently a solid carbon laminate stemhead chainplate for a 124 ft. sloop.

GMT NEWS

Late in 1996 GMT shipped a 95 foot mast for a Tony Castro designed 73 foot sloop to Taiwan. The all carbon rig with custom stainless steel fittings was very impressive but paled next to the logistics involved in moving the mast in one piece the 11,823 miles to the southern port of Kaohsiung.

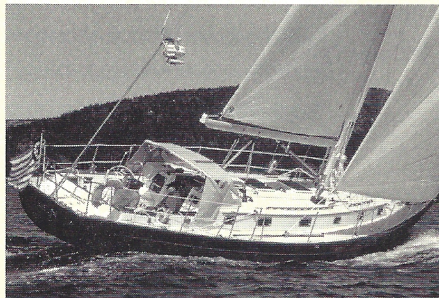


Photo: Morris Yachts

Morris 46 "Vixen" with her GMT carbon furling spar.

The mast arrived in perfect condition and sail trials are expected by summer. Other recent commissionings include a 60 foot Alden yawl, Hinckley 52 and 43 all at the Hinckley Company and a re-sparring of a "Maxi-Multi" high speed trimaran in Seattle, WA. Two more Morris 46's chose GMT rigs and will likely be in Southwest Harbor to celebrate Tom Morris's 25th anniversary in August, 1997. The new production Freedom 45 will ply the waters of Narragansett Bay later this year with its trade mark carbon rig from GMT. Goetz Marine was awarded the contract to supply the rigs for an 86 foot ketch under construction in the U.K. Noted sled builder Dencho Marine has ordered three pre-preg rudder posts to be built by

Goetz. The posts will be installed on three 68 footers designed by Alan Andrews. In case you hadn't heard, GMT built a new state of the art facility on Ballou Blvd. last Spring. Everyone is delighted to have twice the space, a clean room and larger curing equipment. GMT president David Schwartz announced, "I'm delighted with how the new building has worked out. The extra space has enabled us to work more efficiently and produce a better product." Proving that the GMT name brings added resale value to a boat, David recently bought a 40 foot racer/cruiser that had been fitted with a Goetz rudder and quadrant in 1991. Look for MISCHIEF on Narragansett Bay this summer before she sheds her alloy spar for a carbon one!

CARBON RIGS GIVE PERFORMANCE LIFT TO OLDER DESIGNS

With carbon fiber masts weighing half that of aluminum, it's small wonder that a sizable chunk of GMT's spar business has come from the retrofit market. Since we began building carbon spars in 1990, boat owners have understood the value in re-sparring with carbon. Realizing a weight savings of between 150 and 300 pounds aloft (sometimes more) on a 40-50 foot cruising boat has given sailors a variety of choices. Many opt simply to have a stiffer boat that sails more comfortably due to the reduction in pitching moment. Others decide to trade some of the weight savings for increasing the rig height to enhance light and moderate air performance. Still others choose to convert their rig configuration to in-mast mainsail furling while still achieving a lighter spar than what they started with. Regardless of which route is chosen, all agree that a carbon "performance lift" is a worthwhile investment.

Late in 1995 Bob Gould installed a Goetz carbon furling rig on his 1984 Mariner 47 FREE SPIRIT. Replacing his aluminum furling spar would have saved 382 lbs., but Bob decided to increase the height of his rig by 10 feet! The net result was a spar that still weighed 338 lbs. less than the original. In the bargain, Bob got "a much better sailing boat in lighter airs, which we see a lot of in Mass. Bay in the summer." Bob feels the carbon rig not only improved light air performance but noticeably improved the boat's motion, stability, and upwind sailing. "Really, it's like having a new boat." Bob says.

Arthur Dent chose GMT to build a carbon mast for his 1978 Bristol 32. "I had been reading a lot about



Photo: Onne Van Der Wal

Numbers dominated her class with Goetz steering

GMT STEERS NUMBERS AND ESMERALDA TO VICTORY

While many were land bound or stuck in traffic in January and February, '97 Goetz carbon rudders led the pack around the race courses of Key West Race Week and the SORC. The "just out of the box" NUMBERS '97 built by Eric Goetz Custom Sailboats thrashed the competition at Key West and won again at SORC. NUMBERS will represent New Zealand in this summer's Admiral's Cup. ESMERALDA, also by Goetz Boats won the hotly contested IMS division at both events. Sailing on ESMERALDA, Hale Walcoff, Marketing Director for Goetz Boats said, "There's no doubt about it, our GMT rudder put us where we needed to be and got us out of some tight spots to come out on top." A third speedster with a Goetz rudder, MORE WAR STORIES, finished second behind ESMERALDA at SORC. This Summer Whitbread 60's take to the water. All three U.S. competitors will be equipped with GMT steering components. CHESSIE RACING and AMERICA'S CHALLENGE built at the Goetz shop have complete GMT rudders while TOSHIBA, Dennis Conner's entry, is fitted with a high temperature cure pre-preg rudder post. Soon to launch is a 50 foot Farr design. Her GMT rudder will give her the edge as she prepares for her role on the Italian Admiral's Cup team.

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the benefits of a lighter spar, but I didn't really expect as noticeable a change as what I got." While the weight saved was 150 lbs, Arthur notes "The single most dramatic difference is how much less the boat pitches sailing or motoring into a chop". The Goetz team is happy to count Arthur among its many satisfied carbon converts although he tells us "I could be more pleased with my new rig only if it also added 4-5 feet of waterline length". Sorry about that Arthur, we're working on that one.

Shoal draft cruising boats benefit the most from the lighter rigs. For the 1997 sailing season Goetz is building three furling spars for older Hinckleys. One, a Sou'wester 50 yawl will save 407 lbs. in the two spars, affording a significant increase in stability due to the lowered center of gravity. No matter how you apply the weight savings to improve your sailing, GMT has the ability to give your boat the "performance lift" you've been looking for. Call Ben Sprague or Dave Schwartz to learn more.

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"Considering my boat displaces 12000 pounds light and 18000 with full ballast, the spar needs to be designed and built strong enough to take the change in righting moment". The GMT spar is constructed from uni-directional carbon pre-preg and weighed 205 lbs. before the addition of fittings and sail track. In his professional life, J.P. is Sales Manager for R.P. Associates, a major supplier of resins and composites to the marine industry, so J.P.'s selection of Goetz Marine to build his spars is high praise indeed. "Dave's proposal for the carbon rig made perfect sense. I wanted a lightweight spar that I knew could stand up to whatever conditions I would encounter."

During their run to Bermuda, J.P. and company never saw the wind speed drop below 30 knots and frequently beam reached along at 18-20 knots. The second night out the boat hit an incredible 30.6 knots in boat speed. Gybing across the rhumb line CCP CRAY VALLEY logged 765 miles averaging 14.2 knots for the passage. "The GMT spar performed perfectly. There was no mast pumping. Gybing in those conditions even though there is no permanent backstay was no problem".

J.P. has entered the 1997 Around Europe Race scheduled to take place in June. The fully crewed event starts in Cherbourg with stops in the Netherlands, Norway, Germany, Finland and finishing in Sweden. Among other friends J.P. has signed on as crew is fellow solo sailor Isabelle Autissier. The boat will spend some time in France before J.P. sails her back to Rhode island to continue his preparation for the 1998/99 Around Alone Race. The entire Goetz family wishes Jean-Pierre the best of luck and good sailing.

THE BEST Continued from Pg 1

on the shop floor, you have a sticky, gooey mess. It's not possible to evenly wet out the carbon while you apply it to the tool. More than the optimum amount of resin has to be used to prevent dry areas. The result is a heavier part with only a 50% fiber to resin ratio. Since the carbon carries the load, a lower percentage of carbon means the mast isn't as strong.

FIBER STRAIGHTNESS has long been an attribute of uni-directional pre-preg. During the pre-preg manufacturing process, the machinery aligns the carbon fibers, coats them and then applies them to the backing paper so all fibers are straight and parallel. At GMT we then can lay out the material on the tool or in the mold and the fibers remain perfectly straight. Wet processes that utilize braiding or filament winding incorporate kinks in the individual fibers which prevent ultimate straightness of the fibers. Hand lay up of fibers that have been wet out in the shop have two potential pitfalls: insuring sufficient saturation and maintaining straightness. We all know from doing small glass repairs how tricky keeping the material where you want it can be. Since the strength and

stiffness of a composite are primarily along the direction of the fibers, you can see how important it is to keep the fibers straight.

VOID CONTENT is the number one enemy to the structural integrity of a carbon spar. By keeping the resin content under control with pre-preg materials the laminator is able to reduce the size of any voids and keep the number to a minimum. With wet lay up the problem becomes greater as air is easily trapped in the wet resin. It's more difficult to restrict the size of voids in the laminate, much less eliminate them.

At GMT we have routinely tested carbon parts made using the different materials and processes. Come see the results for yourself. The parts made from pre-preg consistently yield higher fiber-to-resin ratios. Visual inspection makes the differences even more compelling. The wet laminated parts depict uneven ply layering, irregular resin distribution, and higher void content. Pre-preg parts also require less fairing, further keeping the weight down. Saving weight through the best materials is how we at GMT help you get the most out of your carbon!



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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



Goetz Marine Technology

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