FREE

GOUGEON EPOXYWORKS®

BUILDING, RESTORATION & REPAIR with EPOXY

Number 38 ■ Spring 2014

In This Issue

EPOXYWORKS®

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Epoxyworks is published twice a year by Gougeon Brothers Inc., Bay City, MI, USA.

Product Number 000-605

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The 37th Annual Wooden Boat Festival
Port Townsend, Washington

By Bruce Niederer

The cover photo shows a good overview of the busy harbor on a gorgeous day this past September.

If you are interested in US Maritime history and heritage, you owe it to yourself to visit Port Townsend, Washington. Port Townsend is located 56 miles NNW from Seattle and sits on the waterfront of Port Townsend Bay in Puget Sound. This unique village is known for its sense of community and a lifestyle of "salt water hippies" focused on boats and the sea. Port Townsend is also the home of the oldest and largest wooden boat festival in the Pacific Northwest, perhaps in the US. Truly an international event, the festival features as many as 300 wooden boats from the US and Canada during the first week of September each year.

Also in Port Townsend Maritime district is the Northwest Maritime Center, a beautiful building that is headquarters to the Wooden Boat Foundation. This foundation was formed in 1978 after the first Wooden Boat Festival. The mission of the Wooden Boat Foundation is simple:

To celebrate and preserve traditional maritime skills, heritage, culture and marine trades through education and community participation in the joy of wooden boats.

The implementation of that mission is anything but simple, taking untold hours by hundreds of local volunteers who raise the money necessary to fund the Maritime Center's many programs including the festival, the Wooden Boat Chandlery, a boat shop, the H.W. McCurdy Library, and conference and class rooms.

Gougeon Brothers, Inc. has participated in the Wooden Boat Festival for many years now, returning year after year to promote WEST SYSTEM® Epoxy, answer specific questions from those attending the festival, and visit the many friends we've made over the years. For the last few years, we have shared our tent with our very good friends, Ashlyn and Russell Brown, who owns and operates PT Watercraft. Russell builds and sells innovative, quality boat kits. Both the boats he brought to display, the PT 11 Nesting Dingy and the PT Spear Dingy, drew a lot of attention and attracted a constant flow of festival attendees to our tent.

Left: Nesting Dingy built by Russell Brown displayed at our tent.

Below: The Wooden Boat Foundation and local community raised over one million dollars to build this facility that connects the historic civic district with the maritime district.

The guys from CLC are from Annapolis, Maryland and drive to the west coast for four shows ending in Port Townsend traveling with all this gear! They are on the road for a couple months before heading back home.

Another of our friends who attends this show year after year is John Harris and his crew at Chesapeake Light Craft. CLC is the leading boat kit supplier in the US.

Another fun aspect of the festival is the opportunity to make new friends and contacts. Although there are plenty of traditionalists at the festival—folks who are loathe to even mention epoxy in the vicinity of their boats—there are plenty of wood/epoxy boats built with WEST SYSTEM to inspect. Most are one-off projects built by the owner. I really like talking to these people because they are proud of their accomplishment and love to chat about their true love, this boat they built.

Reg Miller is just such an individual. I spent some time chatting with Reg and his wife (never underestimate the importance of "the significant other" to any boat build even if they never pick up a tool!) about the Jericho Bay Lobster Skiff he built from plans he bought through WoodenBoat magazine. It is a beautiful strip-built skiff using yellow cedar strips, mahogany trim, and walnut for the deck—all using WEST SYSTEM Epoxy. As you can see from the photos to the right, with the custom interior and canvas I am certain this boat will never see a lobster pot. I am also certain they will spend many relaxing hours tooling about their home waters of Anglemont, BC, Canada. Great job Reg!

Heidi with the newest member of the Java Gypsies.

Another interesting couple I met and talked to was Hari and Judie Heath who have designed and built a unique canoe/kayak hybrid they call a Wahnooyak. The bow is styled after an Ojibwah canoe and the stern is an enclosed kayak style shape with plenty of watertight, enclosed space for camping gear or touring gear. The bow area also includes a watertight compartment for additional buoyancy in the event of a swamping. I watched Hari paddling his creation during the parade of boats that is a great end to the festival, and was impressed with how easily it paddles and tracks. They also build what I think are the lightest and most beautiful hollow wooden paddles I have ever held. Hari and Judie say these paddles are also very durable.

John and Heidi Burbank are The Java Gypsies. They own and operate the Java Gypsy Mobile Coffeehouse from a restored milk wagon. I got to know them in 2009, the first time at the festival for me. Their coffee wagon is about 25 yards from our WEST SYSTEM booth and they provide vendors and guests alike perhaps the most valuable commodity at the show—caffeine! This is not just coffee; it's tasty cappuccino or mochaccino. They have uncaffeinated choices

The moderate but ample rocker, plus a fine bow entry and stern exit make the design stable and able to track very nicely.

Here's Hari Heath paddling along the shore line during the parade of ships. The Wahnooyak moved easily and quickly through the water.

including their signature Chai tea, but I need the full leaded stuff! John and Heidi always have some great classic rock playing and I am a huge fan. We started talking about old music and I showed them my King Crimson compass rose tattoo and the rest, as they say, is history. They camp behind the Java Wagon for the weekend in their VW Microbus: perfect accommodations for this very friendly couple.

On the waterfront in the Seattle area and around "the Sound" the weather is consistently inconsistent. The festival takes place in early September because that's normally when the area enjoys the best weather of the year. My friends who live in the area always have stories about days upon days of rain followed by weeks of drizzle. Michigan summers are outstanding by comparison, assuming the stories are not too exaggerated.

The photo above was taken during the parade of ships. There was a stationary inversion during the entire parade of ships. I'm not sure I can definitively explain what's going on here, but I think the warmer air is pouring down from the land, above the trees, and is getting funneled on top of the cool water. A blanket of warm air then holds the fog in this well-defined shape. Boats from the parade would sail out of sight into the fog blanket only to reappear when they tacked and headed back to the port area. For a valley dweller like myself, this phenomena is breathtakingly beautiful. In 35 years of sailing the Great Lakes I've never seen anything like it.

One last word of advice: if you plan to visit Port Townsend during the festival make your plans and reservations early. Hotel accommodations get booked early and they are not inexpensive. You won't find a Motel 6 in Port Townsend or anywhere close. But if you ask me, it's worth every penny!

RESOURCES

Wooden Boat Foundation: woodenboat.org
Northwest Martime Center: nwmaritime.org
Port Townsend Watercraft: ptwatercraft.com
Wahnooyak hybrid canoe/kayaks: wahnooyak.com

Above: This inversion was stationary during the entire parade of ships. Below: The parade always draws a big crowd. Note how nice and sunny it is, in comparison to the picture of the inversion.

Above: Why Naut, built by Reg Miller. Left: The area boasts a large and active fleet of Thunderbird 26 plywood racer/cruisers. The 1958 design was the brainchild of Seattle Naval Architect Ben Seaborn. Below: A couple hearty souls after my own heart. That's their beer dingy they are pulling loaded with a tapper keg!

BOY SCOUTS OF AMERICA®

Composites Merit Badge

By Mike Barnard

As an Eagle Scout, I understand the work ethic and dedication each Boy Scout must have in order to achieve the Eagle Scout rank. It involves earning 13 required merit badges demonstrating knowledge on topics ranging from cooking to nuclear science to music plus a minimum of 8 elective badges. As of January 1, 2014 there are over 120 elective badges a Scout can earn beyond the required 13. A Scout must obtain a certain number of elective merit badges for each rank.

In 2006, Boy Scouts of America created a merit badge for composite materials. As a merit badge counselor and a Gougeon Brothers Technical Advisor, I am familiar with the composites industry and the criteria a scout needs to fulfill to earn their composite materials badge.

The first step is learning the basics about composites, and Boy Scouts of America can provide counselors with a presentation on the basics. Next, Scouts are required to build at least two items using composite materials.

A composite is made out of more than one material. Composites have been around for thousands of years, but they have never been more sophisticated than they are today. Bricks of mud and straw were one of the first man-made composites. When the mud dries, it becomes hard, but when combined with the straw this forms a composite stronger than either of the individual components alone. In the twelfth century, the Mongols used tendons from animals, glue from tree sap, bamboo, and sheets of horn to create a more complex composite material to make bows. These 800-year-old bows have been tested recently and they were found to have about 80% of the strength of modern day composite bows—at 800 years of age. Likewise, the first boat built with WEST SYSTEM® Epoxy (*Adagio*) still sails every week during the summer months here in Bay City, Michigan. She has completed her 44th summer of sailing, far less than 800 years old, but still quite impressive for a sailboat on the Great Lakes.

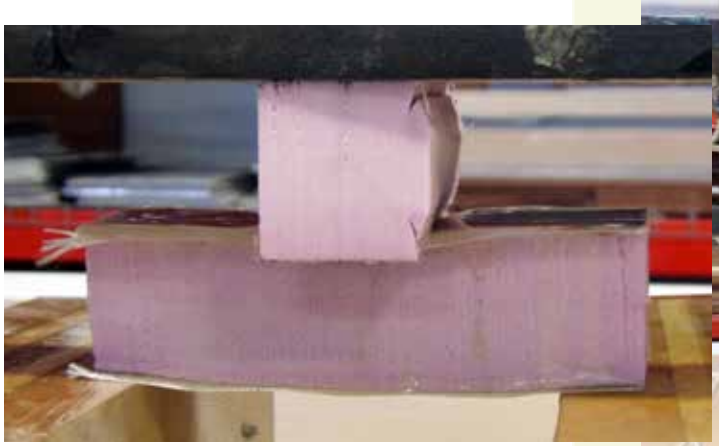
This age defying quality is what fascinates me about composites, and one of the reasons my bachelors degree is in composite materials engineering. The concept of taking two or more components and combining them to make something that is stronger and will last longer than each of the individual components is impressive.

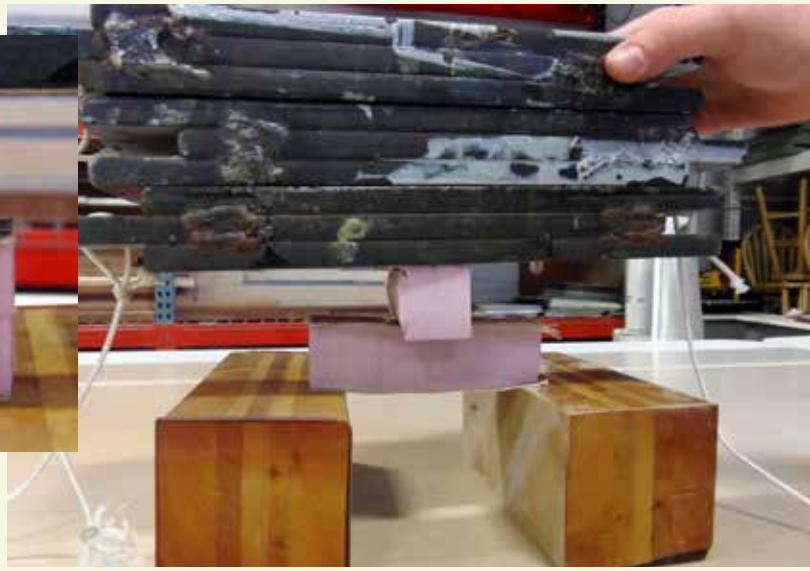
The merit badge does not require use of epoxy in creating a composite, but as resins go it's a good choice, especially for someone who is new to composites. Epoxy has low odor, low volatile organic compound content, and very high strength. While epoxy's vapors are safer than those of polyester or vinyl ester resins, it is a skin sensitizer and should always be handled with gloves and safety glasses. From a safety standpoint, it's much easier to control for skin contact than for air quality.

To earn the composites merit badge, a Scout must:

A. Demonstrate his knowledge of the composites industry to the counselor.

B. Complete two projects with composites, at least one of which must come from the Composite Materials merit badge pamphlet. The second project may come from the pamphlet or may be one the Scout selects with the approval of his counselor.





2"x5" Fiberglass and foam block supporting 60 lbs. of weight

C. Find an appropriate site where the projects can be safely completed under the counselor's supervision and/or the supervision of an adult knowledgeable about composites and approved by the counselor.

D. With the counselor, determine how the finished projects will be evaluated.

The projects listed in the Composites Merit Badge pamphlet are: model airplane, birdhouse, walking stick, model boat, skateboard, snow shoes, repair of a wooden tool handle, patrol kitchen box, camp signage or fire bucket.

I will describe projects that can be completed to fulfill at least one of the badge requirements. These projects would be good for anyone who wants to learn more about composites.

These projects should only be attempted with adult supervision and gloves. Remember that epoxy is a skin sensitizer and can cause rashes so it is very important to keep it off your skin. When leading projects such as these, it is important to keep in mind the age and maturity level of those learning, and choose a project accordingly.

The Sandwich Composites project, in addition to showing Scouts how to make a simple composite part, demonstrates that stiffness is driven by thickness. If these two layers of fabric were used without a core material between them, they would not hold nearly as much weight. In my brief testing of this concept, my 1.5" foam composite was able to support 60 pounds. When an extra 20 pounds was added, the sandwich composite bent so much that it slipped off of my supports—without breaking.

Project materials

Sandwich Composite

Required materials

- 101 Handy Repair Pack
- 80-grit sandpaper
- 2" x 10" x 2" thick foam
- Gallon freezer bag, plastic film or drop cloth
- Gloves and safety glasses

Instructions

- Sand foam lightly
- Cut the fabric and foam into two 5" long sections. Set one section of foam aside for comparison later.
- Mix entire resin/hardener packet
- Over the plastic film, brush mixed epoxy onto foam
- Lay one 2" x 5" piece of fabric down and apply more epoxy
- Flip over and repeat the previous two steps
- When the epoxy cures, see how much weight it can hold versus foam alone

Optional Increased Difficulty

- Use longer pieces of foam and add several layers of fabric to each side or use carbon fiber

Project materials

Inserting pushpins into ceiling tile

Winding wet-out carbon fiber around pushpins

Bridge being placed between vertical supports for testing

Composite Bridge

Required Materials

- 105 Epoxy Resin®
- 205, 206 or 207 Hardener
- Cotton string
- Plastic tacks or pushpins, waxed
- A ceiling tile (this works best, though you could use a similarly sized scrap of drywall or piece of flat, high-density foam)
- Gallon freezer bag, plastic film or drop cloth
- Printed or hand drawn image of a bridge structure
- Gloves and safety glasses

Instructions

- Place the picture of the bridge structure on the ceiling tile and put the plastic film over it.
- Insert waxed pushpins with plastic heads at the intersections of the "beams," pushing them in securely.
- Wet out the cotton string with epoxy and wind it around the pushpins connecting each pushpin to the next.
- Allow to cure for 24 hours at room temperature.
- You can determine which composite bridge structure has highest strength-to-weight ratio by supporting the bridges upright over a gap between two tables, and dividing the weight it can support by the weight of the structure.

Optional Increased Difficulty

- Design your own bridge.
- Use fiberglass or carbon fiber rovings.

	Cotton String	Carbon Fiber
Bridge Weight (Grams)	22.7	4.8
Force to Break (Pounds)	120	80
Design		
Strength to Weight Ratio	2,398	7,560

Sides and bottom taped

Sides folded up and taped

Fillet being applied to joints

Tool Box

Required materials

- 2 pieces of plywood (3 ½" x 16"), sides
- 1 piece of plywood (6" x 15 ½"), bottom
- 2 pieces of plywood (6" x 8") tapered with holes drilled for handle, ends
- 1 dowel rod (¾" x 15 ¾")
- Duct tape
- One tube of Six10® Thickened Epoxy Adhesive
- Gloves and safety glasses

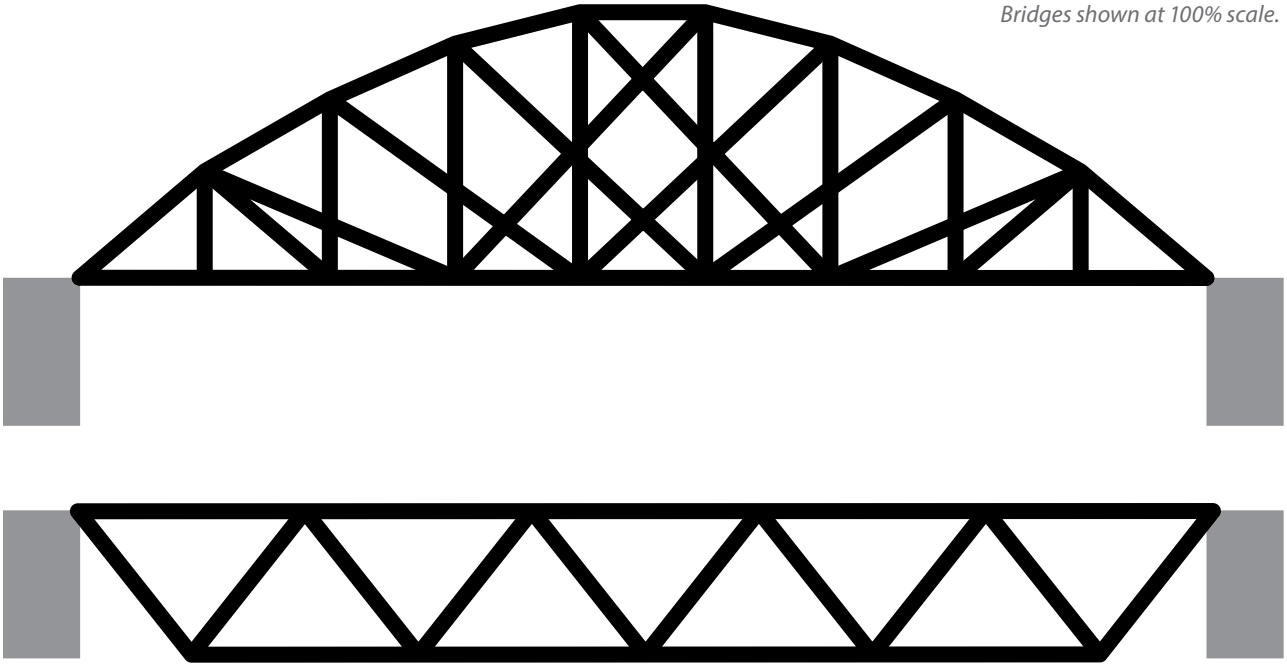
Instructions

- Lay out the sides and bottom with about ¼" gaps between them
- Duct tape them together across the gap
- Flip over, fold up sides and tape together
- Apply Six10 Thickened Epoxy Adhesive and fillet each corner
- Apply epoxy to dowel rod and push into place
- Let cure

Optional Increased Difficulty

- Instead of a tool box, modify the lengths of the wood to build a birdhouse, which is one of the required projects from the merit badge book.
- Instead of Six10, you could also use the 105 Resin® and 205, 206 or 207 Hardener thickened with 406 Colloidal Silica. This is great for learning how to mix fillers into the epoxy, but is potentially messier than Six10.

Bridges shown at 100% scale.



For the Bridge project, I tried some things that did not work so well. I used a lower density foam to support the pushpins, but they moved too much while I wound the string around them. I also tried using nails in wood, but the nails ripped my gloves and the fibers were not as condensed as I wanted them.

The curvature of the pushpins really helps to bring the strands together, and because they had plastic heads, the 105 Resin-based epoxy didn't adhere strongly, allowing them to be easily pulled off after the epoxy cured.

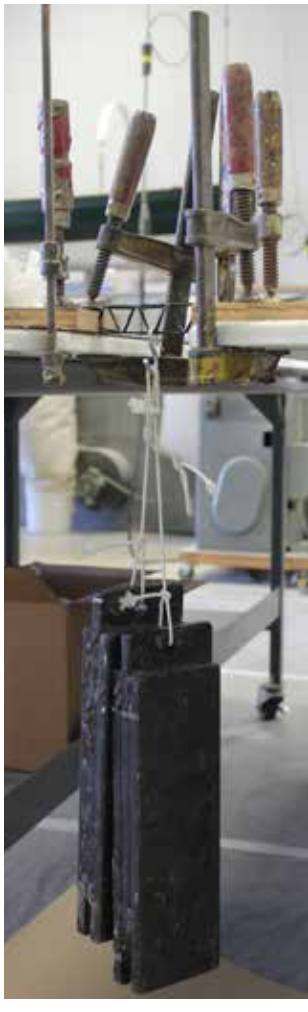
Another difficulty was in wetting out the string or fiber rovings. I cut the cotton string to length and stirred it into the mixed epoxy. This worked for shorter lengths of string, but the longer lengths got tangled and very messy.

I made a miniature impregnator for the string that consisted of a cup, a mixing stick cut to the same length as the diameter of the cup, and a small weight that could be placed on the cup. I drilled two holes on opposite sides of the cup, fed the string through them, and jammed the mixing cup stick into the bottom of the cup. With the cup filled with epoxy to just above the mixing stick's level, I pulled the string through the holes. The theory was that I could saturate the string by pulling it through the epoxy. It didn't work well because I pulled the string too fast, not giving the epoxy enough time to fully wet out the fibers. If you try this method, be sure to pull the string slowly.

Another method I tried was clamping the string to a table covered with a plastic sheet and using a brush to wet the string with mixed epoxy.

During all of this testing, I used several different methods to construct the bridges, including taking different routes when stringing them. This played a huge role in the resulting strength-to-weight ratios. Using just two different bridge designs (see images above) and two different string materials (cotton string and carbon fiber), the strength to weight ratios that I achieved ranged from 600:1 up to 7,500:1. The larger of these ratios would be the equivalent of a 200 pound person supporting 1,500,000 pounds. Had I been more consistent and smarter on how I laid the string down, I am confident these values would be much larger. Also, these numbers were generated by supporting weight from a single point in the middle of the bridge, and would be higher had the loads be evenly distributed throughout the entire length of the bridge. Still, my 4.8 gram bridge was able to support 80 pounds. Biologists say that ants can carry 10-50 times their weight; that is nothing compared to these bridges.

I hope these projects can help others learn about composites; either as a fun project or as a tool in earning the composites merit badge. Contact your local BSA council if you are a Boy Scout interested in earning the composites merit badge or if you are an adult looking to become a composites merit badge counselor. ■



This 6" carbon fiber bridge held 80 lbs. before failing.

Bottom Fairing Adagio

By Greg Bull

Most seasoned sailors would agree that a clean bottom leads to faster sailing. Sometimes it may be necessary to do more than scrub away the algae and zebra mussels, though. In the case of *Adagio*, 44 years of sailing was starting to ripple the bottom of the boat. Simply put, it was time to fair the bottom. While fairing the bottom of your boat may seem beyond your reach, it is a project that novices and experienced boaters alike can accomplish with a few simple tools and a love of a little manual labor.

The first step that I took to fair the bottom of *Adagio* was to get the main hull tipped up on an angle to make working on it easier. (*Photo A*) On most boats 35 ft. or longer, sanding is done above your head with dust falling into your face. This is not that fun to do, and it is better if you have a group of people to help with the sanding.

With the hull tipped up and supported, I easily sanded off all the VC17 bottom paint with a dual-action sander and 80-grit sandpaper. (*Photos B&C*) I used a vacuum to get the dust off the surface and then rolled three coats of epoxy thickened with 410 Microlight® with a 3/8" nap roller cover on to the surface. I waited for the epoxy to tack up between coats. When the 410 mixture is first put on the hull it looks like a textured ceiling in a house, but it will flatten out and look like dimples on a golf ball. I allowed time for all three coats to cure.

The mixture I used was WEST SYSTEM 105 Resin® and 205 Fast Hardener® thickened with 410 Microlight; I thickened it to the consistency of honey. I mixed three or four batches per coat depending on weather. (Epoxy cures faster in warmer temperatures.)

After all three coats cured, the surface was washed with water and a Scotch-Brite™ pad to remove the amine blush and dried with clean white paper towels. Next, I needed to sand down the high spots of the cured 410 mixture. I started sanding with a 2" wide by 4' batten with 60-grit sandpaper on it to find the high and low spots. I used the batten to make sure I was sanding the highs off and passing over the lows. (*Photo D*) I sanded until the surface was smooth or until fiberglass started to show. I did not sand into the fiberglass.

After sanding down the high spots, I filled the low spots with a 410 mixture the consistency of peanut butter. (*Photo E*) I used a squeegee and spread it into the low areas, some of which measured two feet square. (*Photos F&G*) If time allowed, I would then roll on a coat or two of epoxy thickened with 410 Microlight. I rolled the mixture on top to fill the lows and highs that needed to be sanded when dry.

When fiberglass started coming through, I stopped sanding and filled the low spots with epoxy thickened with 410 Microlight. I repeated this process four times. When sanding at this stage, I used 60-grit sandpaper for the first two coats. (*Photo H*) For the next stage of rough sanding, I switched to 80-grit sandpaper. I continued until the sanding board was on the whole surface at one time and I was happy with the results.

At this point I should mention that it is a good idea to sand 45 degrees off the center line with the board running the length of the boat. I tried to sand at


A


B


C


D


E


F


G


H


I


J

45 degrees off the center line the same number of times in both directions. It took different length boards to fit around the hull. A longer board is more effective for fairing a larger area at one time. A shorter fairing board will go into the low spots and make them lower instead of fairing them in.

After the sanding, I cleaned off all the dust and applied four coats of 105 Resin and 205 Fast Hardener to the sanded area. I added 501 White Pigment to color the epoxy. I followed the normal process for coating with epoxy: wet on wet. When doing this, I waited until the previous coat tacked up (or did not come off on my gloved finger when touched). (*Photos I&J*)

After the epoxy cured, I washed away the blush with water and Scotch-Brite pad and dried with white paper towels. I used a dual-action sander with 180-grit then 220-grit paper to sand the surface dull. At this step, I used layout die mixed with acetone to color the surface. This step let me know when I had sanded all the dimples out of the clear coats of epoxy. When I do not have layout die, I use pencils and scribble on the surface so I have a gauge to go by. The high spots sand off the pencil marks and in the low spot they remain. This method makes it easier to get all the imperfections out, and, hopefully, it makes for less sanding.

Once I was satisfied with the fairing on the bottom, I taped the water line and reapplied the bottom paint.

The very last step: put in the water and enjoy! ▪

Repairing an Edison Concert Phonograph

By Tom Pawlak

Crack in the edge of the wooden phonograph horn.

Ronnie Janowicz, a good friend of mine, called to say the wooden horn on his antique Edison Concert phonograph was cracked. I had Ronnie bring it by so I could take a look.

I told him it could be repaired very nicely with epoxy if that is what he wanted to do. "Why wouldn't I want it repaired that way?" he asked. I explained that repairing an antique with epoxy may affect its resale value if the potential purchaser objects to the repair. Some collectors take a dim view of wooden antiques being repaired with epoxy because repairs are not easily reversible like they would be if glue was used for the repair instead.

Ronnie said he had more confidence with the epoxy and was not worried about potential devaluation because the phonograph would stay in his family for at least another generation.

I told him I would be happy to repair it in a very non-invasive way and if I did my job well, he would not be able to tell that it had been repaired.

Repaired Edison phonograph with the original 1913 bill of sale

I gathered the following items before starting the job:

- Spring clamps
- Shop light with an incandescent bulb
- 807 Plastic Syringe
- G/flex 650 Epoxy
- Small plastic tarp
- Cheese cloth

I warmed the damaged section of the horn by placing a shop light close by for 15 minutes or so. I had to be careful because it is easy to damage the finish/patina on the surface of wooden antiques with just a bit too much heat.

I mixed a small batch of G/flex® 650 and transferred it into an 807 Plastic Syringe.

I removed the heat source just before applying a bead of G/flex 650 Epoxy along the crack with the tip of the plastic syringe. Because the wood was warm (maybe 125°F) the epoxy thinned on contact and easily soaked into the cracked section.

Left: Warming the repair area with a heat lamp. Center: Epoxy applied to the crack through a syringe. Right: Removing excess epoxy smears with cheese cloth.

I applied epoxy multiple times over several minutes to fill any remaining voids in the joint.

When the joint would not absorb any more epoxy, I clamped the area with spring clamps, allowed the excess to squeeze out, wiped off most of the excess with white paper towels and wiped off the last of the epoxy smears with dry cheese cloth.

I wanted to avoid using any solvent for cleanup because these old finishes are easily damaged with solvent. I have used dry cheese cloth to remove the last slight smudges of uncured epoxy from the surrounding area many times before with excellent results. An old terrycloth towel will work just as well.

I allowed the epoxy to cure overnight then applied a bit of Old English Furniture Polish to the horn with cheese cloth.

I think from the photos you'll agree that the repair came off fine. More importantly Ronnie is happy. He sent a photo of the Edison with horn installed along with the original bill of sale from March 18, 1913. ■

The Norway Boat

By Gene Steely

This is the story of a 20' sailboat manufactured in Norway in 1956 by the Ejvinds Company. This boat sailed from Iceland to the east coast of Canada, then down to Miami. From Miami it sailed south to St. Croix and the Virgin Islands. After a few years in St. Croix it was brought to the Florida Keys in 1967 and had two or three different owners. I purchased it in the Florida Keys in 2003 and brought it to my home in Murray, Kentucky for restoration.

By the time I towed this 3,000 lb. boat to Kentucky, it was in need of a lot of work. The gelcoat was almost completely gone and was brush painted with green house paint. All the wood inside had rotted away, the paint was peeling and the prop had fallen off. The hull is ½" to ¾" thick and in very good condition.

In 2004, I started rebuilding the boat. I sand blasted the hull and cabin and completely replaced the gelcoat with West System® 105 Resin® and 207 Special Clear Hardener™. I replaced a ¼" x 2" stainless steel part on the bottom of the keel, repaired the rudder bushing, replaced the stringers in the floor, built new floor boards, benches, and bulk heads, installed new windows and built new rails on the outside.

On the inside I used black walnut, and on the outside I used teak. The original instruments and hardware were in good condition and were reinstalled. I outfitted the boat with a new 27 hp diesel Yanmar engine, new shaft, shaft bearings and a new prop. I also finished many small details in 2013.

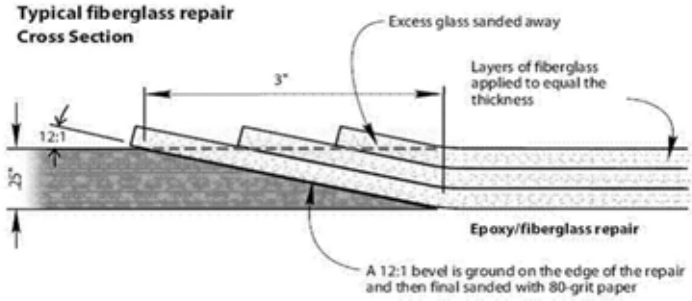
The boat runs perfectly and very smoothly at 2,000 RPMs. The engine turns 3600 RPMs at full throttle. After all the work restoring the boat, I hope to take it back to the Florida Keys before listing it for sale. ■

Exterior and interior views of the restored 20' Norwegian sailboat built in 1956.

Common Errors in Fiberglass Repair

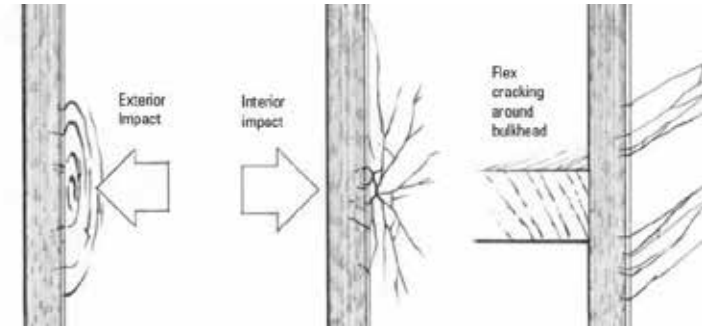
By Jeff Wright

While most of our customers are successful when using West System® Epoxy to repair damaged fiberglass, we have become familiar with some common mistakes that are easily preventable. These mistakes are made by both professionals and amateurs. The information discussed in this article is available in our Fiberglass Boat Repair Manual and West System User Manual, and on our website westsystem.com.



Typical Repair

This diagram illustrates how we recommend laminating a repair after the damaged fiberglass has been removed. It is critical that the scarf angle be at a minimum ratio of 12:1 and that the patch thickness matches the original laminate. Matching the original thickness ensures that the stiffness will be the same as the surrounding area, reducing the chance of a crack around the repair area.

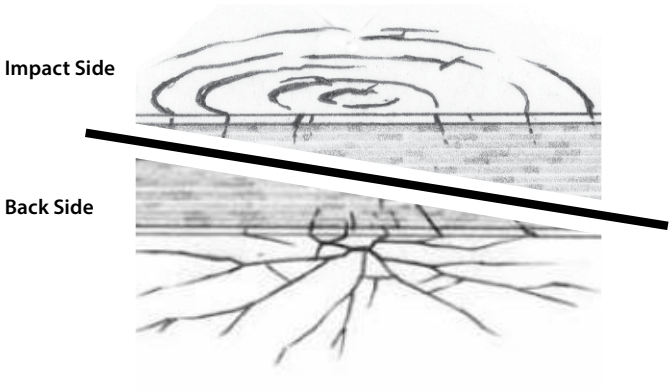


Missing the root cause of damage

Finding the root cause of the damage can ensure that your repair holds up well for years. Stress cracks can help us understanding what caused the damage. They may indicate whether something inside the boat has broken loose and caused the damage or if it was caused by something hitting the boat from the outside. The cracks can also point to a structural defect that must be corrected.

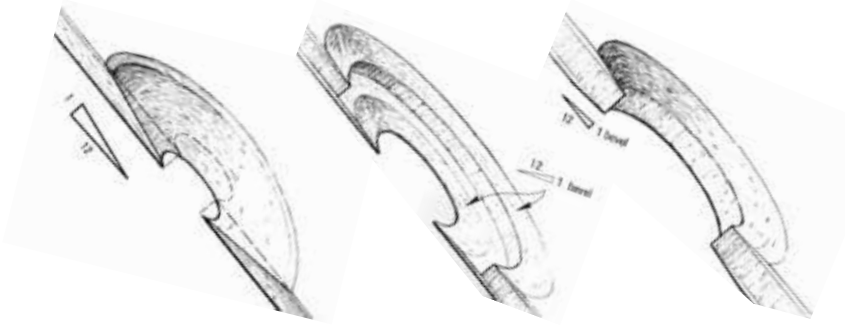
Poor adhesion caused by bonding to a damaged laminate

Adhesion failure in the repair laminate is the most common failure mode for fiberglass repairs. To ensure good adhesion it is critical that the repair patch is adhered to undamaged laminate. This requires identifying and removing all damaged material.



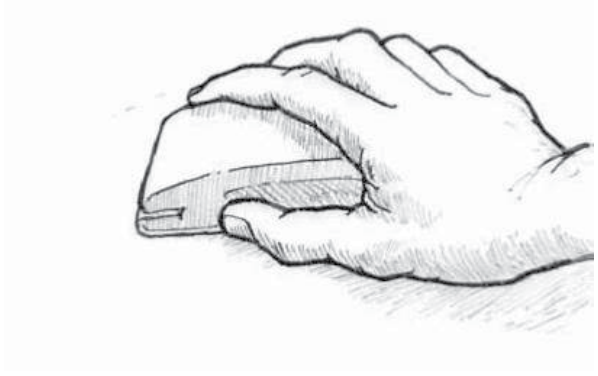
Not accounting for backside damage when estimating repairs.

With a cored composite, damage can be hard to evaluate when just looking at the outer skin. To fully assess the damage, inner and outer skins and the core must be seen. These pictures show a fiberglass/wood/fiberglass laminate that looks only slightly damaged on the impact side, but the back side has significant amount of broken fibers. When there is no access to the back side, you may need to grind away the outer skin and core to inspect the inner skin.



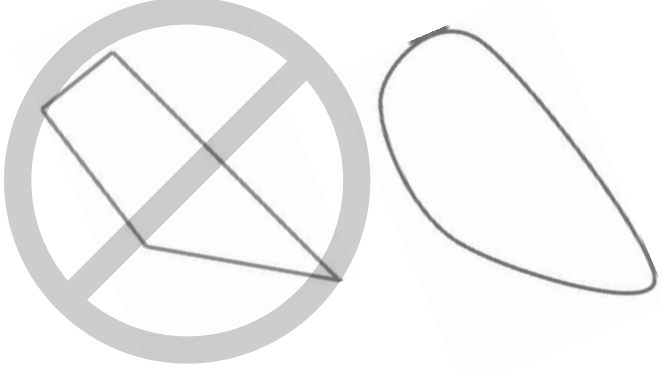
Inadequate scarf ratio

The scarf on the original laminate helps in many ways. It creates a substantial amount of surface area for adhesion and provides a transition zone so that the difference in properties of the new and original laminate are not concentrated at one point. We suggest a minimum 12:1 ratio between the length of the scarf and the laminate thickness. This ratio applies to both skins when repairing a cored laminate.



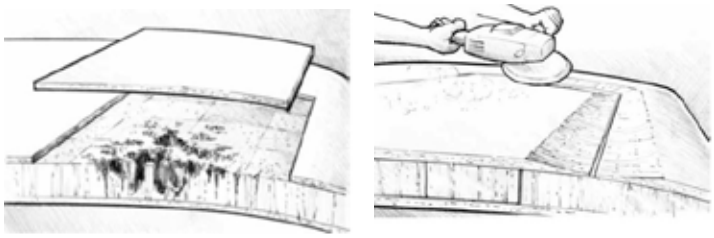
Damaging the surface of the repair area with excessive heat when grinding

The removal of the damaged laminate and creation of the scarf can be done with electric or pneumatic grinders and a 36-grit abrasive disc. Once everything is machined to the proper shape, the surfaces should be sanded by hand with 80-grit sandpaper. This is important because the high RPM power tools can generate significant heat that can soften the surface, resulting in a less-than-ideal surface profile for adhesion.



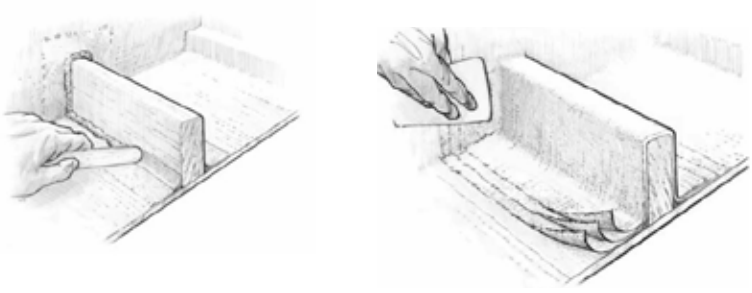
Creating sharp corners when shaping the area to be repaired

Corners can be described as stress concentrations. Machinists know this and avoid creating any sharp corners, machining a radius whenever possible. The same principle applies to fiberglass repair. Before grinding the scarf onto the surface, take the time to create a nice rounded shape to the repair area.



Discarding a reusable skin when replacing core

A common fiberglass repair is replacing damaged core, often because of water absorption. In many of these repairs the fiberglass "skins" are in great shape but need to be peeled off to replace the core. Bonding the original skin back onto the new core can save significant time and money. The only fiberglass required will be around the perimeter of the removed skin. This is a very nice technique when dealing with molded non-skid patterns.

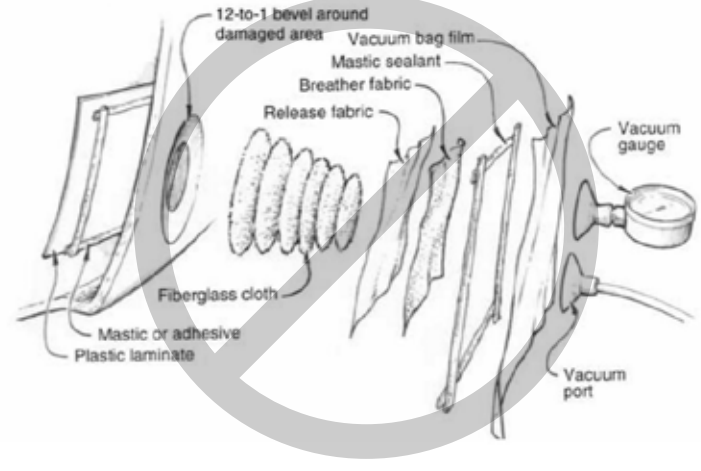


Creating stress concentrations by not filleting corners and tapering laminates

Sharp corners can cause a problem in the laminate just like they can in the shape of the repair area. Smooth the transitions by making a fillet with thickened epoxy on the inside corners. Also, when tabbing stringers and frames into place, taper the layers to create a nice thickness transition.

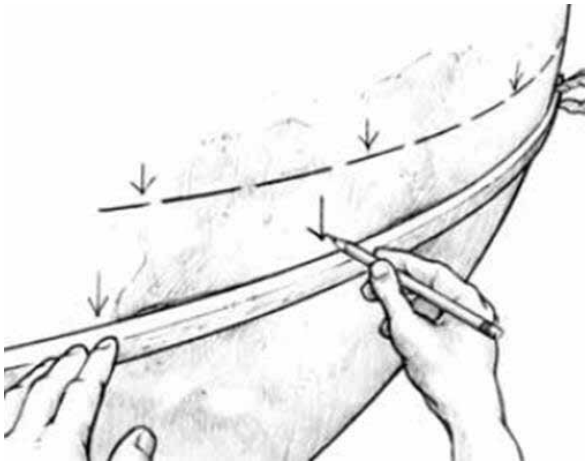
Contaminating the surface after it is sanded

The final hand sanding with 80-grit sandpaper results in an ideal surface for WEST SYSTEM Epoxy adhesion. The sandpaper has exposed resin and fiberglass that has only been touched by the sandpaper so there are no contaminates on the surface. Wiping it with solvents actually increases the risk of introducing contamination either from the rag or a recycled solvent.



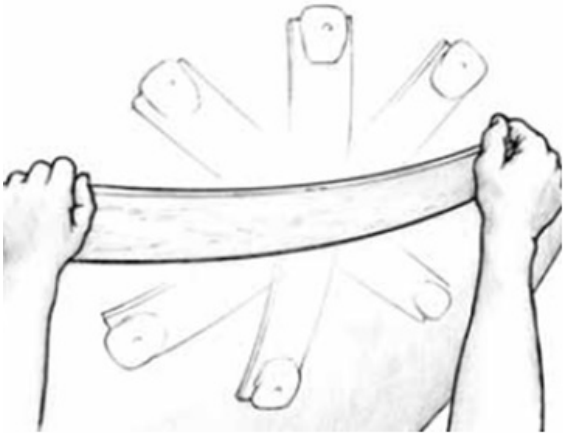
Vacuum bagging the repair laminate when unnecessary

When using a vacuum bag the surface that the bag is sealed against must be airtight. This can be difficult enough when using a mold so in the case of vacuum bagging to a laminate the risk of a leak is substantial. If there is a leak then too much epoxy will be pulled out of the laminate leaving a dry, weak repair patch. It is also important to match the thickness of the repair laminate to the original laminate. If the repair laminate is too thin from being compacted by a vacuum bag it may not be as stiff as the original laminate; if the repair is thicker than the original, it may be much stiffer which can concentrate stress around the perimeter, possibly resulting in cracks.



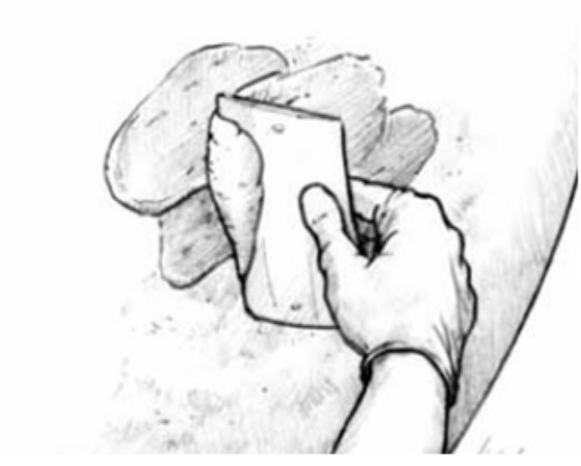
Failing to properly "map" the surface before applying fairing compound

It is well worth spending time to find the high and low spots before applying fairing compound. This is accomplished by using a long batten, as shown in the picture. When the high and low spots are defined it is easier to develop a strategy of what locations need fairing compound and where added thickness is not needed, resulting in less sanding. This also increases the likelihood that the repair will be fair with the unrepaired areas. The WEST SYSTEM Final Fairing & Finishing manual is an excellent guide to saving time and getting great results when finishing the repair.



Using only a palm sander to sand surface resulting in an unfair surface

It is important to use a long board when fairing large flat areas. In many cases, sanding tools designed for automotive bodywork will not work well because boats often have much larger areas to sand. Also, in automotive work the original metal surfaces are much harder than the body filler. In fiberglass boat repair the repair area may have hardness very similar to the original laminate and you can accidentally change the shape of the surrounding area. Plan on using a variety of sanding tools if you are dealing with a repair that bridges both a flat area and a detailed area such as a chine or gunwale.



Applying an extra thick layer of fairing compound does not save time

When fairing the repair, plan on applying at least three applications of fairing compound. Applying thick layers of fairing compound can trap air bubbles and cause you to lose the shape of the surface that you have carefully mapped as mentioned earlier. Although applying fairing compound in multiple layers may seem to take more time, you'll actually spend less time sanding. Multiple layers will make it more obvious where the fairing compound needs to be applied. We also recommend completing the fairing work with a thin coat of unthickened epoxy to provide a nice solid surface for the final finish. ■

For more fiberglass repair information, WEST SYSTEM Fiberglass Boat Repair & Maintenance and Final Fairing & Finishing are available as free downloads at westsystem.com.












Building the Dream

By Laura & Philip Harvey

1. Bulkhead setup

2. Carbon chain plates

3. Hull faired and sprayed

4. Aft cockpit fitout

5. Foam between stringers

6. Hull interior

7. Bridge deck joint

8. Transom and aft steps

9. Aft cabin with engine

10. Foredeck stringers

11. Radius chine

12. Deck stringers going in

We started the DH550 project in the middle of a long-term family cruise. We had sold our boat building company, Harvey Yachts in Cape Town South Africa, and set off on our 38-foot cruising cat. On board were our nine-month-old son and our cat, Velcro.

We sailed from Cape Town to St. Helena Island, Ascension Island, and Azores then into the Mediterranean visiting Portugal, Spain, Italy and Greece before wintering in Turkey. Here was born the dream of a bigger boat that could carry us faster across the oceans. I sketched the boat I wanted to build. I did a lot of thinking about materials before I contacted Dudley Dix, an old friend who had developed the radius chine plywood construction method. He offered to do a collaborative design with me and we set out to do all the planning.

In the meantime we sailed back across the Mediterranean and headed for the Caribbean. When we put our current boat on the market there was a rush of interest, so we headed south to Trinidad to haul and cleanup the boat. It was sold within two weeks. Here we were with a design, and all our earthly belongings. Laura was pregnant so we asked if we could stay to build our next boat. We looked around at what could be done in Trinidad. We had great support from the yard, Powerboats and especially Donald Stolmeyer the manager there. We were introduced to Risa Hall who handled our account at Budget Marine. Without her and the Budget Marine staff it would have been very difficult to build there. We managed to find a piece of land just behind Budget Marine where we had a shed and container storage set up for the build.

We chose the best materials available for this type of build: WEST SYSTEM® 105 Epoxy Resin®, 209 Extra Slow Hardener™ and Brunzeel plywood imported for us by Budget Marine. Locally, we got cedar for stringers and mahogany for structural beams. With *The Gougeon Brothers on Boat Construction* book firmly in hand, we set about building our 55-foot cat *Wild Vanilla*. We used WEST SYSTEM products exclusively and it was a pleasure to work with. We believe this will help our resale price in the future. The boat design can be viewed at dixdesign.com/55cat.htm. We ordered all of our WEST SYSTEM Epoxy, materials and equipment via Budget Marine and Powerboats store.

DH550 Design by Dudley Dix	
LOA	55'
LWL	51' 6"
Beam	28' 7"
Draft	2'6" (7' 2" boards) (3' 4" crusing keels)
Disp.	27,550 lb
Sail Area	1,374 sq. ft.
Power	2x50 HP, diesel

Views of the finished boat's exterior (stern, aft cockpit, and bow)

I started the project on my own. Soon the large plywood sheets I was scarfing together were too large for me to handle, so I employed some local young guys that I trained in the use of epoxy/wood. I soon had six people working with me and I had to train them in all aspects of boat building.

We first made all the plywood bulkheads for the hulls, then put them up on "feet" while I lined them up to accept the long cedar stringers we had made. After this we started adding the scarfed hull panels to the frames. All panels were pre-coated with WEST SYSTEM Epoxy then glued and screwed to the frames. All fasteners were removed once the epoxy had cured.

I used the radius chine construction method to make the hull radiuses. The final hull panels contained carbon fiber chain-plates for the rigging. We then started the fairing process, all the while adding coats of epoxy. We ended up with six solid coats on the hulls before the painting with epoxy high-build primers and finishing in Awl-Grip® topcoats.

Each completed hull was turned upright and set in position before we added the bridge-deck to join the two hulls. The main bulkheads were finished and bonded together. Structural mahogany timbers were bonded to these to complete the I beams of the mast and aft cockpit bulkheads. We added foam between each stringer and additional ¼" plywood to the stringers of the interior. Inside the hulls, this made an even finish that is well insulated from heat and noise. Next came the hull decks. And lastly the coach-roof was finished in the same method as the hulls. Slowly we added the engines, and other interior equipment. The interior was built and finally the electrical and plumbing were complete. We did all our preparations for finishing before I hired a local spray painter (they do the most amazing work outdoors).

Our daughter Jade was born during the build. We sure had our hands full completing a boat and raising young children in the boatyard. We finally launched and once again headed out for the Caribbean.

After a few years I took on some work at the Island Water World chandlery. It was at this time that we were contacted by Peter Johnstone from Gunboat to set up a new Gunboat 60 build program in China. We were there for two years before we came to North Carolina to set up a new yard for the Gunboat 55 catamaran. Now finally we are heading back to *Wild Vanilla* in Grenada for more adventures. She has been on the hard now for three and a half years under the care of Jason Fletcher in Grenada Marine. We will make the final preparations to either do another cruise or consider selling her to make way for our children's further education and the next adventure of the Harvey Family. ■

The front of the school on the day I visited, December 2, 2013. There's already plenty of snow around. Living in the U.P. takes a special breed of individual and one thing is for certain—you must like winter!

Keeping Our Great Lakes Maritime Heritage Alive

The Great Lakes Boat Building School

By Bruce Niederer

On November 27, 2006 ground was broken on a perfect waterfront site overlooking the Les Cheneaux islands in Cedarville, Michigan in a ceremony that marked the end of a two-year fundraising effort and the beginning of The Great Lakes Boatbuilding School.

The Les Cheneaux islands are a group of 36 small islands, some inhabited during the summer months, along a 12-mile stretch of the southeastern shoreline on the Upper Peninsula of Michigan about 30 miles northeast of the Straits of Mackinac. Les Cheneaux is French for "the channels" which describe the extensive system of channels in and

Top Right: The school accepted this 20' fiberglass launch as a commissioned job to modify and finish the interior structure necessary to convert it into an electric launch and to install a wood/ composite deck.

Top Left: The cedar getting sanded fair before getting coated with epoxy and glassed by second year students: (l-r) Troy Huesdash, Matt Edmondson, Kris Kindt and Del Jacobs. The Roberts Runabout is mahogany veneer over plywood. Bottom Left: The upright build is a Harry Bryan design named Katie. All first year students begin by learning to build using a "right-side up" technique.

Bottom Right: A Garvey work boat—a 16' design that utilized the scantlings from the original 19' 7" design built at the Mystic Seaport Museum. It will be driven by an outboard engine mounted in an inboard well and, like the original, it will help move GLBBS boats. This build is a replica of a 100-year-old design sold by the Petoskey Boat Co.

around the islands which make it a popular resort destination for boating and kayaking. Cedarville and its neighbor three miles to the west, Hessel, are small mainland communities that provide marina, lodging, restaurant, camping and shopping amenities to both summer and year-round residents. It's a beautiful and historic setting to build what has become the only accredited boat building school in Michigan.

In January of 2007 Patrick Mahon, a master boat builder and highly respected instructor, signed on as Program Director and began work developing a nine month program. The new 12,000 square foot facility was dedicated with a ceremony on August 4, 2007 in honor of the Noyes family, summer residents since the 1800s and a major fundraiser for the project. In September, the school received its Michigan State proprietary school license and the doors opened for the first seven students. In October, North Central Michigan College's Board of Trustees unanimously approved an articulation agreement with the Boat School to establish an associate degree in wooden boat building as part of their Applied Science Degree program. The school's mission statement says it all:

The Great Lakes Boat Building School teaches and inspires students in the art and craft of traditional and contemporary wooden boat building, which prepares them for productive and rewarding careers in the marine trades. We strive to contribute to the growth of each student as a person and as a craftsman to impart an appreciation of the maritime heritage of the Great Lakes and North America.

My relationship with the school changed a bit sometime in late 2011 or early 2012 when Bud McIntire, Student Services and Industry Relations Director, asked me to take the spot on the Program Advisory Committee vacated by my friend and retired co-worker Jim Watson. I am privileged to join Sandy Bryson from the Michigan Maritime Museum, Tom Flood a past president of the Antique Classic Boat Society, Brian Nettleton a shop instructor with Detour, Michigan High School, and Steve Van Dam, renowned boat builder and owner of Van Dam Custom Boats. The names and faces have changed over the years on the Executive Board and Technical Advisory Board (which is now the Program Advisory Committee.) For example, Tom Flood has been an officer on the Executive

Left: This build is a replica of a 100-year-old design sold by the Petoskey Boat Co. The original boat sold for $40 in the 1910 catalog.

Bottom Right: This is a cold molded, cedar strip and glass, vacuum bagged hull that was built at the school and had been sitting for a couple years and not getting much attention—so Andy bought it for himself. He's in the process of adding floors and interior structure. Eventually, it will have a cuddy cabin and be powered by a 15–25 hp outboard engine. Perfect for toolin' around Les Cheneaux.

Left: This boat was found somewhere in Michigan and given to the school. The students had to work to get the boat back on its lines so they could take scantling measurements and loft the boat to make the replica.

Middle: The full-size lofting diagram.

Board, a director on the board, a director on the Tech Board and now a member of the program committee. The school has been very fortunate to have many such involved and talented people each of whom has contributed to the wise guidance of the school, from accreditation to financial viability. The value of proper management as a key to the success of the school cannot be overstated.

So enough about the history, let's looks at what's happening in the shop now for the 2013-2014 school year. I took a little drive recently up to Cedarville—a paltry 452 mile round trip—to visit, take some pictures and do some research for this article. (To Michiganders, "up" or "up north" means heading some place north of Bay City or West Branch, depending on how far south you start). I was met by Pat and second year instructor Andy James. Pat was busy with first year students so Andy gave me the nickel tour and explained each of the current projects they are working on.

We began my tour by looking at a commissioned project that the four second-year students were working on which is an 18 ft. Runabout designed by Tad Roberts. What was originally commissioned as a 16 footer became an 18 footer on the urging of Andy, Pat and other staff. Andy explained that after looking at the lofting, a skill that all the student's experience, the lines just looked better at 18 feet and they convinced the owner they were right. Built using ¾" cut plywood frames, the boat will be stripped with ¾" thick cedar to the chine and glassed, the sides will be ⅜" plywood lap strake.

An impressive and prestigious project that was finished last year was an authentic whaleboat to be used as one of a fleet of eight such boats built to support the restoration project of the last remaining wooden whale ship and oldest American commercial vessel in existence: the Charles W. Morgan. The restoration of the Morgan has been taking place for years at the Mystic Seaport Museum in Mystic, Connecticut. Pat and his wife Lisa, Bud, and second year graduate Ed Greiner delivered the completed boat to Mystic in June of 2013 where it was on display at the GLBBS booth during the Wooden Boat Show. The boat, built by the class of 2013, is now on permanent display at the museum. You can learn much more about this project on the school's web site glbbs.org/Boats/Whaleboat.

Kees Prins was instrumental in the building of the whaleboat which was accomplished using only

Top Left: The mill shop where wood is stored and machined.

Top Right: The whaleboat was launched at the public dock in Cedarville during last year's graduation ceremony.

Left: The view across the channel at a vacation home boarded up for the winter. I'm told none of these houses are insulated for a U.P. winter and sit empty until spring.

the tools and technology available at the time. No power tools, no epoxy, not even sandpaper. The finish was achieved using planes as would have been done by builders in 1841 the year the Morgan was built in New Bedford, Massachusetts.

At the WoodenBoat Show in Mystic, Connecticut, the legendary Willits Ansel, who is regarded as the definitive expert on this unique American boat, paid particular interest to the GLBBS Whaleboat. Ansel is the author of *The Whaleboat: A Study of Design, Construction and Use from 1850-1970* detailing the history and construction of the vessel. He is also a master shipwright at the Mystic Seaport Museum and commented on the authenticity of the GLBBS whaleboat. Quite a compliment and accomplishment!

Good management plays an important role in the success of the school. Another example of good planning and foresight are the Summer Workshops held at the school while the students are on hiatus from their daily studies. The school runs a non-stop calendar of two-week seminars that include projects that range from metal casting to women's woodworking to lofting and name board carving, in addition to 10 or more different boat building projects. The school has developed a good relationship with Chesapeake Light Craft (CLC), the largest supplier of kit boats in the US, building many of CLC's designs such as the Sassafras canoe, stand up paddleboards, plus a number of kayak designs.

Finally, the real measure of a successful school is whether or not the graduates find work in the marine industry. Bud has told me that the school has a placement record for students interested in making a career in the marine industry of near 85%. Some students never intend to work in the industry—they may be interested in building boats as a hobby or a private business. That's an pretty darn good success rate. A partial list of businesses that have hired GLBBS grads is Tiara Yachts in Holland, Michigan, Van Dam Custom Boats in Boyne City, Michigan, Maritime Classics in Traverse City, Michigan, Brightworks Boatworks in Madison, Wisconsin, the Chesapeake Bay Maritime Museum in Maryland, the Danish Maritime Museum in Denmark, and Mertaugh Boat Works in Cedarville, Michigan. Ed Greiner has opened his own shop Liberty Call Boatworks in Grand Haven, Michigan.

If you are interested in learning more about the Great Lakes Boat Building School or possibly becoming a student please visit glbbs.org. ■

Turned wooden goblet. The cracks are filled with G/flex 650 and black pigment.

Goblet Rx

By Tom Pawlak

Vern, a good friend of mine, turned the exterior of a wooden goblet made from a nice piece of spalted sycamore. Unfortunately the blank was not as dry as he thought and it cracked along one edge as it sat uncovered on his lathe overnight. He called to see if there was anything available for gluing it back together. I said I had some ideas and asked him to drop it off at work so I could take a stab at the repair.

I asked if he wanted me to match the wood color or to accentuate the crack by filling it with a dark epoxy. He decided a bold black crack fill might make for an interesting feature in the goblet so I went about setting up the repair.

The first thing I did was dry the goblet a bit more so the wood would not continue to shrink after the crack was repaired. I put it in the warm/dry environmental hut we affectionately refer to as the Arizona Room. This room is set at 100°F with very low humidity. I meant to leave it in there for 3-4 hours in front of the forced air electric heat source. I came back three days later. (Yes, I had forgotten it over a weekend and the crack had increased in width from ⅛" wide to ¼" wide—a 100% increase!) Embarrassed by the mistake and for the significantly wider crack, I called Vern to give him the bad news. He said, "That's OK. It was junk before I called you. Just go ahead and fill the crack."

My plan was to use G/flex® 650, the liquid version of G/flex, so it would flow down into the crack. I chose G/flex Epoxy over 105 Resin based epoxy because it is more flexible and not as hard. It machines similar to wood when you cut it compared to 105 Resin/Hardener based epoxy that is noticeably harder when cutting/machining. G/flex 650 Epoxy is similar in viscosity to room temperature honey and like honey is thinner

Clear cellophane tape applied over the crack to contain the epoxy.

Above: Syringe tip being inserted into a straw

Right: Cracks in the goblet filled by a syringe with straw extension.

when it is warm. I began by warming the goblet to 100°F. I covered the crack with clear cellophane tape to keep G/flex from leaking and so I could see the epoxy as it filled the crack.

I added a bit of 423 Graphite Powder to the epoxy (see Bruce Niederer's article Adding Pigments to Epoxy in *Epoxyworks 21* for more ways to color epoxy). I mixed it thoroughly and used an 807 Plastic Syringe to inject it into the crack. To get the epoxy injected near the bottom of the crack, I slipped a ⅛" diameter plastic straw onto the tapered tip of the syringe (see photo) so the epoxy did not have far to flow.

Injecting the black epoxy into the 100°F wood lowers viscosity on contact which helps it flow into recesses of the crack and lets air bubbles rise to the surface and escape.

Bottom Right: Close up showing how the plastic straw extending the syringe tip conforms to narrow cracks

I called Vern the following day to let him know his goblet was ready to go. Vern reported later that when he turned the inside of the goblet on the lathe the cured G/flex turned just like wood with the shavings at times coming off the cutter in a continuous ribbon.

Vern eventually applied his favorite wood sealer and wood finish to give the goblet a nice subtle shine. I think viewing the photos you'll agree that it was worth saving. ■

Introducing Bryan Jacobs

The Gougeon Technical Department has added a new lab technician, Bryan Jacobs.

Before coming to work at Gougeon Brothers, Bryan served in the United States Army and earned the rank of Sergeant (E-5). Bryan served multiple combat tours in support of the global war on terrorism and was awarded the Bronze Star. He then tried out for a Long Range Surveillance Unit (LRSU), where he was deployed in support of Operation Iraqi Freedom.

Bryan left the Army in late 2010 and used funding from the G.I. Bill to earn his associates degree in Chemical Technology from Delta College. He interned at a local company that produces oil and lubricants. In his spare time Bryan enjoys outdoor activities such as hunting and fishing. He also enjoys drawing and painting. ■

G/flex Keel Repair

By Don Gutzmer

Early in March of 2012, a local boat owner called our technical line and asked about repairing his cast iron wing keel with WEST SYSTEM® Epoxy. He asked if a technical advisor would be willing to take a look at the cracks on his keel and recommend the best way to repair it. After looking at the boat I gave the customer a call back and recommended using G/flex® Epoxy. The advantage of G/flex is that it is a toughened system that has a tensile elongation of more than 30 percent, which would prevent cracks from reappearing in the fairing compound. The boat owner then asked if I knew of a person in the area that could do the repair. I told him that I would be willing to take on the job and thought it would be a good opportunity to write an article about repairing a keel with G/flex Epoxy. Here are the steps I used to fix the problem; the pictures will help tell the story:

Multiple small cracks in fairing compound on each side of keel varied from 6" to 12" long. Cracks continued to the leading edge of the keel and in areas where the iron was exposed it rusted. Many of the boats in the boatyard had similar cracks.

The first step was to sand a shallow bevel on each side of the crack to increase surface area for the epoxy. The metal surfaces were sanded with 60-grit to expose bright metal.

In the areas where the iron was exposed, G/flex was applied and the uncured epoxy worked into the metal with a wire brush. This step removes the weak oxidation layer and suspends it in liquid epoxy where it is sealed, and exposes fresh metal for better adhesion.

Left: G/Flex 655 thickened version was used to fair the sanded surfaces.

Right: A plastic squeegee worked well to fill all low spots with epoxy.

Once the epoxy had cured, the surface was cleaned with a Scotch-Brite® pad and water to remove amine blush (greasy film) that can form on cured epoxy. The surface was dried with plain white paper towels to avoid leaving any contaminates behind.

The surface was sanded fair with 60-grit by hand before applying paint. G/flex 655 sands better than less flexible epoxies. An orbital sander would be a better way to get the job done faster, but in this case power was not available.

One year later I got a call from the boat owner to do more work on different areas of the keel that had rusted. In the areas that were repaired with G/flex it had held up great. Repeating the steps I used before, I am confident that G/flex will take care of the problem.

For information about WEST SYSTEM® products or technical information for a building or repair project, Gougeon Brothers offers a range of detailed publications that can help you get started. These publications are available at your local WEST SYSTEM dealer or by contacting Gougeon Brothers. They are also available as **free downloadable PDFs at westsystem.com.**

Free literature (US and Canada only)

Visit westsystem.info to order online or call 866-937-8797 for the WEST SYSTEM free literature pack. It includes:

002-950 **WEST SYSTEM User Manual & Product Guide**—The primary guide to safety, handling and the basic techniques of epoxy use. Includes a complete description of all WEST SYSTEM products.

000-425 **Other Uses–Suggestions for Household Repair**—Repairs and restoration in an architectural environment. Many useful tips for solving problems around your house and shop with epoxy.

Also included are the current price list and stocking dealer directory.

How-to publications

For sale at WEST SYSTEM dealers, from the WEST SYSTEM Info Store at westsystem.info, or by calling our order department, 866-937-8797.

002 **The Gougeon Brothers on Boat Construction**—A must for anyone building a wooden boat or working with wood and WEST SYSTEM Epoxy. Fully illustrated composite construction techniques, materials, lofting, safety and tools. 5th Edition, revised in 2005.

002-970 **Wooden Boat Restoration & Repair**—Illustrated guide to restore the structure, improve the appearance, reduce the maintenance and prolong the life of wooden boats with WEST SYSTEM Epoxy. Includes dry rot repair, structural framework repair, hull and deck planking repair, and hardware installation with epoxy.

002-550 **Fiberglass Boat Repair & Maintenance**—Illustrated guide to repair fiberglass boats with WEST SYSTEM Epoxy. Procedures for structural reinforcement, deck and hull repair, hardware installation, keel repair and teak deck installation.

002-650 **Gelcoat Blisters-Diagnosis, Repair & Prevention**—A guide for repairing and preventing gelcoat blisters in fiberglass boats with WEST SYSTEM Epoxy.

002-150 **Vacuum Bagging Techniques**—Step-by-step guide to vacuum bag laminating, a technique for clamping wood, core materials and synthetic composites bonded with WEST SYSTEM Epoxy.

002-740 **Final Fairing & Finishing**—Techniques for fairing wood, fiberglass and metal surfaces. Includes fairing tools, materials and a general guide to finish coatings.

002-898 **WEST SYSTEM Epoxy How-To DVD**—Basic epoxy application techniques, fiberglass boat repair and gelcoat blister repair in one DVD.

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Above: Designed and built by veteran boat builders Gregg Hatten and Roger Fletcher, this handcrafted wooden rocking boat is a replica of the historic McKenzie Style Drift Boats that run the Big Water Rivers of the Pacific Northwest. For more information on how to buy or make your own, visit therockingboats.com
(Does this little boat seem familiar? Maybe that's because it's a 1/3 scale version of Portola featured on the cover of Epoxyworks 35.)

Left: Coyote, a Wee Lassie canoe built by David Wohl, won Honorable Mention both in 2012 and 2013 at the Wooden Boat Show at Mystic Seaport in the Concours d' Elegance competition in the Owner Built/Man-powered division.

The circular coyote inlay on the front deck is framed in purple heart. The coyote is African padauk, and its eye is brass. The mountainside is Brazilian rosewood, the night sky is black walnut with silver stars and the moon is burled maple with a nice burl that looks like a crater.

Readers' projects

Facebook Feature

October 15, 2013

A beautiful strip built kayak made with WEST SYSTEM Epoxy. This photo was shared with us on Facebook by the kayak's builder, Scott Codding.

Like WEST SYSTEM Epoxy on Facebook and share your latest WEST SYSTEM creations.

Below: This stand up paddle board, commonly called a SUP, was lovingly hand crafted by Joe Pakkala. His attention to detail is impressive in the herringbone inlays and the non-skid foot pads incorporated into the epoxy's finish. As opposed to traditional adhesive non-skid pads, incorporating the nonskid into the epoxy allows you to have a safe place to stand without covering the beauty of a natural wood finish.