FREE

EPOXYWORKS®

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In This Issue

EPOXYWORKS®

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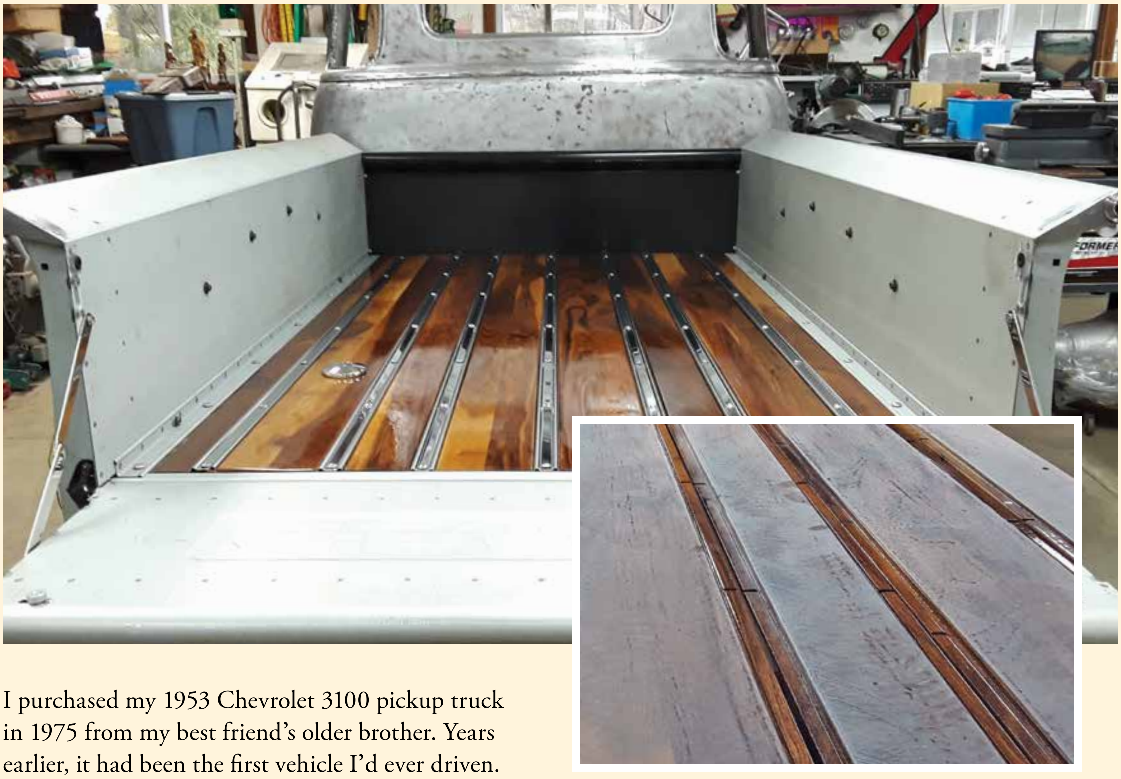
NEW Bed for a Tired TRUCK

By Kerry Barnard



The completed truck bed in the remodeled 1953 Chevrolet 3100 pickup truck.

I purchased my 1953 Chevrolet 3100 pickup truck in 1975 from my best friend's older brother. Years earlier, it had been the first vehicle I'd ever driven. For the next 29 years, it was stored outside and used sporadically. In 2004, I half-heartedly began restoring it and finally got serious about the project when I retired in 2018.

After being exposed to Minnesota weather for many years, most of the truck's wooden bed was rotten or missing. With a few sections that survived and the help of YouTube, I was able to reproduce the eight wooden boards close to the original ones. I used some black walnut that my dad—a woodworker for many years at a local grandfather clock company—obtained that wasn't up to their standards. However, the truck's original design required four of the eight boards to be 7 1/8" wide but the widest boards I had on hand were only 5" wide.

I recall my dad always using Elmer's® white wood glue for joining wood and that if the excess glue wasn't properly removed before drying it created more work (sanding) and/or affected the final finish. WEST SYSTEM® 105 Resin® and 207 Special Clear Hardener® was the perfect solution. It had the right adhesive properties to hold the wood together and resulted in a clear, hard surface that would show off the grain of the black walnut. A call to Technical Advisor Don Gutzmer at Gougeon Brothers confirmed my choice. He provided tips and much-needed guidance.

I used a dual-action sander with 120-grit sandpaper before applying the first coat of 105/207 to the walnut boards. I applied three coats, leaving 2 ½ to 3 hours between coats. I think the best tip (pun intended) was using a small section of a foam roller to tip the fresh epoxy after rolling it on. It did a great job of leveling the surface.

Before final sanding, I let the epoxy cure for three days. I sanded using 120-, 220- and 320-grit. Then I used a microfiber cloth to wipe off the dust. I followed up with a maroon Scotch Brite® abrasive hand pad, then 600-grit and 800-grit sandpaper. Again, I used a microfiber cloth and alcohol to remove all traces of dust/residue. For the final finish, I used an Spraymax® 2K Clear Coat an ultraviolet-resistant automotive coating.

For my first project of this type and size, I am thrilled with the results. It turned out so much better than I ever could have expected!

Chris-Craft Transom REPAIR

By Don Gutzmer — GBI Technical Advisor

In order to demonstrate proper repair methods, our Technical Department purchased a neglected 1980 Chris Craft Scorpion 230 in need of a complete restoration. It had rotted stringers, transom, cockpit sole, and other problems common in fiberglass boats. I'll explain the process we used for replacing the transom to provide some direction on tackling similar projects.

To prevent future issues, it was important to investigate why the wood in the transom had rotted. The water intrusion appeared to be coming from the screws holding the rub rail onto the boat. To evaluate the extent of the damage to the transom, we needed to remove the inner fiberglass laminate. We pulled out the motor and removed the transom assembly to gain access to the inner laminate. This way, enough of the structure was left intact so the hull maintained its shape. The trailer was supporting the hull so additional blocking was not needed and we only worked on the transom. Our plan was to repair the plywood in the transom from the inside so we wouldn't need to perform cosmetic repairs to the outside fiberglass laminate; it's difficult to color-match gel coat and to get the repair perfectly fair.

In addition to the transom, the entire cockpit sole had such bad wood rot that, in some places, you could step right through it. We removed the sole during the demolition phase, making it easy to access the entire transom.

A vibrating multi-tool was effective for cutting the inner fiberglass laminate into small sections for removal. Using a hammer and wood chisel, we peeled the laminate away from the plywood.

Measuring the transom's original inner fiberglass laminate with slide calipers, we determined the thickness needed to make the new fiberglass laminate. The 1 ¾" plywood transom needed to be entirely removed because it was rotted and damp in many areas. I found that a small circular saw, set to the depth of the plywood, was efficient for cutting out the wood in manageable sections. Wood chisels, a flat bar, and a hammer were useful tools for removing the rotted wood. We quickly filled multiple trash bags with all the small wood pieces.

To prepare the outside polyester laminate for excellent epoxy adhesion to the new plywood, we used an orbital sander at a low speed with 80-grit.

Next, we made a cardboard template for tracing out the new plywood pieces. The new plywood consisted of two layers of ½" and one layer of ¾" Okoume marine grade plywood BS1088. We chose marine-grade plywood instead of exterior-grade plywood because marine grade is free of voids and higher in quality. In order to match the original laminate stiffness, we needed to match the original plywood's thickness. We cut three separate pieces of plywood per layer to help make it manageable to install. The butted vertical plywood seams were staggered by at least 3" from one layer to the next, providing uniform strength across the entire transom.

Draping plastic sheeting over hull sides helped keep the hull free of epoxy drips while we installed the first layer of ¾"-thick plywood into the transom. Unlike the original, we beveled the top of the plywood for easier installation. So we'd have enough assembly time, and to get good contact between the plywood and fiberglass laminate, we installed only the first layer of ¾" plywood into the transom during the first epoxy operation. West System® 105 Resin® and 206 Slow Hardener® provided sufficient working time for epoxying the plywood.

Greg Bull helped with mixing the epoxy, which cut down on mess since I didn't have to climb in and out of the boat to get more epoxy. If I'd tried to worked solo in the warm temperatures, the epoxy would have kicked off too fast and more cure cycles would have been needed to complete the project.

Greg coated both sides of the ¾" layer of plywood with neat epoxy at the same time I applied neat epoxy to the transom. Then I thickened the epoxy to a mayonnaise consistency with 406 Colloidal Silica Adhesive Filler and applied it to the transom with an 809 Notched Spreader to achieve a consistent thickness. Greg handed me the first layer of panels to bond into place.

To create a transition from the new plywood transom to the hull sides and bottom, we applied a fillet of West System Epoxy thickened with 406 filler to a non-sag consistency. An 808 Flexible Plastic Spreader with one corner cut to a 2" radius made a great filleting tool.

The laminate required two layers of 17 oz. biaxial fiberglass fabric with mat (West System 738) to match the original inner laminate thickness. To save time cutting the fiberglass layers to be installed over the new plywood, we modified the cardboard template we'd used when we traced out the plywood. The first layer of fiberglass fabric extended onto the hull sides and bottom by 3" and the second layer extended 2", creating a gradual transition. The fiberglass fabric was overlapped on the vertical seams by 2" and the overlaps for each layer were staggered.

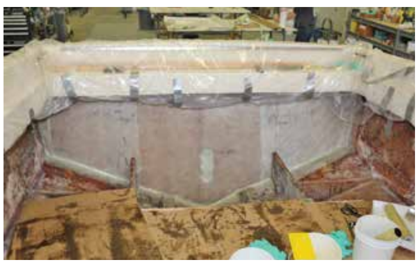
Using a black indelible marker, we marked each piece for proper alignment. We applied neat epoxy with an 800 Roller Cover to each side of the fiberglass fabric, completely wetting out each layer. Dragging a plastic spreader over the fabric at a 45-degree

Removing the inner skin from the rotten plywood.

Cardboard template for tracing new plywood pieces.

Installing the new plywood.

Applying fiberglass to the plywood transom.



Fiberglass has been applied to the transom and tabbed on to the hull.

The completed transom painted with marine bilge paint.

Using the existing holes for the swim platform, we drew the plywood against the fiberglass laminate with screws and large washers. I then laid a short 2" X 4" covered with cellophane tape (to prevent the epoxy from sticking) across the opening for the outdrive assembly. We used C-clamps to hold the 2" X 4" in position until the epoxy cured.

The following day, we sanded off the epoxy that squeezed out between the seams. Using the same procedure as we did for the first layer of plywood, we installed the remaining two layers of ½" plywood. Next, we braced and clamped them in place and waited for them to cure.

angle forced the fabric against the plywood, ensuring it was thoroughly wet out with epoxy. The last layer of fiberglass received three coats of epoxy, filling the weave of the fabric.

After the epoxy cured, we cleaned the new inner fiberglass laminate with water and a 3M Scotch-Brite™ pad, sanded it dull, and applied gray marine bilge paint. To prevent future damage from wood rot, we epoxy coated the outdrive and swim platform holes drilled into the transom.

The transom repair was a good start to a multitude of future projects that will need to be completed before this Chris Craft gets back on the water.

Getting to Know the SCARFFER®

By Terry Monville — GBI Technical Advisor

Scarfing wood together dates back ages. Scarfing is the process of cutting corresponding angles (or sometimes shapes) on two similar pieces of wood and gluing them together to create a larger piece of lumber or plywood. The most common place scarfing is used is in building a stitch-and-glue canoe or kayak.

I had plans to build two kayaks over the winter, with five scarfs on each hull. I'd only done a few scarf joints over the years, so this was an excellent opportunity to learn the pros and cons of the WEST SYSTEM® 875 Scarffer. There are several different ways to join plywood but for stitch-and-glue construction, scarfing allows more of a natural bend to the wood that you can't achieve with a butt block or a half lap joint.

The 875 Scarffer is an excellent tool for cutting the 8-to-1 scarf needed for plywood. It's ideal for plywood up to ¼" (6 mm). For plywood ¼" (6 mm) to ½" (12 mm), the scarf needs hand finishing due to the depth of the sawblade.

Like any new woodworking tool, there is a little setup time required. You will need to drill holes in the baseplate of your circular saw. Check the alignment of the holes on the base plate before drilling. Some saws may have added support or a bracket that could interfere. It's rare but possible. Follow the directions included with the scaffer on laying out the holes and drilling. Then bolt the guide and guard onto the saw. If you pick up a cheap saw at a rummage sale you can leave the guard on the saw, saving you the trouble of bolting and unbolting the Scarffer every time you need to make a scarf.

Instead of trying to scarf two sheets of plywood together, I precut my panels to the size needed for the hull. This way, my longest scarf is 12 ½" and I don't have to handle a 4' x16' sheet of plywood once scarfed together. The downside is that I have to set up, square, and cut ten separate pieces.

The instructions called for a piece of 2"x 4" to be clamped on the end of a table to act as a fence to run the guide along. The end of the plywood you are scarfing needs to stick out 3 ⅝" from the fence and 3 ½" from the edge of the table. The goal here is to provide enough room under the plywood so the attachment has clearance and doesn't hit the table. On the topside, the guide will overlap the table by ⅛". This is to support the guide so the weight does not bend the plywood.

I thought the setup was a lot of work to go through ten times for each boat. To make things simpler, I cut a couple of stopper blocks notched by ⅛". I screwed these onto my 2"x4" to offset it ⅛" back from the edge of the table.

Close-up of the stopper block notched by ⅛".

With my new setup, I could lay down my strip of plywood and place the fence assembly over top. While holding the fence assembly flush to the edge of the table, and using my combination square, I squared up my plywood with the end of the piece 3 ⅝" from the fence. When everything was perfectly aligned, I clamped the 2"x4" fence to the table, therefore clamping the plywood between the 2"x4" and the table too. Now I'm ready to cut my scarf. A few months later when I start the second boat, I'll just pull my fence and scarfing saw from the shelf. I'll be able cut the ten panels and epoxy them together in about an hour.

Squaring the plywood to the fence.

A Few Tips

A couple of practice cuts on some scraps is worth the time and material. I went a bit overboard on this, trying not to goof things up. This experimentation is how we learn and have a remedy ready when a customer contacts us. Through this I found out about the saw twisting. Once the guide is more than halfway off the plywood, the saw's weight wants the front of the saw to tilt down to the table (an ⅛" lower than the surface of the plywood). The back of the blade is now cutting off a little extra. I tried using a small piece of wood the same thickness as I was scarfing to help support the guide, but I found it just got in the way. It wasn't worth the trouble. Just be aware that the saw wants to tilt and holding it level works great.

I also added a second 2"x4" clamp. Clamping the fence alone did not hold the plywood tight enough to hold it still while making my cuts. I added a second 2"x4" a little ways behind the fence for added clamping pressure. I continued to use the double clamp for the rest of my scarfing.

The fence clamped to the plywood with additional secondary clamped 2"x4".

Waiting for the blade to stop at the end of the cut, before pulling the saw away from the wood, was another big improvement in my technique. This helps prevent twisting the saw and gouging the wood.

Cutting the scarf at an 8-to-1 bevel.

Avoiding Mistakes

If you have the end of your plywood sticking out too far (more than 3 ¾" from the fence) it will take it deeper into the sawblade and scallop the edge of your scarf. If the end of the plywood is not out far enough (less than 3 ½" from the fence) your scarf will have a flat end and will not blend in smoothly.

Do not adjust the angle of the sawblade between cuts. Both mating pieces need the same bevel.

Make sure to mark the side you are planning to cut the bevel on. One bevel faces up and the other down. If you have a "good side" to the plywood (or have already started shaping your panel), and you cut both bevels on the topside, it's a real bummer. Not saying that hasn't happened to me, but it won't happen again… I hope.

Once I had everything set up (which wasn't too complicated), and was done playing around trying to goof things up, things went smoothly and quickly. I find the 875 Scarffer a great addition to my toolbox.

For more information, you can read the scarfing chapter in *The Gougeon Brothers on Boat Construction* (available at westsystem.com) or contact the West System technical staff at 866-937-8797.

MKOS
#MOREKIDSONSAILBOATS

Kids Rescue a Pair of CLUB 420 DINGHIES

By Brett Langolf

The prep crew in our youth sailing organization, More Kids On Sailboats (MKOS) recently rescued and restored two Club 420 sailing dinghies using a combination of their own tenacity and West System® Epoxy. At MKOS, we strive to let the kids lead, make mistakes, and learn how to do better the next time. The Club 420 project allowed them to do just that.

The Club 420 is a seaworthy and stable boat design that's popular in youth sail training. It features a durable, reinforced hull, is simple to sail, and popular in North American youth sailing competitions. The "420" indicates the boat's length in centimeters.

Prep Crew to the Rescue

Last September, we made a social media post requesting the donation of a Club 420 dinghy. This led to a road trip to Milwaukee Community Sailing Center (MCSC) to rescue two Club 420s whose next tack was towards the dumpster. We brought along three kids from the program's prep crew. The mutual feeling of excitement for the boats' future from our crew and MCSC was palpable. If boats have feelings, this pair of Club 420s were as excited for their next adventure as we were.

The Cleanup Begins

The MKOS prep crew dove in with power washers, scrub brushes, and knives. Yes, knives—to cut out the bird nests, hornet nests and mouse burrows. At this point in the process, the adults were not sure what was salvageable. But true to our mission, we let the kids lead the charge. They took indelible felt markers to the hull to identify weak spots, cosmetic flaws, fiberglass gouges and, of course, the opportunity to make their mark via autographs.

Bring on the Power Tools

Properly equipped with safety gear and instructions, the prep crew literally dug in, grinding out soft spots with angle grinders. They were initially worried about grinding too deep or too far or "cutting the boat in half." In response, a mantra was quickly born, "There's nothing that we can't fix with West System." With the fear of failure eliminated, the kids were able to confidently sand and grind beveled sections to prepare for fiberglass and epoxy repair.

Science on the Hard

We know sailing is filled with science and math on the water including wind angles, tactics, weather, hull design, and sail design. But the MKOS program prep crew experienced firsthand how science and math are intrinsic to boat restoration "on the hard."

Luckily warm March sunshine brought temperatures above 50°F, allowing us to make repairs with epoxy. We added equal pump strokes of West System 105 Resin and 205 Fast Hardener, stirred it with our mixing sticks, then added 406 High-Density Filler. The crew measured fiberglass, cut it, and laid it down as described in "Repairing Gelcoat Stress Cracks" by Terry Monville in *Epoxyworks* 52. They smoothed the epoxy over the fiberglass with 808 Plastic Spreaders.

We were quick to answer our young prep crew's many questions: Is it working (editors note: It should not!)? Why does it smell like that? And, Woah, should it be smoking? The shock and awe of liquid epoxy turning solid was magical.

Reaching the Finish Line

We plugged in the power tools again, making heavy use of disposable gloves and sleeves as we faired in our fiberglass and epoxy repairs. Sanding with 120-grit then switching to 220-grit was repeated often. Finally, we got the surface smooth enough to be fast on the water. The finishing touches included filling some tiny pits with West System 105/205 loaded into syringes.

Ready for the Water

The final step was prepping the hulls with primer and painting with Interlux Brightside® polyurethane topside paint. We then flipped the boats over to finish the decks. The boats are now on the water and on the racecourse, filled with girls and boys moving to the next MKOS programs: Practice and Perform.

Top: Club 420 after our delivery from Milwaukee.

Bottom: The prep crew mixing a pot of 105/206 epoxy.


MY EPOXY IS...

Team MKOS sanding the hull.

About MKOS

#MOREKIDSONSAILBOATS

We believe that allowing kids to exercise critical thinking skills, make mistakes, and solve problems will develop the grit and skills they need for success in life. More Kids On Sailboats (MKOS) is a 501 (c)(3) dedicated to instilling these skills in today's youth. These opportunities come both on and off the water through four core programs:

Prep: Boat restoration & repair

Practice: Learning to sail & introduction to new boats

Perform: Racing team

Provide: Philanthropic connection

To see these boats, learn about the crew or provide support, follow us on Facebook, Instagram or morekidsonsailboats.org.

Use the hashtag #MoreKidsOnSailboats for your next sail.

how to make a

WOOD & EPOXY VASE

in 8 simple steps

By Ed Lewis

In 1947, my parents took me to Gatlinburg, Tennessee for my first vacation. I was fascinated by a wood turner and resolved that I would one day learn the craft. In the early 1970s, I found an ancient used lathe in a flea market. I bought a box set of chisels at Sears and set out to learn the craft. I didn't have a teacher and I made a lot of mistakes.

During my first 20 years of turning wood, I finished my work with Danish oil, lacquer, varnish, tung oil or polyurethane. In 2003, I switched to West System® Epoxy, and I have never looked back.

I keep a careful record of my work: to date I have finished over 600 pieces with West System Epoxy. Here again, I didn't have a teacher, but with my background in chemistry, I understood epoxy materials on the molecular level. I still made many mistakes.

The Technical Advisors at Gougeon Brothers have been very helpful, but there is a limit to solving problems over the telephone. I didn't know of any other wood turners who used epoxy as a finish. I have since taught a number of others the techniques I have laboriously learned on my own.

How to create your vase

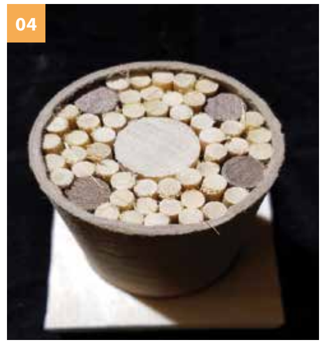
The materials you'll need for your wooden vase

- A 2" diameter mailing tube, about 4" long
- A roughly 4" x 4" base to which you can adhere the mailing tube
- One ¾" diameter, 4"-long dowel
- Four thinner, darker colored 4"-long dowels
- Several thinner, lighter colored 4"-long dowels
- WEST SYSTEM® 105 Epoxy Resin® and 207 Special Clear Hardener®
- Epoxy pigment such as WEST SYSTEM 502 Black Pigment

Mix a small batch of 105/207 epoxy and adhere the mailing tube to the base, allow to cure.

Epoxy the ¾" dowel to the base, at the center of the mailing tube.

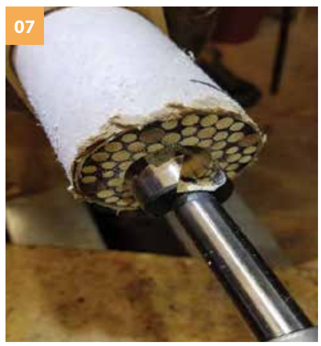
Epoxy the four darker colored dowels to the base inside the mailing tube, around the center dowel.



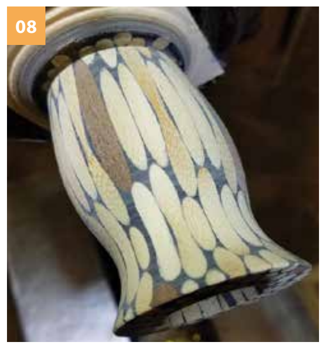
Insert the lighter colored dowels to fill the remaining space.

Mix 105 Resin/207 Special Clear Hardener, then add pigment.

Slowly pour the epoxy mixture into tube and allow it to cure.



Mount it on a lathe and hollow the vase.



Turn the vase to the shape you desire.

Tips

- Stir epoxy resin and hardener for a minimum of 2 minutes, scraping the sides and bottom of your mixing container. Stir slowly to minimize introducing air bubbles.
- If you're using fewer dowels and your pour requires a greater volume of epoxy, pour it in multiple, smaller batches. Allow each batch to cool completely and reach the tacky "green" stage before adding the next. This will prevent uncontrolled exotherm (epoxy overheating and bubbling).

Applying epoxy on VERTICAL SURFACES

By Greg Bull — GBI Technical Advisor

Why can't I apply epoxy to vertical surfaces? This is a question Gougeon Technical Advisors are asked all the time. Our response? Why, sure you can! You just need to apply it in thin coats using a foam roller. I'll provide some tips for preventing sags or runs when coating vertical surfaces, achieving a thin coat, and choosing the best hardener for your working temperature.

Begin with the Right Tool for the Job

The application tool used to apply the epoxy coat will have a significant bearing on the outcome. I prefer our West System® 800 Roller Covers. Their ⅛"-thick foam provides excellent control over film thickness. They are less likely than thicker (paint) rollers to make the epoxy overheat, and they leave less stipple on the coated surface. The 800 Roller Covers are easy to cut into smaller sections for tipping off uncured epoxy coatings.

After applying the epoxy coating with a foam roller, tip it off by dragging a cut section of foam roller over the surface. This smooths the coat of epoxy and lets you control how much epoxy stays on the surface.

As an experiment, I decided to roll coats of West System Epoxy onto a vertical surface to see if it would run.

Understanding Mil Thickness

To measure the amount of the epoxy I was applying, I grabbed our "wet film thickness gauge" or mil gauge. Although it's used mostly in the painting industry, it worked fine for my application. A "mil" is simply a unit of thickness equal to one-thousandth of an inch (.001"). The higher the mil thickness, the thicker the coating. For comparison, a 4-mil coating is about as thick as a piece of notebook paper and a 6-mil coating is the thickness of a kitchen trash bag. Talking with the other technical advisors, we determined 2, 4, and 6 mils as the minimum and maximum thicknesses at which to test apply epoxy coatings to vertical surfaces.

I mixed 105 Resin® with 207 Special Clear Hardener® and then added 501 White Pigment so the color of the epoxy would stand out from the wooden surface. I used an 800 Roller Cover to apply the epoxy, and then used a segment cut from another 800 Roller Cover to tip the rolled epoxy. In three separate areas, I rolled the epoxy on at the 2 mil, 4 mil, and 6 mil thicknesses, leaving a dry area between each section. That way, when one coat ran it didn't pull its neighboring coat with it. I rolled the epoxy evenly in both directions across each section. I finished by horizontally rolling and tipping the epoxy coating to prevent a thick running or sagging epoxy build-up. Horizontal tipping prevents dragging the wet epoxy, which can also cause sagging. I wanted to let gravity do its thing so any sags or runs would form on their own.

When rolling out epoxy, aim for a film thickness of 2 to 4 mils regardless of your working temperature. Next, we'll look at how working temperatures affect epoxy coatings on vertical surfaces.

Getting a Good Vertical Coating In Warmer Temperatures

If the temperature rises while you're applying a thicker coat of epoxy, it reduces the epoxy's viscosity, causing runs and sags. For example, you might have applied two epoxy coats to a vertical surface with no problem. But then air temperature increases, reducing the uncured epoxy's viscosity and causing it to run and sag.

Working in warmer temperatures can also trick you into rolling on too much epoxy. The epoxy's lower viscosity makes it easy to roll on a thin film. It looks like there isn't enough epoxy on the surface, so you roll on another coat. Now it's too much epoxy and the thicker coat starts to move.

Rolling the epoxy on in a thin film and applying an additional coat only after the previous one has reached the green stage (when it's about as sticky as masking tape) is the best way to prevent epoxy from sagging on vertical surfaces in hot weather.

How to Prevent Vertical Coatings from Sagging in Cooler Temperatures

Epoxy can run on vertical surfaces in cooler temperatures, too. Cooling epoxy slows the cure process, giving it more time to sag or run. It's also harder to roll on a thin film in cooler temperatures because cooler epoxy is more viscous. Initially, this thicker coating may look like it's going to stay put on your vertical surface. But after a while, it starts to sag anyway. This sagging is the result of the long cure time created by the cool temperatures.

The extended cure time of epoxy in cooler temperatures is another factor that can result in runs and sags. For example, you coat the bottom of a fiberglass sailboat and then coat the lead keel. The epoxy sags only on the keel. What went wrong? The lead keel is a lot cooler than the fiberglass so it takes longer for the coats of epoxy on the keel to tack up compared to the epoxy on the fiberglass hull. This is especially likely if temperatures were much cooler overnight before the warm day when you applied the coating. The boat's surfaces will be cooler than the air temperature.

When temperatures are cool, you're still going to want to apply a thin film thickness, only adding an additional coat when the previous coat is tacky.

Choose the Right Hardener for your Working Temperature

Typical outdoor working temperatures may range from 50°F to 90°F. This is a good reason to keep a couple of different West System Hardeners in your quiver. You can switch to 205 Fast Hardener® when it's cooler and 206 Slow Hardener® when it's warmer. 207 Special Clear Hardener® provides a pot life and working time similar to 206. For very warm weather, you may want 209 Extra Slow Hardener®.

Having more than one speed of hardener on hand is especially convenient when you need a faster hardener for coating in the cool of the morning or evening and a slower hardener for working in the heat of the afternoon. Using the hardener that's the right speed for your working temperatures can go a long way in preventing running and sagging on vertical surfaces.

Initial Coating

2 mil coating.

4 mil coating.

6 mil coating.

After 3 Hours

2 mil coating + 3 hours.

4 mil coating + 3 hours.

6 mil coating + 3 hours.

Do it yourself WINDOW SCREENS for car camping

By Tom Pawlak — Retired GBI Technical Advisor

When I retired three years ago, I had plans to do a lot of camping. We have a small travel trailer that we love, yet there are times when camping alone that I prefer to keep things simple by leaving the trailer at home. Sleeping in the back of my small SUV works fine for me. There is even room to bring my canine pal along.

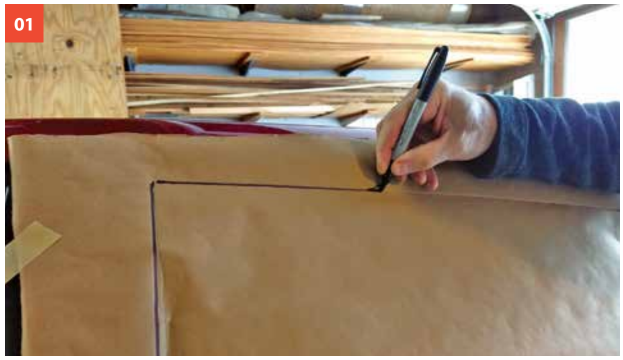
One of the challenges with car camping is getting fresh air without allowing mosquitoes in for their blood-letting endeavors. I decided to devise a simple window screen that can be easily attached and removed. The screen panels that I came up with can be made in a weekend. The thing I like most about them (besides the fact that they keep the mosquitoes out) is that they store flat and unnoticed under the mat in the back of my car.

My plan was to design a screen frame that was thin enough to fit between the car windows and the rubber seal that the window slides up and down as the windows are raised and lowered. The window screen frame would need to be no more than 1/16" thick.

The window screens (pictured) work extremely well. While you can purchase window screens for cars online, to me these look like a one-size-fits-all approach that is bulky and time-consuming to install.

I made a set of custom window screens for each of our cars. One set of screen frames were made from leftover fiberglass scraps and epoxy. The other set of frames were made with 1/16" thick cardboard (not corrugated) that I saturated with epoxy. Once the epoxy on the frames was cured, sanded smooth, and painted, I glued a flexible plastic window screen to the inside of the frame with West System® G/5® Five-Minute Epoxy.

I think you'll agree that they look good. Best of all, they store flat and out of the way when not in use. If you are interested in making a set for your vehicle, here's how.



1. Create a template using clear plastic film or craft paper on the car window opening. Make the template large enough to cover a half-opened side window.

2. Hold the plastic film or paper in place with tape while tracing the edges of the window. Add a ½" or so on each end to extend under the rubber seal.

3. Transfer the template to your cardboard or fiberglass screen frame stock. Cut to shape with scissors, snips or a utility knife.

4. Test the fit on your car window to make sure the frame lays flat against the window after the edges have been slid under the rubber seal. Trim as needed.

5. Apply a slow-set West System® Epoxy such as 105 Resin® with 206 Slow Hardener® or 207 Special Clear Hardener® to the cardboard. Keep applying epoxy, letting it soak in until the cardboard is saturated. (Alternatively, you could use two layers of 10 oz. or three layers of 6 oz. fiberglass cloth saturated with epoxy if you have fiberglass scraps on hand.) Be sure to work on a flat surface protected with thick plastic film or protect the surface with multiple coats of a mold release like Carnauba wax.

6. Allow the epoxy to cure, then flip the frame material over and coat the other side. Continue applying epoxy as it soaks in, and remember to apply epoxy to the edges as well.

7. Allow the epoxy to fully cure, then sand surfaces dull and remove any burrs from the edges.

8. Apply a plastic-compatible paint such as Rust-oleum® Universal Paint and allow it to dry. I like their Hammered Finish Paint because it provides a uniform dimpled finish that hides scratches and imperfections extremely well.

9. Flip the screen frame over, dull the backside with sandpaper, and glue in plastic window screen fabric (available at hardware or building supply stores) with G/5 Five-Minute Epoxy. Allow the epoxy to cure.

The car camping screen, installed and ready to keep mosquitoes at bay.

Installation

To install the new screen frame on your car, begin by lowering the window a bit. Slide the front edge under the rubber seal, then work the back edge of the screen frame under the rubber seal. Slide the screen frame up and under the seal at the top of the window opening. All is good if the frame fits a bit snug under the rubber seal and the bottom edge of the window screen lays flat against the top two inches of the window glass.

If the screen frame bubbles up along its bottom edge, you likely need to trim it slightly so it can be slid a bit further under the window seal. Keep trimming and test fitting until the bottom of the screen frame lays flat on the top edge of the window. Once that is done, you have successfully completed your own set of custom car window screens. Congratulations!

In the event of rain, your car windows can be raised while the screen frames are in place.

Tackling thru-hull repairs on TAKARA

By Jeff Mueller

Upgrading our sailboat's navigation instruments called for eliminating one thru-hull fitting and reducing the diameter of another by ⅛". *Takara*, a 1974 Irwin 30 Competition, has a one-piece molded fiberglass and polyester hull with alternating layers of hand-laid mat and 24 oz. woven roving. Her original instrument set included a pair of 2 ⅛"-diameter transducer thru-hulls in the bow. Upgrading to modern instrumentation standards required installing an NMEA 2000 network instrument that was 2" diameter.

The project, while simple in scope, posed a few complications:

- The two original thru-hulls were quite close together
- These thru-hulls were close to the centerline of the bow
- From the inside, the thru-hulls were near some laminated stiffening for the bow as well as some tabbing to the inside liner

We reached out to Gougeon Brothers, Inc. and were connected with Technical Advisor Don Gutzmer. We sent some pictures over and he assessed our situation. This was truly the best thing we could have done. Don's technical expertise was evident throughout our discussions.

He recommended we start by reinforcing the inside area with two layers of biaxial fiberglass cloth before making the repair from the outside. On the outside, to eliminate the obsolete thru-hull, we needed to taper the fiberglass at 12:1. Repairing this unneeded hole required eight layers of 17 oz. biaxial fabric with mat. The resized thru-hull would need a couple of layers on the outside as well. Since it only had to be ⅛" smaller, it could be filled with a "puck" of thickened epoxy, covered with two layers of glass, and re-drilled.

With our game plan in place, we gathered the tools, materials, and WEST SYSTEM® Epoxy for the job. We easily removed the old thru-hull transducers. Next, we began grinding to prepare the inside of the hull for proper adhesion of two layers of 17 oz. biaxial fabric.

To make a clear area for applying the reinforcing layers of fiberglass on the inside of the boat, we removed an original piece of fiberglass tabbing. We then used a piece of clear plastic sheet to make a template for cutting the two layers of fiberglass cloth to be applied inside the hull. The template made it a breeze to cut the fabric to the correct shape.

With the inside prepped and ready for new fiberglass, we moved to the outside of the boat to begin the more significant elements of the repair. On the exterior, we marked a circle for the proper 12:1 taper required to eliminate the unneeded thru-hull. We made a template for the new glass cloth as we had done on the inside of the boat.

Don recommended a layup schedule of eight layers of 17 oz. biaxial fiberglass fabric to match the thickness of *Takara's* hull. This was the perfect thickness and left us with very little sanding and fairing to do. Nice to have experts working with you!


Left: Prepping our tools for the job. Middle: 2 ⅛" diameter transducer thru-hulls in the bow. Right: Prepping the hull by grinding the inner glass laminate.

Our next step was to prepare the unneeded hole. We tapered the hole to the full thickness of the laminate, at a 12:1 bevel. We used a straightedge to ensure that we were not "dishing" the taper. This kept all the layers of cloth in plane for the best possible repair. The taper was a little tricky because it wrapped around the centerline of the boat, but we did our best to keep it consistent.

We followed the same process for the resizing hole, but instead of grinding the bevel all the way down to the inside of the hull, we only tapered the hole to a depth of approximately two layers of 17 oz. biaxial fiberglass, at a 12:1 bevel. We roughed up the inside edges of the resizing hole to prep it for filling with thickened epoxy.

With the holes properly tapered and prepped on the outside, we were ready to apply fiberglass inside the hull. Using 300 Mini Pumps, we mixed West System 105 Resin® and 206 Slow Hardener® for applying two layers of 17 oz. biaxial fiberglass cloth on the inside.

After this cured, we mixed a batch of 105/206 thickened to a peanut butter consistency with 406 Colloidal Silica Filler. The mixture didn't run or sag when we used it to fill the resizing hole. We allowed this to cure.

Next, we moved to fiberglassing the thru-hulls from the outside. Using the template we had created earlier, we cut the layers of fiberglass cloth for each thru-hull—two layers for the resized thru-hull and eight for the unneeded thru-hull. With our cloth cut and the repair area masked off to keep things neat, we mixed additional resin and hardener to wet out the biaxial cloth patches and applied them from largest to smallest. We used rollers to ensure there were no voids or air bubbles in the layup. The resulting repairs were beautiful and precisely matched the hull thickness.

After the epoxy cured, we moved on to the final step: fairing the repair area. We mixed some resin and hardener then added 407 Low-Density Fairing Filler. We applied this fairing compound to the repair area. Because of the precision of our work up to this point, the repair needed very little fairing compound or sanding.

We applied new tabbing from the hull to the inside liner where we had removed it earlier. Then we carefully marked the center point in the resized thru-hull, drilled it out, and installed the new thru-hull fitting for the updated navigation instruments.

Our last step was to apply a fresh coat of anti-fouling bottom paint. Finally, *Takara* was ready to splash! With our plans to take the boat from the Great Lakes out to bluewater, we could not have been more pleased that we'd executed an extremely structurally sound thru-hull repair and resizing. Don's expert advice and direction was invaluable. West System materials are top-notch and formulated to be easy to work with. *Takara* is moving into the exciting realm of modern-day navigation and instrumentation. Her hull is strong, fast, and ready for upcoming bluewater cruising!



Left: We tapered the unneeded hole at a 12:1 bevel. Middle: New fiberglass patches are applied to the hull. Right: The final thru-hull after applying anti-fouling bottom paint.

SNOW SLED

built with West System Epoxy

By Don Gutzmer — GBI Technical Advisor

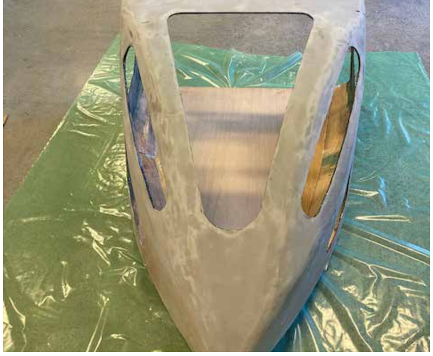
Taking the completed sled out for a spin.

A picture of an Equinox Snowcoach 685 inspired me to build a similar snow sled for my young kids. Growing up in Michigan, I learned to appreciate the outdoors. I remember snowmobiling with my family at a young age and those memories stayed with me as I got older. I still look forward to the few times each year I go up north to trail ride. I want my kids to appreciate snowmobiling as much as I do so, I decided to build an enclosed sled to pull behind my snowmobile.

Instead of spending $1,200 - $1,600 to buy a used enclosed sled, I figured I could build one myself. As the saying goes, a picture is worth a thousand words, so I made sure to capture as many pictures of this project as possible.

In order to save money, I used materials that I had readily available. I didn't want to fall into the trap of spending $2,000 to build a sled when I could buy a used one for around $1,200.

To create the shell of the sled I started with a few sheets of ⅛"-thick plywood left over from another project. The thin plywood could be bent into shape to help maintain a fair surface for applying fiberglass to build strength. I temporarily held the plywood in position by fastening it to a plywood form. Holding the plywood in place with zip ties, I injected West System® Six10® Thickened Epoxy Adhesive into the seams. After the epoxy cured, I removed the form to fiberglass the inside of the shell, strengthening the bond between its panels.



Left: Injecting Six10® Thickened Epoxy Adhesive into the seams.

Middle: The shell with the corners ground smoothly, ready to be fiberglassed.

Right: The shell has had glass applied and awaits final fairing before applying a coat of 105/207 with 5 oz. black pigment.

The outside of the shell was prepared with a grinder and orbital sander to smooth the corners, creating a radius edge for the fiberglass cloth. I applied one layer of 10 oz. fiberglass fabric over all of the plywood using West System 105 Resin® and 206 Slow Hardener®. On the corners, I added a layer of 17 oz., 727 biaxial fiberglass tape.

I wanted more headroom inside the sled to allow an adult to ride, so I cut part of the bottom to accommodate a footwell. Using ¾"-thick plywood I made a box that is 6" deep and attached it to the sled with multiple layers of 17 oz. biaxial fabric.

I tinted 105 Resin and 207 Special Clear Hardener® with 502 Black Pigment and used it as the final finish. Because we would only use the sled a few times each year, I was not concerned about preventing UV degradation.

I found some used plastic snowmobile skis that would work great for the sled. I drilled a row of four ½"-diameter holes in the bottom of the sled, epoxied in metal bushings, and then bolted on a crossbar longer than the width of the sled to serve as the axle. To attach the skis, I built custom brackets and welded them onto the crossbar. The skis were then bolted to the bracket.

I created windows with ⅛" thick Plexiglas®. It was a learning process, cutting the Plexiglas slowly, using a jigsaw with a fine-tooth blade to avoid cracking it. Straight cuts work best. I used stainless steel bolts to fasten the panels to the shell. To seal the windows I applied butyl tape on the edge of the Plexiglas panels. The front window has a piano hinge to let the rider climb into the sled. Finally, I used a plastic cabinet catch to lock the front hatch closed so it could be opened from inside or outside.

Building this enclosed sled was a fun project, and the nice thing is, I put only $600 into building it. That's probably about half the cost of a used sled. The sled pulls easily and the kids think it is the coolest thing ever. There are endless possibilities to building and repairing when using West System Epoxy products.

Left: The completed snow sled. Note the custom brackets fabricated to attach the skis to the axil.

Right: The interior seat complete with seatbelt and custom footwell.

LULU The biggest, baddest trailer sailor

By Brad C. Frederick

Brad C. Frederick designed and built Lulu, a water-ballasted motor sailor.

I've always wondered if *LuLu* wasn't the largest trailerable sailboat on record. I've been sailing this 35', self-designed and homebuilt motor sailor since launching her out of Morro Bay, California in 2010. I laid the keel in 1993 after three years of testing on a half-scale model I'd built. Her construction consists of ¾" planks bent over bulkheads on strongback and closely fitted, layered joints held together with a lot of West System® Epoxy. I also used West System® when I sheathed her with fiberglass.

Because *LuLu* is water-ballasted, she's easily towed with my ¾-ton 2015 GMC pickup. We now sail her exclusively out of Marina Del Rey, California and will cruise to Catalina. *Lulu's* flood hatches total 3'2" of bottom area, allowing her to morph into a 14,800 lb. cruiser just five minutes after launch. The 540.17 sq. ft. of sail she carries on her 30' mast will drive her at near hull-speed easily in a calm sea. Her two 25 hp Hondas can add a knot or so to that.

LuLu's rudder was a proud boat building achievement for me, I'll admit. Its inner structure is bent stainless steel ribs stacked vertically and welded horizontally to the post. This is covered by ⅜" plywood cheeks. It's very strong but at over 200 lbs., it's a little heavier than it needed to be.

I chose the name *LuLu* because it was the nickname of my cat, Lucretia, and because I knew it would symmetrically span the rudderpost.

When I designed the boat, I used Excel as my basic computational and drawing tool. It turns out that by treating cells as pixels you can draft and even animate with Excel. I'd traced her lines from a full-keel Herreshoff design I saw in a book. It took me 17 years to finish the boat because it was a soup-to-nuts development rather than a conventional build. It wasn't just her hull that I had to develop. Her water ballasting system was a challenge, going from 7,000 lbs. to 14,800 lbs. on launch while keeping her floating on her lines. I went through four different designs of her mast erection system—each taking about a year to build and test—before I found one that satisfied. Her trailering system is large enough to carry *LuLu* dry, low-slung enough to launch from a 1:7 ramp and get under 14' overpasses, and still light enough for my pickup truck to tow. I worked on the entire project alone while working my day job. It's nice having *LuLu* to sail.

Interior of the aft cabin from the hatchway steps, looking forward.

SPECIFICATIONS

Construction - ¾" plywood sheathed with fiberglass and West System Epoxy

LOA – 35'

Beam – 8.5'

Draft – 2.7'

Mast – 30'

Displacement – 7,000 lbs. dry, 14,800 lbs. with water ballast

Trailer Weight – 3,000 lbs.

Sail Area – 540.17 sq. ft.

Engines – Two 25 hp Hondas

Top Left: LuLu in erectus. Top Right: Interior of the cockpit, looking forward.

Middle Right: Interior of cabin shot from mid bulkhead looking aft.

Bottom Left: Lulu on an outing. Bottom Right: Interior ceiling ribs.

Building Chesapeake Light Craft STAND-UP PADDLEBOARDS

By Bruce Niederer — Retired GBI Technical Advisor

I guess I'm one of those guys who finds retirement much busier than work. In fact, I wonder how I ever found time to work. One of the first projects I started after retiring was helping my brother Nelson build two Chesapeake Light Craft (CLC) stand-up paddleboards (SUPs). We were building them for the best kind of friend—the paying kind.

Choosing a Model

CLC offers various options to fit their customer's pocket book, ambition, and skill level. (1) You can simply order the plans and cut all the parts from plywood in your own shop. I doubt many take that option because of the inner grid work. (2) The next option is ordering the kit with all the parts delivered pre-cut by CLC. This is the best option, in my opinion. Completing the board is relatively easy for those with limited building skills. Just follow the step-by-step instructions—the stitch and glue construction method is a good place for beginners to start. (3) The easiest option is to choose plywood for building the whole SUP, including the deck, hull, and interior framework.

Nelson and I are not beginners (see "My First Cadillac" in *Epoxyworks 44*, about how we restored a 1954 Cadillac Runabout). We opted for CLC's upgraded kit with plywood hull and framework but with a stripper deck using pre-cut strips of ash, mahogany, and walnut provided with the kit. We were free to design our own color combination for each deck.

Left: Making sure the hull shape is uniform, square, and level.

Right: Wiring the interior support pieces in place.

Stitch and Glue Construction

To make construction easier, the deck is flat. This means the modest rocker in the hull is not transferred to the deck so all that is needed to glue the strips together is a long, flat table or workbench. I used a polyurethane glue (any white variety that dries clear will work) to glue the bead and cove strips together. Once the glue dried, we set the decks aside and built the hulls.

The CLC parts are delivered on a palett, so the plywood panels for the hull must be glued to reach their full length. This is easily done by fitting and gluing the puzzle joints together with WEST SYSTEM® 105 Resin/207 Special Clear Hardener®, which is what we used throughout this build. This makes four hull panels—two bottom panels and two side panels. The two half bottom panels are mirror images. We applied fiberglass tape to all four panels using 105/207 on the inside seam surface. The side panels are then attached using stitch-and-glue techniques. Once the fillets cured, we removed the copper wires and reinforced the inside filleted seam with glass tape and 105/207.

With the hull shape now established, the interior grid support pieces were wired into place again using the supplied copper wire. Before gluing these structural supports in place, we spent a good amount of time making certain they were tightly wired and then made sure the hull shape was uniform, square, and level. Once satisfied, we (and by we I mean Nelson), created fillets using WEST SYSTEM Six10® Thickened Epoxy Adhesive to secure the grid in place. After the Six10 cured, we sealed the inner surfaces of the hull with a single coat of 105/207, including the grid work.

Fiberglassing

Next, we turned the hulls upside down for fiberglassing. The WEST SYSTEM 742 6 oz. glass was dry fit and smoothed, then wet out with 105/207 because we planned a natural finish on all the wood. This went pretty well on both hulls, without bubbles raising the glass and creating white spots.

Top Left: Using pre-cut strips of ash, mahogany, and walnut to design our own color combination for each deck.

Top Center: Prepping the inner grid.

Top Right: After routing the deck.

Below: Fiberglassing the upside down hull.

Above: The deck pads in place and the decks prepped for more epoxy before we fixed the pox.

Below: The completed CLC Stand-Up Paddleboards.

The next step was sanding to prep both the underside of the decks and the top surfaces of the grid frames, inwales, and transoms. Rather than using the plywood transoms supplied with the kits, Nelson opted to build custom transoms for each board. He used the cut-offs left from the deck strips to make each transom unique. Again using Six10 Adhesive, we applied a thin bead to the tops of these surfaces and secured the decks in place with clamps. The decks were still oversized. After the epoxy cured, we removed the clamps and trimmed the decks to shape with a router. At this point, we had two structurally sound boards.

Even Pros Make Mistakes

Things went a bit south when we fiberglassed the tops of the decks. During Michigan summers, southern-facing windows receive direct sunlight all day. Nelson's shop windows face south and therefore tend to heat the shop as the day progresses. Here's where it pays to listen to your epoxy professional. If you start applying fiberglass and epoxy over wood while temperatures are on the rise, the wood can outgas and lift the glass unless the epoxy has cured enough to resist the outgas pressure. My advice was to come back to the shop after dark to glass the decks when the shop had cooled. The epoxy would be cured by morning before the shop began to heat up for the day. Nelson didn't follow my very wise council and both boards had varying amounts of "the pox."

Some of the largest bubbles were located where the footpads belonged, so we cut off the offending glass with a razor knife and simply recoated the wood in these areas. The remaining blemishes were cut off, the edges hand sanded, and small patches cut and glued down. If done carefully, these repairs will go mostly unnoticed by all but the most detail-oriented observer. Of course, it's all the builder sees!

Finishing

Having dealt with the pox, we prepped the hulls and decks for more 105/207 to fill the weave of the fiberglass. For this, we used an abrasive pad because sandpaper would be too aggressive for this step. It can cut through to the glass, which makes it look white and there's no good way to fix that. This took a couple of coats of epoxy to achieve. Finally, we prepped the cured epoxy with an abrasive pad (220-grit sandpaper would also work) to remove epoxy drips or runs. We used Z Spar® Captain's Varnish to apply two coats to both boards.

When ordering kits from CLC you will need to request West System Epoxy 105/207 or pick up your own at any fine marine store or chandlery.

The completed CLC stand-up paddleboards were very well received and now reside at Michigan's Houghton Lake.

Current stand-up paddleboard pricing and kit options are available at *clcboats.com*.

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.**

How-to Publications

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. Also, procedures for gelcoat blister diagnosis, prevention and repair, and final fairing and finishing.

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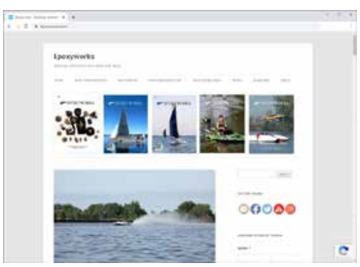

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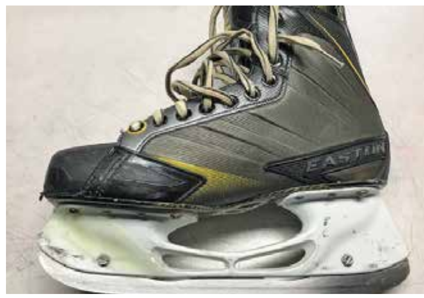
Readers' Projects

Bay City, Michigan carpenter and frequent *Epoxyworks* contributor Bill Bauer created this whimsical waterfall table.

This cedar strip canoe and strip plank soaker tub, both laminated with WEST SYSTEM® 105 Resin®/207 Special Clear Hardener®, are the work of Kurt Mangseth of Grand Rapids, Minnesota.

Chris Righetti of Barra de Navidad, Mexico designed and built the catamaran *Eager El* as well as the Righetti Rocker.



Chet Asher of Ocean City, New Jersey repaired the broken blade holder on his hockey skate with 105 Resin/205 Fast Hardener and 6 oz. fiberglass cloth.

Alala, a 7-seat, 45' Unlimited Canoe built by Donald Weir of Hilo, Hawaii was featured in *Epoxyworks 52*. Here she is under sailboard and sail with a crew of 4.

Share your work and fuel your creativity

Submit your projects at info@epoxyworks.com

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