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# EPOXYWORKS®



BUILDING, RESTORATION & REPAIR with EPOXY  
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# Six10 Adhesive Finds a Home in "Boutique Style" Construction

By Emily Soyka

Renew Urban Charleston, LLC in Charleston, South Carolina has been using WEST SYSTEM® Six10 Epoxy Adhesive to glue hundreds of pultruded fiberglass channels and square tubes together to form decorative louvers. When installed on the building, the louver assemblies create an aesthetic detail that draws attention to the unique rooftop residence on King Street in Charleston.

The project architect, Kevan Hoertdoerfer, dreamed up the idea of a super contemporary steel and glass inspired building placed in a historic context. He and our client worked for several years to develop the design and engineering while seeking the right general contractor (GC) for this project. Renew Urban Charleston was selected based on our experience and understanding of what would soon become a very complex, strategic construction process. Renew Urban was founded in 2007 by owners Andy Meihaus and Mark Regalbuto. The core of our business is high quality, 'boutique style' historic restorations of commercial and residential spaces. Andy's experience in high-end new construction made him the right contractor to oversee this job.

Shortly after we signed on as the GC, the company responsible for the engineering designs closed due to the recession and we were forced to find a new engineer capable of understanding the complexities of this building. Luckily, Ed Fair with Rosen & Associates here in Charleston was a great fit for this job. Ed was actually the first person who recommended that we use a WEST SYSTEM adhesive.

The system itself is comprised of pultruded structural fiberglass operable louvers. It's designed to balance on two track systems so that the home owner can open and close them based on which balconies he wants to use at a given time. Each louver is made up of two 3" vertical tubes with 90° angles and necessary bolts, nuts, and washers- all made of pultruded fiberglass. The final aesthetic detail is made of the pultruded fiberglass channels and all of these are held together with the Six10 Adhesive. The fiberglass

manufacturer also recommended that we use Six10 Adhesive since its impressive tensile strength is capable of holding such a system together.

Before gluing 90° FRP angle brackets to 3" fiberglass pultruded tubing with Six10 Adhesive, surfaces were cleaned with a solvent wipe and sanded dull with fresh 80-grit sandpaper.

Because there are limits to how much FRP bolts can be tightened, Six10 Adhesive was used to glue them in (at least for these angle brackets) so they would not loosen up over time.

We started construction in August 2013 and are still in progress. Our plan is to have this completed in spring 2015. Some interesting notes:

- It is the first contemporary design of its kind to be approved by the City of Charleston Board of Architectural Review.
- It's also the first project in the City of Charleston to have been awarded the air rights to construct on an existing (and historic) building.
- This residence is on the roof of a building that currently contains an Apple retail store and separate office space for a web design/digital marketing firm. One of the owners of that firm is the owner of this residence.
- This part of town is vibrant due on its close proximity to the College of Charleston and prime King Street shopping, so it's a unique modern addition in what is otherwise a tightly controlled historic district.

We're excited to see how this concept may impact downtown Charleston's new construction in the coming years.

Emily Soyka  
Company Coordinator  
ReNew Urban, Charleston LLC  
renewurban.net



Cover Photo:  
Installing some of  
the assembled FRP  
louvered panels on  
the rooftop residence

Six10 Adhesive being  
used to glue bolts and  
brackets in place





The completed, black epoxy trimmed table.

# 502 Black Pigment

By Mike Barnard

On January 1st, 2015 we began selling a new WEST SYSTEM® Epoxy pigment. We already had the 501 White Pigment and the 503 Gray Pigment, so it seemed right to add 502 Black Pigment. Just like the 501 and the 503, it alters the color of the epoxy mixture without affecting the cured physical properties. Similarly, the maximum acceptable loading is 3%. This is great for covering a surface with a single coat of black epoxy. Adding more pigment will increase the opacity, but it can skew the mix ratio because there is epoxy resin in the pigment.

## Here are a couple projects that can be completed with 502 Black Pigment:

A great application for this pigment is to fill imperfections in wood. Rather than try to hide the imperfections, this would accentuate them and draw the eye to them. It makes for a really nice accent. In *Epoxyworks 38* this technique was used to fill cracks in a blank that was turned into a goblet. At the time that project was done we didn't have our 502 Black Pigment so we used 423 Graphite Powder instead. The pigment creates the same effect without the side effect of the sanding dust coloring the surrounding wood.



Turned pieces that had cracks filled with graphite powder creating the same effect as using 502 pigmented epoxy

Another example of this is when there are knotholes in wood that need to be filled. This is probably most common in wood flooring applications. Customers have done this with our 423 Graphite Powder, and the result with our 502 Black Pigment would be similar.

In the last issue of *Epoxyworks* an article explained the process for building a drum. 502 Black Pigment was added to the epoxy used to adhere the wood veneers and fill the seams between wood strips. I think you'll agree it helps add differentiation between the varieties of wood.

Black pigmented seams from "Drumming in Circles" in *Epoxyworks 39*



Another great project for the 502 Black Pigment is to create a border for a table. I used this method on my coffee table at home. I wanted a nice sharp line of black tinted epoxy around the edge of the table, so I put masking tape directly on the wood and applied the pigmented epoxy half over the taped line so it would be a sharp line. When I did this, the epoxy penetrated into the wood a little ways and was soaked up by the wood under the tape. This created a very uneven, jagged line that was unsightly. A beginner's mistake.

To solve this, I coated the entire table top with 105/207, let it cure, sanded, re-taped over the cured epoxy, and applied another batch of the black pigmented epoxy around the edges. This same process could be used when filling knotholes or drilled holes with black epoxy to prevent the black color from seeping into the surrounding wood grain. Recycled barn lumber is often used in this manner to give it an earthier look. As you can see, the end result turned out great and I learned a valuable lesson.

Technical Advisor Tom Pawlak did a project similar to mine. His son needed a decorative, removable box to cover some plumbing in his basement, so Tom created a custom mirror. This would hang on the wall covering the pipes, yet could be removed if they needed to be accessed. By coating the frame with black epoxy, the custom mirror would be less obtrusive and match the decor better.



*A nice sharp line...the second time around.*

To start the project he built a decorative frame out of some lumber and molding he had on hand. Using a roller, he coated all the flat surfaces with a thin coat of 105/207 Epoxy to seal the wood. Next, he went back over the grooves and corners with a brush to coat all the detail surfaces.

After the clear coating had dried, he mixed a batch of 105/207 with 502 Black Pigment at a 3% loading. He applied this coat using the same techniques as the first coat. Once that dried, all that was left was to install the mirror in the frame and hang it on the wall. No more ugly pipes.

- (1) Rolling the edge of the frame with a coat of clear epoxy (2) Coating the grooves and corners with a brush for an even coating (3) A second coat of epoxy, this one with pigment (4) The pigmented epoxy makes it easy to see which areas have been coated and which haven't. (5) Coating any missed areas with a brush.



# The Great Lakes Boat Building School Graduates the Class of 2014

*By Bruce Niederer*

I traveled to the U.P. (that's what we Michiganders call the Upper Peninsula) on June 7 to attend the graduation ceremony and participate in the yearly on site PAC (Project Advisory Committee which I currently sit on) meeting. I arrived on a beautiful sunny day with temperatures in the mid 70s, a stark contrast from my last trip to the school in mid-April when I awoke to 4" of new snow and 3°F! For those of you who live in the southwest, the Great Lakes finally became 100% ice free the beginning of June.

Pat Mahon is the Program Director and Head Instructor of the school, so he leads the committee. Currently the school has articulation agreements with North Central Michigan College and Eastern Michigan University. Students can earn an Associate of Applied Science or a Bachelor of Science degree, respectively, in Wooden Boat building, which gives students access to financial

aid and student loans through these schools. The next project for the committee and the school is to become a fully accredited school through the Accrediting Commission of Career Schools and Colleges (ACCSC). The ACCSC is a nationally recognized accrediting agency and is the agency that has qualified the schools that compete with GLBBS for students. Fundraising will soon begin to raise about \$10,000 needed for the effort.

The big event for the day was the graduation ceremony, complete with a catered lunch and plenty of time for the students to show off their handy work to their families.

Steve Van Dam is a Master boat builder who has had his shop in Boyne City, Michigan for decades. He also sits on the PAC and this year was asked to deliver the keynote speech at the graduation ceremony. Steve began his comments by saying



**All lined up for a class picture so without further ado, I present the Great Lakes Boat Building School Graduates for 2014:** (l-r) Second-year Instructor Andy James, first-year students Gus Bell, Troy Huesdash (second-year) and fiancé Carla Foggin (first-year), Pat Mahon (in back), Del Jacob (second-year), Adam Breister (first-year), Kris Kindt, Matt Edmundson (second-year foreground), Nic Seifert (first-year, bearded in back), back row James Harback (first-year), Steve Ridderman (first-year), Bud McIntyre (Student Services & Industry Relations Director), Michael Gravatt (first-year).



Master boat builder Steve Van Dam gave the keynote speech at the graduation ceremony.

“I want to congratulate you all for accepting the challenge to learn the skills it takes to work with your hands and build beautiful boats. I also want to assure each and every one of you that you will fail...” there were some nervous chuckles at that point, but after Steve explained what he meant by that everyone was nodding in agreement.

Steve echoed the sentiment I expressed in my article about true American craftsmen (page 7), that the trades don't yet get the credit and admiration they deserve in today's America. What he meant by “you will fail” was that all craftsmen will develop and hone their skills over time as they progress in their chosen career and by definition that means mistakes will be made. As an example, Steve told a story about himself back when he apprenticed for Vic Carpenter (as did Jan Gougeon, may he rest in peace, and Jim Derck, retired Gougeon Tech Advisor). He was trusted enough after 10 years under Carpenter's tutelage to work alone on weekends. He was drilling blind holes to mount the chain plates in a new wooden sailboat, using electrician's tape to gauge the depth of the drilled holes. As many of you probably suspect, he climbed out of the boat only to see that he had drilled holes in the finished and painted hull!

His point was that failure taught him an important lesson: own your mistakes and learn from them. He went on to tell the graduates to be proud of what they have chosen to do with their lives, what they have accomplished so far, and don't be afraid to make mistakes and experience the inevitable failures we all endure as tradesmen. Then one day you will have enough experience to convince people that your so called failure was exactly how you planned it in the first place!

## Second Year Projects



The second year students built this commissioned electric launch. They completed and installed all the deck and interior wood, the electric propulsion and battery systems. The result is a beautiful and environmentally friendly launch for the owner to haul supplies to his island cottage and tour around the Les Cheneaux Islands.



The woodworking and joinery skills the students learned over two years really paid off. The joinery and elegance of the wooden decks and cockpit are what really make this boat especially beautiful.



The second-year students also finished the commissioned 18' Tad Roberts Runabout. The paint job and finish work is striking and looks as good as any professional job I've seen. The owner is quite pleased with the result.

## First Year Projects



Students lofted, pulled scantlings and then built this replica of the 100-year-old Petoskey Boat Co. rowing dingy.



Students completed the carvel planked Katie adding the deck, house and interior to the boat started last year. Pat plans to take this boat to the WoodenBoat Show in Mystic, Connecticut.



The first-year students also finished the Garvey workboat, which is a design Pat Mahon adapted from a similar style workboat he saw in Mystic Seaport while there for the WoodenBoat Show. You can see the paint cracking after a short period of weather exposure. Bud told me this was happening on uncoated (no epoxy) southern yellow pine.

Because the boat is a work boat – heavily built and finished for work, not show, they were going to leave it as-is for the summer and do some work on it in the off season.

Not all the work was completed by the students. Andy James somehow found time to complete the strip planked and glassed hull he bought from the school. It's an attractive and practical outboard runabout perfect for fishing and touring about the Les Cheneaux area.



# Talkin' the Talk

By Julie VanMullekom

Here at GBI we're not just your average epoxy "retailer." We are the leading provider of quality epoxy products AND service. Quality epoxy as in: we dream a big, sticky, epoxy dream. We research it, develop it and produce it. Service as in: packed within our 20,000(ish) square-foot walls is a wealth of knowledge and experience so vast that it has enabled us to educate hundreds of people worldwide on the features and benefits of WEST SYSTEM® Epoxy. Spanning from A to Z...Alaska to Zimbabwe. Yeah, I know. Alaska. Mind blown.

In my job I wear many hats. So in my walk-in hat closet (eat your heart out Kim K.) one of my responsibilities is to coordinate the professional training sessions that we present each year. A big venue for us is the annual International Boatbuilders Exhibition & Conference (IBEX) where we have been putting on training nearly every year since 2006. It's attended by thousands of qualified marine industry professionals and our WEST SYSTEM Fiberglass Repair session (aka Glue U) is typically held one day before the scheduled IBEX exhibition begins. But that doesn't stop hundreds of people from all over the world from attending.

Check out these stats:

### Countries

US, Canada, Poland, Germany, France



### States

AK, AL, AR, CA, CT, DE, FL, HI, IL, KY, MA, MD, ME, MI, MN, MO, MS, NC, NJ, NY, OH, OR, PA, SC, TX, VA, WA, WI

Also Grand Cayman Islands, St. Maarten, Puerto Rico



Satisfied customers we've had the pleasure of training

At Glue-U, IBEX style, we cover topics such as basic epoxy repair techniques, composite technology and repair, fairing, gelcoat blister repair and much, much more. Another cool benefit of the training is that the professional speakers are just that, professionals...the actual members of our technical staff with many years of technical know-how behind them, such as: boat building and repair, composite engineering, material testing, and many, many years of combined customer service. We are very proud and honored to have them all on our team and you must be too... 202 people and counting can't be wrong.

IBEX 2015 Louisville, Kentucky... hope to see you there!





*Dave Wrzesinski*

# Profile of an American Craftsman

*By Bruce Niederer*

I hear it said increasingly often in the last couple years as I meet people during my travels, “Who will be the next generation of tradesmen? Who is going to work on our cars, boats and homes?” This is a serious lament posed by today’s tradesmen, potential employers who have a very hard time finding apprentices and workers to learn their trade. The U.S. is in dire need of men and women willing to work with their hands and develop the skills necessary to build and repair all our...stuff.

We read and hear daily news reports highlighting the shortage of plumbers, electricians and boat builders and people who can weld, fix a car, build and repair homes. Part of the reason is that, much like my father told me, “You need to go to college if you want to get ahead in life. Work smart – don’t work hard.” He didn’t mean don’t work hard at whatever I decide to do, he meant use your brain—not your back—to earn a living. This was commonly accepted wisdom as I was growing up in the late ’50s and early ’60s. So now we have too many young people with expensive educations competing for jobs with thousands of others, or stuck with useless degrees.

My point is, the trades in today’s world do not get the respect they deserve and as a result thousands, maybe hundreds of thousands, of good paying trade related jobs go unfilled across this country year after year.

I’m telling you this, dear readers, as a way to introduce you to a true American craftsman, Dave Wrzesinski. Dave and his son Scott work together at a classic boat restoration shop Dave started many decades ago on the north shore of Houghton Lake nearly smack dab in the middle of Michigan’s lower peninsula.

Marine Services Unlimited is an unassuming shop made up of a gamish (Yiddish for mishmash) of

additions and garages surrounding their homes. Don’t be fooled by appearances: This father and son team turn out some of the most beautiful classic boats you’ll see—Chris Craft, Hacker, Century and Riviera—and their reputation for quality craftsmanship is well known all across this great land of ours. Probably parts of Canada as well.

Dave and Scott are proud of the work they do and rightly so. Dave’s story is not only interesting but it’s one that begins right here in Bay City, Michigan. Dave grew up on the shores of Saginaw Bay with Jon Staudacher, another great American craftsman (see *Epoxyworks* 13, 22, 23 and 37). As boys, they would wander along Marquette Street and hang out in the many boat shops that lined the river in those days, including Ben Huskins’ shop. This is the same shop that Jan and Meade Gougeon bought from Ben in the late ’60s and is the site of Gougeon Brothers, Inc. world headquarters. These boat builders took these two young boys under their wings and taught them how to use tools and build boats. Dave says they each worked 40–45 hours a week before long. It’s an interesting aside that while minimum wage is so controversial today their pay for a full week as teenagers was exactly \$0. Yet Dave remembers those days fondly and makes no bones about it when he says “I learned the skills I needed to do this work for, as it turns out, the rest of my life.”

In sixth or seventh grade, Scott began working with his dad learning the business and developing the skills necessary to rebuild classic boats, both wood and fiberglass. He worked with his Dad through high school and then joined the Navy, becoming an engineer on a nuclear sub. Following his five-year stint in the Navy he returned to Houghton Lake to work with his Dad.

When Dave got older he married a German girl whose father was a cabinet builder. Dave worked for his father-in-law for many years, improving his



*Dave’s son Scott also works in the shop restoring classic boats.*

fine woodworking skills along the way. When that business began to fade and his father-in-law neared retirement age, around 1984, Dave began splitting his time between Bay City working for Jon Staudacher four 10-hour days a week and three days a week trying to get his own boat restoration business going in Houghton Lake. Eventually by 1985 he was able to devote all his time to his own business and put an end to the long distance commute.

When I arrived at the shop on a sunny Thursday afternoon I found Scott inside a 1957 Chris Craft 21' Continental with Dave outside discussing how they would fix rotten stringers and motor mounts. The engine is a big block Hercules 175 hp dual carb engine that is huge for the modest horsepower it sports. This boat is one of only six ever produced.



*1957 Chris Craft 21' Continental*

The 'fins' are made from wood, not fiberglass. The engine is a bit underpowered for skiing, and the engine mounts broke as a result of the owner running up the RPMs and slamming it into gear to achieve the acceleration to pull up a slalom skier. Dave's advice: "Don't do that!"

Dave and Scott then took me on a tour of their projects, some completed and some still

*1951 20' Riviera*



*Stern rail*



needing work. Let me take you on a virtual tour; to the left of the 1957 Chris Craft was a rebuild of a 1952 Chris Craft Sportsman. There are no fasteners in this boat anymore—Marine Services Unlimited is a WEST SYSTEM shop. The bottom is two layers of plywood glued to the frames and the fasteners backed out and filled after the epoxy cured. The owner was going to finish it himself then decided he'd never get it done so it's back to be finished. The sides are 6 mm plywood and the removed planks will be reinstalled after planing them so that the overall thickness of the sides matches the original thickness of the planks alone.

In the finish room sat this 1951 20' Riviera being restored for Ed Dore. Finish work must be suspended in the spring until the fish fly and insect hatches are over. Dave said there's no way to keep them out of the room completely and they always end up in the epoxy or varnish. It's not worth the frustration and extra work.

Look closely at this stern rail. It was glued in (using WEST SYSTEM Epoxy) as basically a square plank with the outside corner cut off a bit. The rest was shaped by hand with a plane and sandpaper. The seams and fit are perfect: the mark of a true craftsman.

Here's another Riviera from Scott's garage. They're refinishing this one for a different customer, including new varnish and new interior upholstery.



*1950s era Riviera*



Note the bullnose bow characteristic of '50s era Riviera. Also note the blond wood on the deck which Dave and Scott replaced new, again with no fasteners, using Satinwood instead of traditional bleaching to achieve that effect.

1962 Buehler Turbocraft  
 Left - Jet drive cover/swim  
 platform fabricated by Dave  
 Center - Bow in the travel trailer  
 Right - Custom hand rails and  
 ski tow post



In his travel trailer ready to go to a show was this rare beauty, a 1962 Buehler Turbocraft. This is one of the first production jet boats ever built. This fiberglass boat sports a beautiful powder blue gelcoat deck that genuinely captures the era in which it was built.

The transom piece that doubles as a jet drive cover and swim platform was missing when they got the boat. Dave first built a mold then laminated the part and installed it. To look at it I would have never guessed it wasn't original equipment.

The photo on the right shows the swim platform hand rails and ski tow post, all custom made, coming up onto the stern deck. To really appreciate this boat you need to see it in person. These photos only hint at the beauty of this rarest of boats.

Across the street from the shop in a pair of garages sat a couple more classic gems.

The first one I was shown was a 1965 Century Resorter that sports a custom windshield with Riviera wing brackets, all new wood, new custom interior upholstery, new instruments, and a new Ford V-8 260 engine. Many years ago, just as the restoration nearing completion, the customer died. Dave's son-in-law bought it from the family. It's now for sale. I asked what something like this might cost and was surprised when Dave said about \$35 grand! This boat is simply a work of historical art—nothing less.

The last boat I was shown was a 19' flat bottom Bubble Boat in the first stages of restoration. The name is a result of the bubble shape on the back of the deck in front of the windshield. It's a fiberglass boat that will be finished with a wood deck.

Back in the shop, in a room behind the '57 Continental. The walls of Dave's woodshop are a treasure trove of historical photos from over the years. There were so many it's not possible to cover them all in this space. But there was one set of photos that I must talk about.

These photos over the door leading back into the front shop area are of Les Staudacher's *Tempo ALCOA* (below). Les, Jon's father, wanted to set a new speed record on water and built a jet boat—not a jet drive boat like the Buehler. This boat had an actual jet engine from an airplane. For more details, read the article *A Rendezvous with History: Les Staudacher and Tempo ALCOA*.

So to come full circle, this is a story of how a true American Craftsman comes by that title. Not in a straight line by any means, but by perseverance, pride in one's workmanship, and a love for the work you do.

The bottom line is, to get where Dave and Scott are there is only one path: you have to earn it.

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Photos of Les Staudacher's *Tempo ALCOA*





# A Rendezvous with History

## Les Staudacher and *Tempo ALCOA*

*This is the first and only run the jet boat made on the Saginaw Bay.* By Bruce Niederer

My article *Profile of an American Craftsman* touched on the photos of the Les Staudacher jet-powered boat *Tempo ALCOA*. What follows are the details of that historic event.

In 1957 Guy Lombardo and the Royal Canadians were in high demand. The band leader and his music were well known throughout the U.S. and Canada. Lombardo was also a successful and well known driver of Gold Cup hydroplane speedboats. Prior to WWII, Lombardo had a distinguished 225 cubic inch class career and moved up to the Gold Cup after the war when he bought the proven champion *My Sin* from Zalmon Simmons in 1948. Simmons had won the 1939 and 1941 Gold Cup races driving *My Sin*. Lombardo repowered the boat with a 1,300 hp Allison V-1710 aircraft engine and renamed the boat *Tempo VI*. Lombardo is credited with as many as 15 Unlimited and Gold Cup victories between 1946 and 1953, but 13 of those victories were in multiclass free for all races that are not recognized in modern historical records. His two big wins were the Gold Cup in 1946 and the 1948 Ford Memorial race—both in *Tempo VI* and both in Detroit.

In Miami in 1946, Lombardo set a new Gold Cup class record in *Tempo VI* for a one mile run with a speed of 113.031 mph becoming only the second Gold Cup driver in history to break 100 mph barrier. He failed to achieve his ultimate goal of besting the Unlimited Class speed record held by the renowned *Gar Wood* of 124.915 mph set in 1932 in Algonac, Michigan driving his four-engine *Miss America X*. (Fun Fact: Algonac is the original site of the Chris Craft production facilities.)

Around early 1960, Lombardo announced he was getting back into racing in a boat being prepared for him by Les Staudacher in Kawkawlin, Michigan – a 30 foot Gold Cup racer with a 1510 Allison aircraft engine Lombardo named *Tempo VIII*. This cemented a relationship between kindred spirits, adventurers obsessed with being the fastest boat ever, evidenced by the fact that Lombardo and Staudacher with the Aluminum Company of America (ALCOA) had already teamed up to work on a jet-powered speedboat with no props. Their goal was to bring the world speed record back to the US currently held by Brit Donald Campbell who piloted his jet boat on a 248 mph run to take the record.



*This is the end result of the run on the Saginaw Bay. Dave thought he remembered the boat reaching 267 mph before crashing into the woods somewhere along the western shore.*



*Les fires up the engine strapped on a cement pad, right in the middle of a neighborhood.*

It took Staudacher the better part of a year to build the boat which he designed himself. Lombardo said it looked like a “pickle fork” with the two tines (sponsons) jutting in front of the driver’s seat. Staudacher had to overcome a number of design problems to make this work. There was no deck or foredeck in front of the driver like on traditional hydroplanes. Hydroplanes operate with about 3 degrees of lift allowing the sponsons to “float” above the water with little but the prop in the water. This would not work with a jet engine because the excessive thrust would cause the hull to take off and fly, flip backwards (blowover) and somersault. He took a model of the boat with the engine attached to North American Aviation to test in their company wind tunnel to learn at what speed the boat would fly. Testing showed the boat would be stable up to 460 mph, but the mechanical properties of the structure would not withstand that speed. Still, they were all confident they could reach 300 mph safely.

The first manned test runs of *Tempo ALCOA* took place in early June 1960 on Pyramid Lake in Nevada. Staudacher made two or three easy runs up to about 180 mph on dead calm water and everyone was very pleased. They were ready to call it a day when a photographer from Popular Mechanics asked if he could get some photos of the boat underway. Les fired up the engine again and made another run for the camera closer to shore, but a breeze had come up causing ripples on the water which doubled the stopping distance of the boat. Staudacher noticed a small peninsula jutting in front of the boat, and too late to stop, hit it at speed. The boat flipped over in the air and landed

upside down in the water. A frantic Lombardo raced down the jetty and fell, tumbling down the riprap, ending up bruised and broken. Staudacher emerged from the water without a scratch on him and drove Lombardo to the hospital in Reno.

The boat and accident received national press attention. Staudacher brought the boat back to his Kawkawlin shop to begin repairs. The rebuild took months, but by spring of 1961 they were ready to try again—this time in Saginaw Bay near Staudacher’s boat yard. But Lombardo was too nervous to let either of them climb into the cockpit, so they spent \$2,500.00 on a custom remote control unit built by North American Aviation. They simply couldn’t look inside the sponsons. Had they found all the damage?

They installed the remote controls and Staudacher piloted the boat into the Bay and started “slow” at 100 mph to see how it would handle. Having no problems, Les came ashore, engaged the auto-pilot, set the throttle at half throttle and ran it up to 200 mph. All went well so they pushed it to three quarter throttle and hit 250 mph. Everything was looking good and they were ready to bring it in when suddenly a sponson came off and the boat veered right and went down with a huge splash while the engine continued straight ahead for a half mile before it sank and disappeared. It turns out the sponson had a defect from the first accident and at 250 mph it broke. That was the end of *Tempo ALCOA* and the dream of going 300 mph in a jet boat.

# G/flex Weds Wood and Glass Crystal

By Tom Pawlak

David Black is a creative boat builder, woodworker and artisan living in San Diego California. He is very familiar with all the WEST SYSTEM® Epoxy resin/hardener combinations but recently has become a huge fan of G/flex Epoxy.

I love it when David calls because his projects are always interesting. He pushes the envelope of how epoxy can be used. His clients appreciate him too for his creative abilities. Do you have an idea for a new table for your mega yacht? Call David. Need a unique teak deck for your yacht that no one else will even consider installing? Call David. Need someone to design and build a one-of-a-kind interior for your new motor coach? David is your guy. If it is out of the ordinary and it tests the realm of possibility and good reason, count him in.

A few months back David called to ask what I thought about using G/flex 650 (the liquid version of G/flex) to glue hardwood to glass crystal. I said as long as both were clean and well abraded—no problem. Today he emailed pictures of the results. I think you'll agree the glasses are amazing. Both sets of champaign glasses/goblets were made for use in toasting the brides and grooms at their wedding receptions.

Nikki and Robby's goblets were made from glass crystal goblets with the stem removed via a diamond wet saw and eventually sanded with 220-grit sandpaper on all bonding surfaces prior to gluing. The cocobolo wood was sanded with 80-grit sandpaper and cleaned with acetone and paper towel multiple times to remove natural oils before gluing.

Hayley and John's wedding goblets were made with a tropical hardwood and glass crystal as well. The gluing area on these goblets is about the size of a dime. To be certain that this was enough gluing area, David "deconstruct



The glass/wood joint with heart details on the prongs



Nikki and Robby's champaign flute



Hayley and John's champaign flute

tested" the joint on his prototype prior to making the actual goblets. He discovered that the G/flex tenaciously bonded the wood and glass crystal together.

G/flex 650 was used to glue the bottom of the glass to the wood base. David allowed lots of time for the G/flex to soak in the wood before mating wood and glass together.

Cotton swabs and rubbing alcohol were used to clean up the G/flex that squeezed out while still uncured. Dry cheese cloth can also be used to wipe off uncured epoxy smudges.

The copper jewelry beads were glued into a concave recess in the goblet base with G/flex 650 as well. David ran a continuous length of polyester sewing thread through the beads twice so it would stay attached to the goblet circumference without lifting off as the knot was tightened. Polyester thread was used because of its strength and because it is a bit stretchy. Once again rubbing alcohol and cotton swabs were used to clean up the epoxy squeeze out from around individual beads.

If you decide to make a set of goblets for yourself, consider sending us photos so we can see your creations. Possibly they will show up as a readers' project photo in a future issue of *Epoxyworks*. I'm sure David would love to see your creations there as well.

# Dirt Bike Loading Ramp

By Daryl Brunette

A dirt bike loading ramp is very bulky and heavy, but important for loading everything you need in motocross. You can just use a wooden board thick enough to support the weight of your bike, or you can buy expensive aluminum ramps. But I wanted to build one and give it a personal touch, making it lighter and stronger.

Ten or so years ago I made a board that I used successfully for five years until it got stolen. I knew that with the right design and products, the new board I planned to build would also be a success. The most important aspect of this project was making sure the board would be stiff enough to support a bike, with very little deflection. Our Technical Advisor Mike Barnard helped me with the project. As stiffness is highly dependent on thickness, we chose 2" thick pink foam insulation. Though foam insulation is not structural, it was sufficient in this instance. We then cut and glued another small section of foam onto the larger piece to create a tab that hooks onto the tailgate and allows the bike to be loaded without causing the bottom of the board to lift off the ground.

In order to maximize the thickness and stiffness of the board, we used 2 layers of 737 Biaxial Glass Fabric. To make it look good and add a lot of additional stiffness, we finished it off with a layer of woven carbon fiber and 105 WEST SYSTEM® Resin/207 Special Clear Hardener for a clear finish. These are the steps we followed:

- Layout all the layers of fiberglass to be wrapped around the foam on a well waxed table top
- Apply epoxy to the first side of the foam to be fiberglassed
- Saturate a section of the fiberglass the width of the foam board near one end of the fabric. Be sure to wet out all the layers.
- Press the wet side of the foam onto the wet out section of fabric and let cure overnight
- Apply epoxy to the next two sides of the foam and the corresponding area of fabric
- Roll the foam with attached fiberglass at a 180° angle being sure to keep the fabric snug. Let cure overnight.



Above - The finished loading ramp complete with non-skid and stickers.

Right - Daryl applying epoxy to the foam insulation just before wrapping it in fiberglass



- Repeat the wetting out process for the remaining side. Leave a slight overlap from the two ends of fiberglass and trim excess fabric. Let cure overnight.
- Strengthen the tab joint by epoxying a foot long section of 18 oz. stitched carbon fiber on both the top and bottom of the joint.
- Give the board a light sanding with 80-grit paper and repeat the fiberglass process with a layer of carbon fiber.
- Fill in any remaining low areas with 105/207

After building my loading board, I laminated some stickers onto the board to make it more appealing. During a trial run of loading a 230 lb. motocross bike, I found the surface was too slippery. To make the surface non-skid, I took the following steps:

- Apply electrical tape over selected areas where I want to maintain the smooth finish
- Use a Scotch Brite pad to abrade exposed epoxy
- Coat with 105/207 and sprinkle liberally with silica sand while epoxy is still wet
- Remove electrical tape after about 1 hour and allow to cure

The completed non-skid just after the electrical tape has been removed.





# Fairing Basics

The goal of fairing is to create a surface without bumps or hollows.

By Jeff Wright

Fairing Compound should be of a consistency that can be troweled onto a surface without sagging. Add 407 Low Density or 410 Microlight filler to mixed epoxy, checking the consistency as you stir in the filler to determine if the mixture has the correct viscosity for your application.



Catsup Consistency

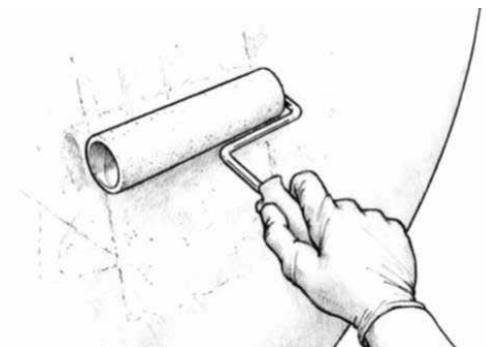


Mayonnaise Consistency



Peanut Butter Consistency

Highly thickened fairing compound mixtures will have very little epoxy available to wet the surface of the hull and may be an issue on porous surfaces such as wood. To ensure good adhesion with highly thickened mixtures, apply a thin coat of unthickened epoxy to the surface before troweling on the fairing compound. The fairing compound can be applied right after you apply the unthickened coat, but you may want to wait until the unthickened coat becomes tacky so a thick application of fairing compound does not slide on the surface.

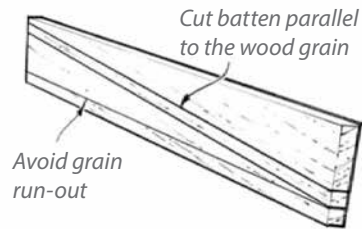


When selecting your hardener, consider the required working time, the ambient temperature, amount of epoxy that will be mixed, and desired cure speed.

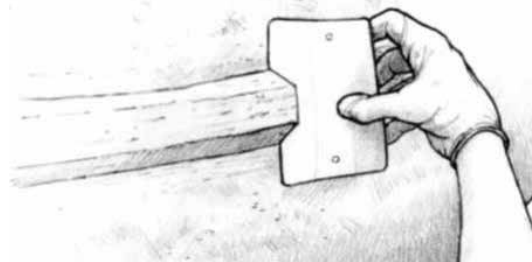




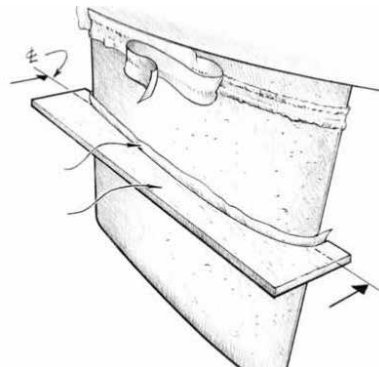
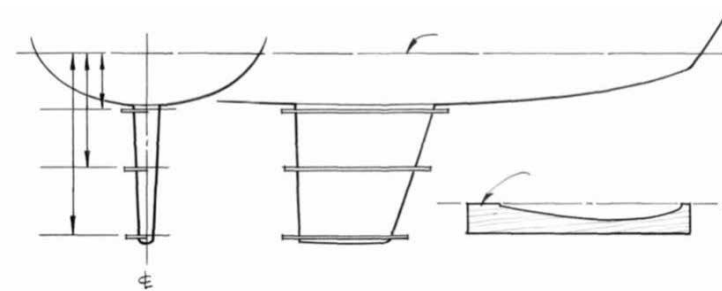
Use a chalk and a batten (a long, flat, strip of metal, plastic or knot-free wood) to find the low and high spots on the surface, then decide whether to proceed by filling in low spots or removing high spots.



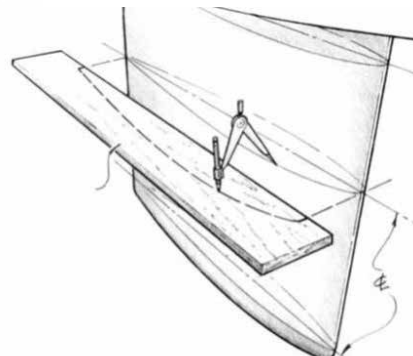
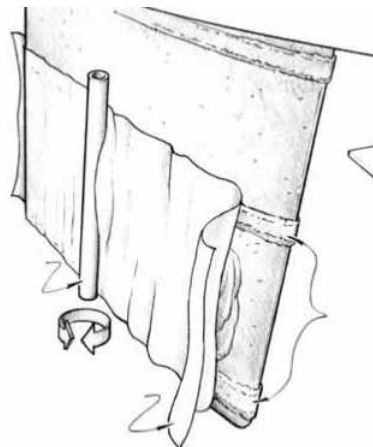
After marking the low spots, use a spreader with a notch to create a "guide." After a strip of fairing compound is applied, the batten can be wrapped in release fabric and placed into the fairing compound. After these strips cure, fairing compound can be applied between them to fair in the entire surface.

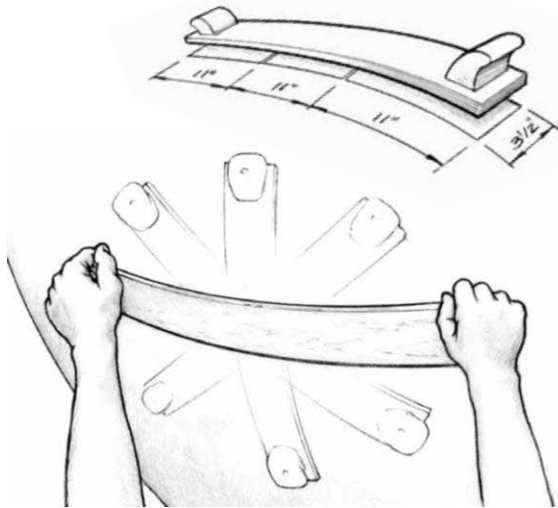


Reduce sanding by applying the first layer of fairing compound with a notched trowel. Only the top of the ridges formed by the trowel will be cut by the sand paper. A second application will fill in the valleys.



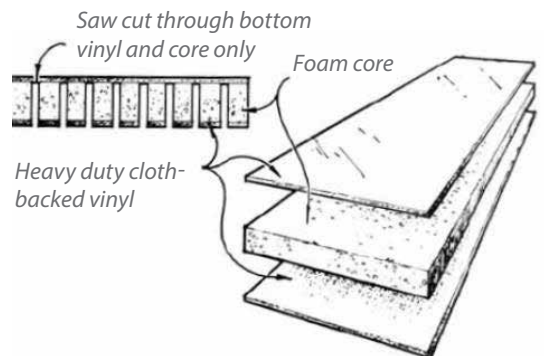
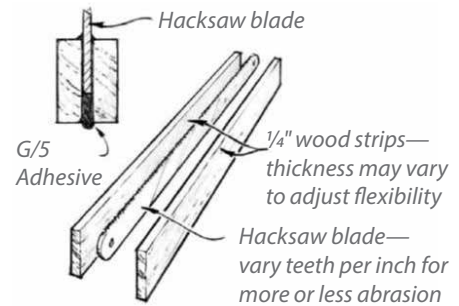
Templates are very useful when fairing foils and can be created from a drawing or a surface. Tracing the shape onto a board gives you a rough shape and then a batten can be used to make it a fair curve. The template can be used to form guides to assist in the application of fairing compound on the rest of the foil's surface.





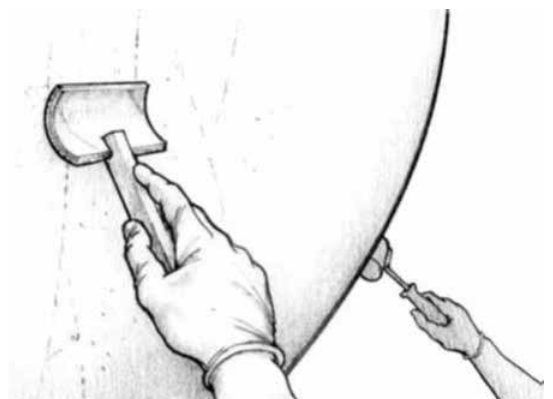
When removing material is very important to use a “long board” which you may have to make yourself. The sanding board must be flexible enough to bend, but stiff enough that it will maintain a fair curved when it does flex. In many cases automotive type body work tools will be too short and dual action rotary sanders should be used only for creating a profile on the surface.

Scrapers are a great tool for removing drips, runs and ridges because they will only cut away the protruding surface defect. They can be purchased, or made from hacksaw blades.



Custom sanding tools may be required for gunwales, toe rails and style lines. This example shows a tool that only flexes in one direction and could be used on the chine of a round bilge hull.

Even on wooden boats, proper fairing and finishing is important. Note the mirror like finish on RASCAL, a 14'10" runabout built by Steven Gembrowski. His build was featured in Epoxyworks 24.



When all the fairing is completed the surface often consists of a combination of fiberglass laminate, fairing compound and old paint or gelcoat. By applying a coat thickened epoxy to the entire surface a more uniform and stable surface will be created ensuring an excellent surface for the final finish.



# FIBERwave PAVILION

*By Alphonso Peluso and his Spring 2014 IIT Architecture Students Joseph Bertucci, Cecilia Campos, Dijon Dunmore, Xinyun Huang, Jared James, Ryan Kim, Dakotah Lucas, Jeffrey McQuiston, Nick Rienstra, Teresita Pineda, John Seaman & Jeffrey Wigen*

The FIBERwave PAVILION was designed and built as part of a student-based design research studio. Carbon fiber was used because when coated with epoxy it can become as hard as steel, and added layers enhance its strength. It offers designers great control over structural properties and is incredibly lightweight.

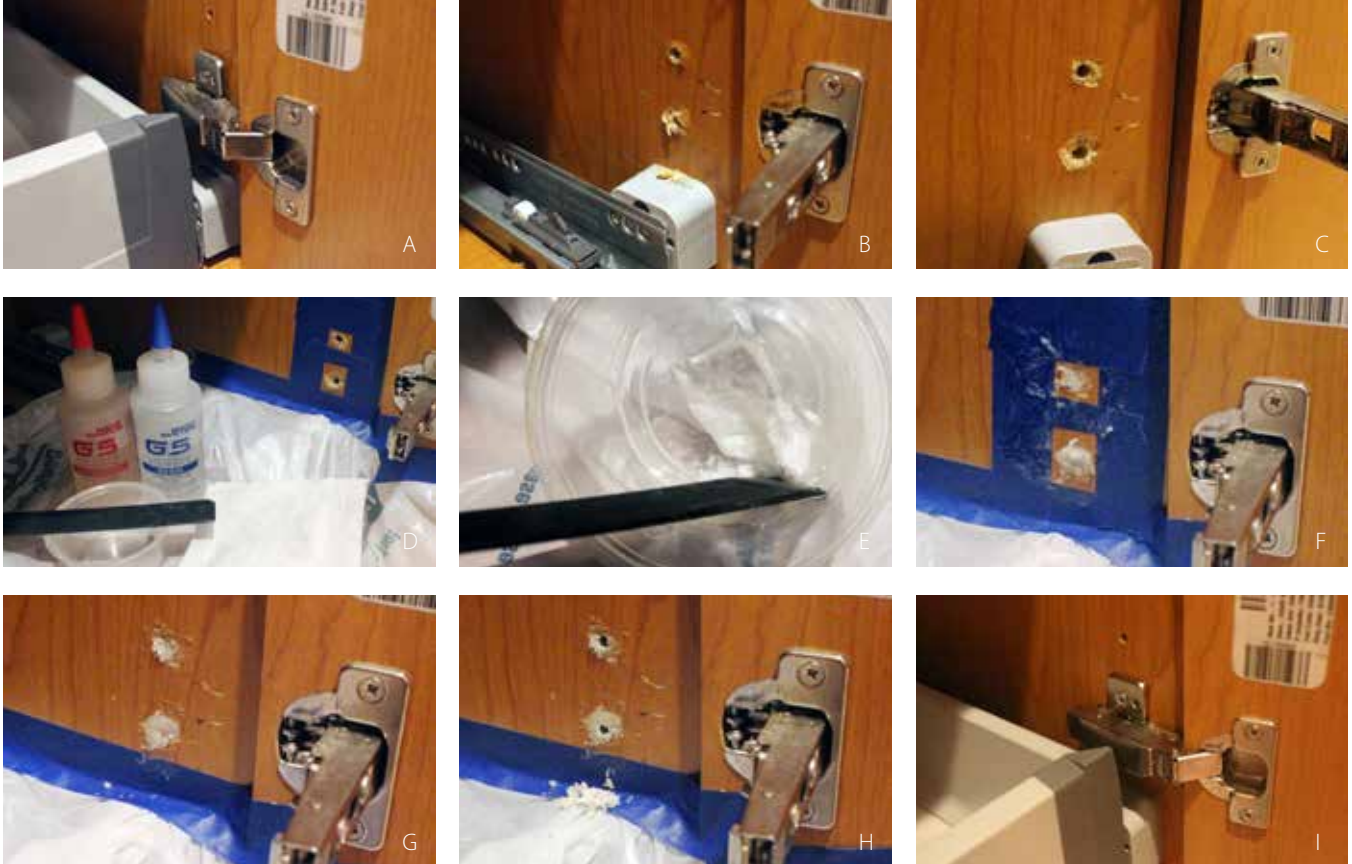
The pavilion is comprised of one geometric unit, “the shell,” repeated multiple times. The shell is extremely thin and light weight with an overall thickness of 1/8" and weighs 1 lb. The shell connects laterally at two points to another shell on either side with metal plates, creating flexible rows. The rows are then connected vertically by a bolted pin. A specific pattern of row length and vertical connections creates a curving wavelike structure called FIBERwave. The nature of the connections and the shell geometry allows the pavilion to undulate and morph.

The making of the 90 panels began by CNC milling a 44" long by 22" wide wooden male mold. To create the appropriate finish for releasing carbon fiber, .08" thick polystyrene plastic was vacuum formed over the mold. The maximum size of the vacuum former was 22" x 22" so it was necessary to cut the mold in half leaving two 22" x 22" sections. Each section was then vacuum formed and assembled back together (photo 1). Next the mold was prepped with several coats of Carnuba Wax and Poly Vinyl Alcohol (PVA)

to mold release (photo 2). After the PVA was allowed to dry, WEST SYSTEM Epoxy 105 Resin and 205 Fast Hardener was applied to the entire mold (photo 3). Next the first of three layers of 5.9 oz. 3K 2x2 twill carbon fiber cloth was placed over the mold with the fibers running vertically at 90° and resin/hardener applied (photo 4). The next layer was a perforated structural foam core which gave the panel the required strength at less cost versus additional layers of carbon fiber. Then resin/hardener was applied. The remaining two layers of carbon fiber cloth were placed, the first with the fibers running at 45° and the second at 0°, both with resin/hardener (photo 5). The whole process was repeated 89 more times. To save time and money the decision was made not to vacuum bag the 90 panels.

A total of six male molds were eventually made allowing six carbon fiber panels to be completed per day. Once all the panels were made they were trimmed, sanded and finished. To precisely trim the 90 panels a foam mold that matched the six male molds was created. The carbon fiber panels were placed one at a time over the foam mold and the CNC machine trimmed and drilled holes in the panel (photo 6). Next the top, bottom and edges of the panels were sanded (photo 7). As a last minute design decision several panels were selected to be painted bright yellow using exterior house paint. The painted panels along with remaining panels were finished with a clear coat waterproof sealer.





# G/5 Five-minute Epoxy

## a versatile glue for hobbies, crafts and home repair

By Tom Pawlak

A) Before starting the repair

B) Hardware removed

C) The holes cleaned up and loose material removed

D) The area surrounding the holes masked off

E) Mixing the G/5 Epoxy with sections of paper towel as filler

F) Thickened epoxy applied to the holes

G) Tape removed and surrounding area cleaned

H) 10 minutes after applying the epoxy, new holes drilled

I) The hardware reinstalled 20 minutes after being removed

G/5-Five Minute Adhesive is a fast curing two-part epoxy that allows 3-5 minutes of working time. It has an ideal viscosity which allows it to penetrate porous surfaces yet is viscous enough to bridge gaps when gluing broken objects. It adheres to a number of surfaces including wood, ceramic, metal, leather, plaster, stone, fiberglass, glass, cork, some plastics and paper. G/5 is an excellent choice for quick repairs around the house, high-end crafts and much more.

As with any epoxy, for best adhesion roughen any smooth surfaces to provide texture for the adhesive to key into. G/5 does not require clamping pressure as long as contact between parts is maintained during cure. If using clamps, it is best to use minimal clamp pressure to avoid excessive squeeze out resulting in a glue starved joint.

The joint will be ready for light use after 15 minutes and cured to near full strength after four hours at room temperature. It will continue to gain strength and toughness with additional cure time.

### Bridging gaps with thickened epoxy

G/5 Adhesive can be thickened with a variety of powder fillers to bridge larger gaps in glue joints and to create fast-setting sculpting putties. Powders that work for this include talcum, sanding dust, tempera paint powder, laundry lint, cotton flock and chalk line chalk.

Note that while sanding dust can be used to thicken G/5 because it cures very fast, it is not a true thickener for standard epoxies because slower curing epoxies may drain out of the thickened mixture before cure, resulting in glue-starved joints

WEST SYSTEM® fillers can also be added to G/5 to create a thickened adhesive. 403 Microfibers thicken epoxy fastest of all our high-density fillers. Add thickeners quickly while stirring the epoxy so you have meaningful working time left to use the epoxy. Once thickened, G/5 can be used to fill missing sections in broken objects as they are being glued back together. Tissue paper and small bits of cotton balls can also be used as gap fillers if they are wet out with G/5 adhesive just before forcing them into location with a toothpick.

## Modify color

You can add color to G/5 Adhesive by adding wood sanding dust, powdered chalk line chalk, powdered paints like tempera paint or small amounts of acrylic paint pigments and lettering enamel. Other coloring options include metal flake, metal powders, crushed stone and glitter. Add color additives quickly while stirring the epoxy so you have time left to use the epoxy.

## When you don't want epoxy to stick

Use shiny cellophane tape to mask off areas where you don't want the epoxy to stick. You could also use electrical tape, a plastic drop cloth or plastic food storage bags. Vaseline®, paste wax, shortening and cooking sprays can be applied to objects to contaminate the surface to keep the epoxy from sticking.

## Applications/Uses

Cured G/5 can tolerate getting wet but it is not intended for items that are continuously damp or wet. It will work well on exterior applications as long as long term wet/damp conditions are avoided.

## Using G/5 as an adhesive

1. Mask off areas where you don't want the epoxy to stick.
2. Roughen smooth mating surface if possible with sandpaper.
3. Apply mixed resin and hardener to both mating surfaces if possible.
4. Bring the mating surfaces together and hold in place until G/5 hardens.
5. Use tape, rubber bands, spring clamps or just use your hands to hold the parts in position until G/5 cures to a hard, rubber-like state. The joint is ready for light use at this point, but allow more time before seriously stressing the joint.

## Repair stripped screw holes

1. Apply unthickened G/5 adhesive to the hole to penetrate the area
2. Thicken the remaining G/5 in your container with powdered fillers like 403 Microfibers or talcum
3. Fill the hole with epoxy and wipe away any excess
4. Alternatively, you can take bits of tissue paper and wet them with G/5 Resin/Hardener mixture and quickly force them into holes with a toothpick
5. Trim any excess epoxy with a razor blade

before it gets too hard

6. Allow the epoxy to cure for ten minutes then drill a pilot hole for the new screw and screw it into the still flexible epoxy

Another option is to glue the screw in place by inserting it into the wet G/5 before it cures. If you wish to be able to remove the screw later, coat it with one of the anti-stick coatings (like Pam® cooking spray) mentioned earlier before inserting it in the uncured G/5.

## Crafts

Wood turners use G/5 to fill voids after thickening it with wood dust, colored additives or metal filings giving a unique color accent in the turning.

Use G/5 to glue things together on tough jobs where hot melt glue isn't strong enough, especially when gluing the following materials:



\*Abrade for best results

\*\*Abrade for best results. Some plastics, like polyethylene, may require exposing gluing surfaces to a propane torch flame before gluing.

Model railroad set builders can create natural looking surfaces by brushing on a thin film of G/5 Epoxy Adhesive then sprinkling small objects onto the surface while it is still uncured. These objects could include pebbles, sand, coins, dirt, twigs, dried grass, flocking powder, sawdust, grains, nut shells, sea shells, straw, glass chips, glass or plastic beads, metal filings, cotton balls, spun polyester and so on.

Spot prime metals with G/5 in place of slower drying paint primers for indoor applications prior to applying latex paints. Latex paint can be applied ten minutes after G/5 is applied and while it is still soft. G/5 provides a thin barrier and prevents rust that otherwise forms in latex paint while it dries over bare steel.



Spot prime knots in sappy woods like pine and spruce to eliminate stain bleed through prior to painting.

Glue broken porcelain figurines with G/5

### Repair furniture

Glue loose joints back together with G/5



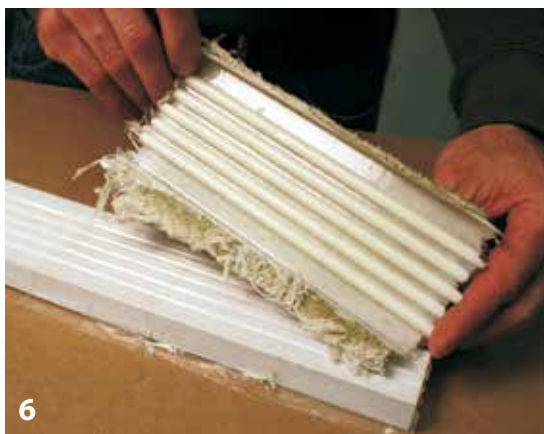
Repair stripped screw holes on fiberboard or pressboard tabletops even missing chunks of pressboard can be replaced with G/5 and drilled and screwed into again

Repair loose countertop laminates like Formica®, Corian® or Wilsonart® surfaces

Make molds for creating multiple parts by following these steps:



1. Cover the area you are taking the mold from with 2" wide cellophane packaging tape. Press the tape into the recesses of the surface.
2. Apply epoxy thickened to a ketchup consistency with 403 Microfibers or other high-density filler to fill the voids in the surface
3. Apply a layer of fabric reinforcing material. Even terrycloth towel can be used for this.
4. Wet out the fabric with epoxy and allow it to cure. G/5 can be used for these steps to make a mold quickly.
5. Remove the mold by working wood or plastic wedges under the perimeter until it releases. The 804 Mixing Stick is a good tool for this.
6. The mold should pop off cleanly—a perfect reflection of the taped surface.
7. Before using the mold, trim the excess off with heavy scissor, snips or smooth ragged edges with a file or course sandpaper
8. Cover the mold with a mold-release like cellophane tape (pressing the tape into the recesses in the mold) or apply an automotive paste wax.



For more details, see A Professional Technique for repairing Damaged Wood Trim in *Epoxyworks 31*.

Create contoured sanding blocks with G/5. See the composite drum building article in *Epoxyworks 39* Fall 2014 for details.

# Skiff Details

By Captain James R. Watson



A skiff is a shallow, open boat with a sharp bow and square stern. After building skiffs of various designs and spending a lot of time using them over many years, I have found certain details that might be of value to others.

## GUNWALE

The gunwale of an open craft is a structural element comprised of longitudinal members that gives strength and stiffness. There are two components to each side of the boat's gunwale, the inwale and outwale, separated by the hull's planking. The outwale is often subjected to impacts and abrasion so is fitted with a rub rail of some protective material. The inwale connects to the breast hook and transom knees as well as oarlock blocking.

Most inwales and outwales are made from a rectangular strip of wood. This can be tricky to bend because of the twist involved, the cross section dimension and the degree of bend.

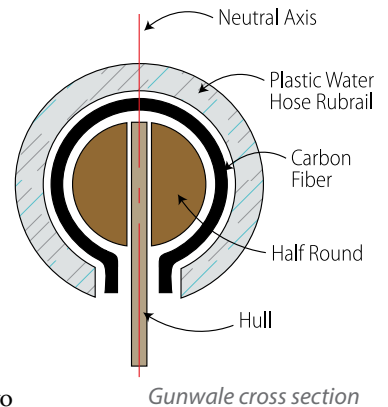
I've come up with a successful modification to a typical gunwale. It twists and bends easily, it is also light weight, stiff and durable.

Using half round mahogany, fir or spruce stock (for

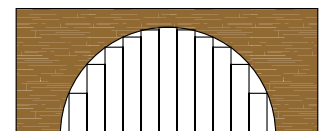
small boats pine molding), fit the inwales and bond them in place with epoxy using spring clamps spaced about every foot to secure the inwale until the adhesive cures. Do both port and starboard at same time to retain hull symmetry. Next, fit and bond the outwales, again securing with spring clamps. It is much easier to install the inwales and outwales separately than to install all four at once.

When all the inwales and outwales are installed it is surprising how much these two elements stiffen the structure. For additional stiffening apply one layer of 2" or 3" wide unidirectional carbon fiber tape the length of the gunwale. The width of the tape you should use will depend on the width of your gunwale. Carbon fiber is a great reinforcing and stiffening material and is best utilized furthest from the neutral axis of the gunwale's cross section (the outer most edges of the gunwale from the hull).

The breast hooks, transom knees, and oar lock blocking must join the gunwale which requires matching the round inwale. An easy way to make a good fitting joint is to machine a half round groove in your stock using multiple passes on a table saw. Then, using coarse sandpaper wrapped around a dowel, sand any remaining ridges in the groove. From your newly machined stock, cut all the parts needed to fit over the gunwale and bond them in place.



SKIFFS BUILT	YEAR	TYPE	BOTTOM
W. F. Crosby 16'	1964	decked	flat w/skeg
Olsen 13'	1965	decked	vee no skeg
Olsen 13'	1965	decked	vee no skeg
J. Dobler 7'3" Pepita	1989	open	multi chine w/skeg
Glen-L Marine 7'10" Sabotina	2007	open	vee w/skeg
Glen-L Marine 12'	2011	open	flat w/skeg
B&B Yacht Design 11' Spindrift	2013	open	vee w/skeg



To make tight fitting joints (right), machine a half round with multiple passes on a table saw, then sand down any remaining ridges (above).

*Slice the water hose by drawing it through a tube with a slit for a utility knife.*



For a rubrail, use a sliced plastic water hose of an appropriate inside diameter to fit snugly over the gunwale.

Slicing the hose safely was given some thought. I fashioned an aid for slicing the hose from an aluminum tube that allowed the hose to pass through it with little clearance. The tube had a slot cut in the top of one end to accept the blade of a utility knife.

Drill a hole through tube so it can be screwed to a shop bench while slicing the hose. Draw the hose through the tube while holding the knife in the slot. Every foot or so wrap the sliced hose with tape to prevent twisting so the slice does not spiral around the length of the hose; that would make for a poor installation. Tip: Always measure your hose and add a couple of feet. I bought 22' of hose and sliced it only to discover the salesman had only given me 20'—I had 9' of slit hose I could not use. Better two feet too long than two inches too short.

Using a few screws, fix the hose in its location. It looks good, and does a good job of protecting the gunnel.

## HELP for HOOKS and KNEES

Skiffs lead a rough life. It's the bump when coming alongside another boat, the bang of a dock and the thump of a piling strike. The corners (at the bow and the transom) of an open skiff attract a lot of forces and are typically reinforced with gussets. Specifically, a gusset at the bow is called a breast hook, and gussets at the stern are called transom knees. The intent of the gusset is to accept tension and compression

forces plus increase attachment area. One of the most challenging forces corners are exposed to however is the silent, unnoticed but ever-constant creep that, if not correctly reinforced, will

fail over time. The force exists as wood's memory to be straight. It resists the curved shape it is bent into to create the boat shape. The resulting cleavage force is due to joint geometry and the direction of loading.

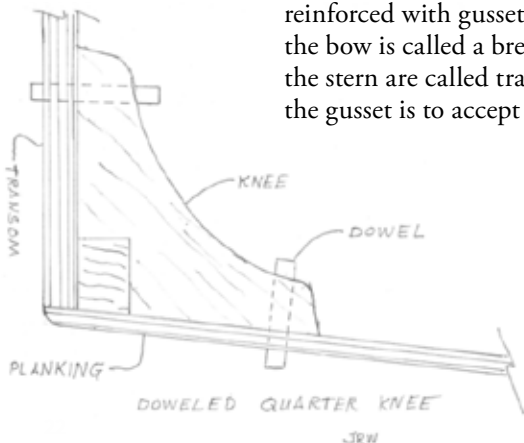
Concentrations of normal tensile stress through the adhesive layer at the edge of the joint make it susceptible to failure. To prevent this type of failure, bond a wooden dowel through all the elements of the joint.

Certainly, you begin assembly with an adhesive that has good creep performance (there is quantitative data available to evaluate this quality). After all the joints of a corner, including the gusset are completed and the adhesive cured, drill a  $\frac{1}{4}$ "– $\frac{5}{16}$ " diameter hole directly through all the elements as close to the end of the gusset as practical. Then swipe the hole with wet epoxy; while soaking, precut dowels (cut  $\frac{1}{2}$ -inch long with square cuts so the dowel does not split when tapping) and place them in the mixing pot (until they swell slightly). Allow the epoxy to soak into all the end grain that the drilled hole exposes then push or tap the dowel into place and allow to cure. Cut flush the next day. Note: if the dowel does not pass through, but is blind, you must not be too aggressive driving the dowel home or hydraulic force may split the wood.

## WOODEN BUNGS

If you cannot use C-clamps, spring clamps or weights, use drywall screws as temporary fasteners. They work well to draw parts together, exert pressure and hold components in place until the epoxy cures. Once the adhesive has cured, withdraw the fastener. What's left is a fastener hole and often, a depression from the fastener's head. Filling with thickened epoxy is tedious, often requiring several attempts to get flush. The difference in material density between epoxy and wood may result in "print thru" over time. A wooden bung resolves this issue.

For boats, I prefer this method over a permanent







*Note cutaway of hole and plug how all the end grain that the screw exposes is protected with epoxy.*

screw as moisture will condense on the screw and enter the end grain exposed by the fastener hole.

This approach is quicker, more effective, economical and looks better over time than filling with epoxy. Counter sink the remaining fastener hole with a #10 Fuller countersink, then bung with a wooden plug of the “approximate” species of wood (e.g. mahogany plywood, use a mahogany plug). Produce these bungs on a drill press from scrap wood using the matching plug cutter. Use non laminated lumber for plug material, not plywood. This works for painted natural finished surfaces.

Drill/countersink the hole using a common drill that fits the countersink and is set to about ½" deep, drip clear epoxy into the hole and dab a little on the bung. I try to align the wood grain of the plug with the substrate. Push in place, sometimes a light tap of a mallet is required. Allow to cure, and then cut flush with a flush-cut saw. A light swipe with sand paper and the surface is ready for coating. If you don't have a flush-cut saw use a chisel but cut (don't split) the bungs because if the grain dives you'll have a divot to fix. Use a sharp chisel. Make a light cut high on the bung to determine which direction the grain is going, then cut more, finally cut flush with the chisel.

## BAILER

The self-bailer (invented by Danish Paul Elvstrom and branded and built by Andersen) is a device that, when opened, draws water from a craft when there is sufficient forward motion (usually about 4 mph). A flap prevents water from flowing into the boat when the speed is insufficient. When the self-bailer is closed, it is flush with the bottom.

I cannot row 4 mph, but the bailer works great if motoring or sailing. It also works well if the dinghy is towed behind its mother ship. However, I like the bailer for another reason; it serves excellently as a drain. It is located at

the lowest point of the hull, so when setting on bunks out of the water, or hanging from davits, the rainwater can drain.

To install a bailer, make a template to mark where the cut out should be placed. Cover the plywood in that area with a layer of 6 ounce fiberglass fabric trimmed to the outer edges of the bailer. The fiberglass reinforces the plywood planking for the bolts used to mount the bailer. After drilling, bed the bailer, in G/flex 655 Epoxy and bolt all together. Be careful to clean all surfaces of excess epoxy prior to curing; scrape first then wipe with alcohol.



*Andersen bailer ready for installation. In the top right corner is the limber through a watertight compartment*

## LIMBER HOLE

The seats of my skiffs are intended to be watertight providing buoyancy in the event of capsize or swamping. The problem is that the middle seat separates the forward half of the boat from the aft half preventing rain water or splashed sea from draining to the lowest point for removal. To solve this problem, I limbered the middle seat so water can pass through, yet the watertight integrity is retained.

To create a limber hole, slice a cardboard tube, like that used for hand towels, length-wise. Place this ½ tube onto a bench covered with plastic. Wet out and apply 3-4 layers of 6 oz. fiberglass cloth over the cardboard tube. Leave extra fabric along the edges of the tube to create a flange and allow to cure. On the seat bulkheads, where you want the limber hole to be, cut a half round hole matching the inside dimensions of the ½ tube you've created. Trim the tube to length and place between the bulkheads. Now, bond the flange in place filling voids and adding glass tape at the joint of the tube to the bulkhead. When the epoxy has cured, the compartment will be watertight with a limber hole passing through it.



*Cardboard tube fiberglassed and ready to be installed as a limber hole.*

Aluminum  
adhesion testing in  
progress.



# Aluminum Adhesion

By Tom Pawlak

As of January 1, 2015, the 860 Aluminum Etch Kit will no longer be offered in the WEST SYSTEM product line. Before making that decision we ran a series of tests that compared bond strength of 105 Resin/206 Hardener and G/flex 650 Epoxy on aluminum surfaces prepared a variety of ways. As usual, we used the PATTI (Pneumatic Adhesion Tensile Test Instrument) to test adhesion.

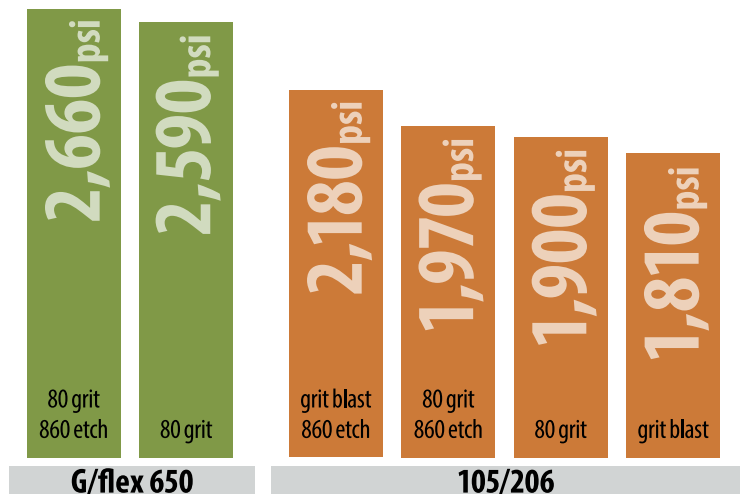
In the charted data you'll see that G/flex achieved the highest bond strength. Based on past adhesion testing, that is what we expected. From this data we concluded that 860

Aluminum Etch is not as important now as it was in the past. Prior to the development of G/flex Epoxy it was worth the time and effort to apply the 860 Etch because it improved adhesion of 105 Resin/206 Hardener by 371 psi over grit blasting alone. Given that G/flex adhesion to abraded aluminum is greater than the bond of 105 Resin/206 Hardener to abraded aluminum treated with 860 Aluminum Etch, it would seem to make the 860 Etch Kit obsolete. In other words, if someone calls us and asks for our recommendation for gluing to aluminum, we will recommend grit blasting or sanding the aluminum with 80-grit sandpaper and choosing G/flex Epoxy as the adhesive.

860 Aluminum Etch will be on store shelves for a while until all remaining stock is sold. After that, aluminum etching products are still available from Aircraft Spruce at [aircraftspruce.com](http://aircraftspruce.com).



*Bolts are adhered to an aluminum panel using a variety of preparation methods. Once the epoxy cures, the bolts are pulled and the values recorded.*





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.**

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**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, free downloadable pdfs on westsystem.com 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. Also, procedures for gelcoat blister diagnosis, prevention and repair and final fairing and finishing.

**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: I made this rocking horse in the style of the iconic Swedish horse as a Christmas gift for our first grandchild. I shaped the body out of 3 pound blue dock foam. I then covered the model with 3 ½ oz. crow-foot fiberglass cloth cut on the bias. I used WEST SYSTEM Epoxy and fairing fillers. The body of the horse was then primed and painted with acrylic water-based paint. The rockers are varnished fir. The horse is very light weight and very strong. When she isn't riding it our granddaughter enjoys pushing her horse around the house. ~Don Kissling



A Conductor's Podium for the local high school band was built by Jeff Andrews. It has two levels for either a 8" rise or 12 ¾" rise. In addition to the laminated curves, WEST SYSTEM Epoxy was use to glue the trim and handrail laminates.



Left: Randy Mortensen's strip planked cooler was built with cedar and redwood. He used 105 Epoxy Resin, 207 Special Clear Hardener, and one layer of 4 oz fiberglass cloth. The top is finished with 4 coats of spar varnish. Randy is an avid camper, hunter and fisherman who will no doubt get a lot of use out of his creation.

## Readers' projects

Below: Meade Gougeon, 75, completed the Everglades Challenge—a grueling race from St. Petersburg to Key Largo, Florida—on March 5, 2014. Meade sailed solo aboard his outrigger sailing canoe VOYAGER, crossing 325 miles in 4 days and 8 hours. He slept aboard his vessel, and came in first in the Sailing Canoe class (class 3).

Meade is one of the founders of Gougeon Brothers, Inc. in Bay City, Michigan, the manufacturer of WEST SYSTEM Epoxy.

