Replacing balsa core in a 1989 C&C 34R

The purpose of this document is simply to capture “lessons learned” that I experienced during my project to replace wet core in the deck of my boat, and share that knowledge with others. There may be better, easier ways to do things, but this is how I made my repairs.

Step 1: Determine the scope of work, the areas with wet core:
Sound the deck using a mini paint roller handle. It is light and works better than a hammer or a screw driver. Hold the handle and tap the metal rod tip against the deck lightly but hard enough to make a sound. Tap the area every few inches and hear a crisp clear sound where the deck is bonded and a dull thud where it is delaminated and/or wet. Mark the area of dull thuds as areas to cut out. I use blue tape. Square the cut wherever possible to make templating and cutting easier. Leave at least 1 ½” of deck intact to grind a 12:1 bevel. This means that you will sometimes make your cut leaving some fiberglass so you must dig out the wet balsa from underneath and then fit new balsa coring into that space before filling the hole.

Some people cut the deck from underneath and leave the top deck skin intact. I tried that method and didn’t like my results. I did a test patch underneath and had trouble with air bubbles. I used a fin roller and peelply, but still found white spots and bubbles in my laminate. I prefer to use gravity in my favor working from above. It requires more grinding and fairing and sanding but I think it’s as strong or stronger than original, this way. I find air wants to rise, so working from the top provides a natural way for air bubbles to rise up a stipple method with a brush, a fin roller, and adding peelply helps even more to eliminate bubbles and white dry patches of laminate so it makes the strongest bond. Working from above adds another problem. It means you have to paint the repair area to protect the epoxy from UVs and paint the whole deck to hide the repair. My non-skid was worn smooth in all the critical places and painting the deck became more a safety need than a cosmetic one. I chose SoftSand for non-skid and will describe that process later.

Get **two 10mil tarps** to cover the area you are doing and keep those at the boat. I tied thinner tarps but they don’t last more than a few months before the sun degrades the finish and they leak. An 18’ x 25’ covers the whole deck from pulpit to cockpit. One tarp will do but buy two tarps so you have backup handy if something rips your tarp or it gets weathered. My boat has a beam of 11’7” and at least 16’ width is needed to wrap over the cabin top and lap over the toe rail on each side about 6” at the widest point. I ordered them in white from Amazon. Well worth it. Remove the lifeline stanchions so you can tarp over the whole deck. I simply removed a single bolt holding each stanchion to it’s base and rolled each set of lifelines into a bundle and tied the bundle to the bow pulpit and stern pushpit, placing a plastic putty knife underneath to keep them from scratching the toerail. Tying down the tarp: I tie sash cord to the grommets so that I have a line every other hole along the long side, down the boat and I leave a bowline on the lines coming from one side. I make the lines from the other side longer and make up a “truckers hitch” to snug the tarp taught so it doesn’t hold water and make puddles.

I bought balsa coring in ¾” thick from Defender.

I bought seven yards 1708 biaxial fiberglass cloth. I use this exclusively for all fiberglass repairs so get several yards on a roll. Never buy fiberglass cloth folded as folding breaks the strands and weakens it. Keep cloth on a roll. Bought peel ply from Fiberglast.com. After trying peel ply, I use it wherever I can to help remove bubbles and it always produces a better, smoother finish. Peel ply absorbs extra resin and amine blush so the laminate doesn't need to be wiped down or sanded before adding more layers. You simply pull off the peel ply and can add more fiberglass or even paint it as is. Great stuff. Buy more than you think you need. It is a one time use product but worth it for the results. I bought a roll of ten yards from Ebay. Jamestown Distributors or fibreglast.com have it too.

I bought West System supplies from Jamestown Distributers. I work with gallon size resin cans and I'm on my fifth gallon. I wouldn't buy the bigger containers as they are too big to handle. I carry the gallon size up a ladder and easily heat it up in a small bucket of hot water when it's cold outside.

I also bought two tubes of **Thixo Flex Epoxy** and a dozen tips from Jamestown Distributers. This stuff is great for filling spider cracks and I used it to fill holes after removing hardware, so the whole deck is rainproof during painting the deck. I remove the fasteners, clean the hole and put 3M clear shipping tape over the hole underneath, then fill from above. If the hole goes through balsa core, I overdrill the hole from above, keep the small hole underneath and remove a good ½" of core around the hole with a bent nail and prime with neat epoxy and fill with epoxy thickened with 404. Keeping the small hole allows me to later drill that hole in the same location accurately. Holes through solid laminate were filled with Thixo Flex. After the epoxy cures, it's good practice to drill a small dimple in the deck to mark where to later drill for the fastener. This will make it easy to locate hardware after the deck is painted.

TotalFair from Jamestowndistributors works best as a fairing compound. It's waterproof and easy to mix, apply, fair with long spackle knives or a metal straight edge, and sand. When sanding, the dust is heavy and lays on deck instead of flying around like lighter fillers. I watched YouTube videos on fairing cars to learn how.

Get **two Oscillating multi-tools**; Harbor Freight. Several YouTubers had multi-tool failure at a critical time in their project, no matter the brand. I bought a second multi-tool and needed it when the first one wore out. No drama. I probably could have later fixed the first one by taking it apart and cleaning the brushes, but they are so cheap, I bought a third one, instead as backup.

I also bought a backup **random orbital sander** when it was on sale; Black and Decker is an exact copy and half the price of the Dewalt. Best to find one that has an exhaust port that fits the hose to a shop vac.

Wet/Vac: I like to use a 5 to 8 gallon **ShopVac** with an 18' long hose. I can set the vac in the center of the boat and reach everywhere without moving it. I glued a piece of carpet to the bottom so it doesn't scuff up the cabin sole or the deck. The hose attaches directly to my sander and I keep a bag in it to catch the fiberglass dust.

Angle grinder (power-tool-of-death) works for grinding the 12:1 bevel using a 40 grit flap disc. When you remove the top skin of the deck, you can see how thick the fiberglass is. Measure that and multiply by 12 to see how wide to grind the bevel.

12:1 Bevel-width

Laminate Thickness	12:1 Bevel	Total width
1/16”	3/4”	1 1/2”
3/32”	1 1/8”	2 1/4”
1/8”	1 1/2”	3”
5/32”	2 1/4”	4 1/2”
1/4”	3”	6”

1/16” thick fiberglass skin needs a bevel ¾” wide and a 1/8” thick laminate needs 1 ½” bevel on either side of the joint. I found my laminate was in between the two but tried to maintain a wide bevel for strength. I epoxied 2” and 2 ¼” wide strips of 1708 into the joint valley and rolled with a fin roller and covered with peelply. After curing, ground it flush with the deck surface. I checked fairness with a 30” long steel straight edge and filled any large low spots with more 1708. Minor low spots got epoxy thickened with 404 High Density Filler and everything got faired with Total Fair from Jamestown Distributers which is economical, easy to mix, waterproof and can be spread best using metal sheetrock knives. I found Total Fair less expense than EZ-Fair by Pettit. It mixes easier than mixing epoxy and adding fillers and probably less costly. It saves a lot of sanding if you go over the area several times with a large knife and press it hard to create a smooth fair surface. I found autobody fairing videos showed good techniques more than sailboat videos. I used a longboard sander from Harbor Freight and a 16” long DuraBlock and rolls of adhesive sandpaper. I started with 80 grit, then 120 grit for primer. 220 was used to prep for gloss coats as per instructions on the paint I was using which is Interlux

More and more I like what I hear about Total Boat products and would choose their product line for paint, next time.

Power Tools Used

Power tools: 5” Orbital sander, Jig saw w blade kit, angle grinder w flap discs and cutting discs, Multi-tool w assorted cutting blades and sanding attachment, cordless Drill Kit w bits, driver tips, centerpunch, awl, Japanese blade saw, ½” belt sander, heat gun, sawzal w assorted blades.

Blue bucket, 100ft extension cord w multitap, 18ft vacuum hose extender, 6ft ladder, roll of 1708 fiberglass biaxial cloth and roll of peelply in a box, tub of power tools, tub of sanding tools, tub of painting tools, box of disposable nytril gloves, paper towels. Further forward is a tub w all epoxy resin and hardeners for different temperature, and fillers, a tub of paints and thinners, and a bag of hand tools and my cordless drill kit.

I grounded flush the two layers of 1708 used in the joint valley. I took off about 90% of the top layer so the bottom layer does most of the bonding. 1708 is three layers of cloth so that's OK. I probably should have ground the valley deeper, down to the balsa in the very middle. I faired the low spots with Total Fair. Sanded and refaired two more times, long boarding at the end and got the first coat of primer. So the deck repair is now as strong as original, plus waterproofed (by Total Fair) and painted.

Chainplates: I dry fitted the chainplates and once I drilled the holes for the screws, I found some of the holes went thru balsa. This was a build flaw from the original assembly and another root cause of wet core in the deck. But heck, it lasted for thirty years. I overdrilled those holes through the deck and filled with "neat" epoxy, drained that into a cup and discarded and then fitted a bottom support with peelply against the deck underside, and refilled the holes with thickened epoxy to seal them up. Next day, I dry fitted the chainplate again and drilled the correct sized holes and double checked that none penetrated into the balsa. I countersunk the holes and chamfered the edge of the hole through the deck for the chainplate itself.

If I had built myself a shed over the boat, I wouldn't have to work around the rain or direct sun, so much. Now I'm too far along to justify building a shed, but it's important for you to consider that. If you are tackling the deck repairs, you must realize you will probably remove and rebed all the deck fittings and paint the deck, which takes many days so you should try to get the boat out of the weather, rent space inside, or build a shed frame with a simple tarp roof. You need standing headroom and the tarp to come down to about 6 inches past the toerail, something one person can erect and dispose of at the end of the project.

I did my project outside and lost many work hours blowing leaves off the deck and cleaning the deck from debris dropped from nearby trees. Several times, I had to stop work because of leaves or cattails or bugs, falling from the trees. Sometimes I couldn’t work because of rain and many days, the sun would overheat the deck above 90 degrees which is the upper limit for epoxy work. So shade and rain protection would have helped. I regret not spending a week and about a thousand dollars to build a structure that could have saved me months or years on this project. In reality, my boatyard probably would have stopped me.

1) Old core removed, new core going in.

2) New core filled in.

3) Top skin epoxied back on

4) 12:1 bevel ground along joint

5) Strips of 1708 applied to the joint & covered in peelply.

6) Joint ground flush

7) Faired with Total Fair

8) Primed

Materials Used: Epoxy, thickeners, fairing compound, Fiberglass cloth

Epoxy: Research and choose your epoxy wisely. I chose West System cause I had a bunch of it from earlier repairs, but I hear most boatyards have changed over to MAS or System3. I've heard good things about Total Boat's epoxies but have never tried it. Whichever you choose, use their pumps and follow their directions and don't be afraid to experiment with the product off the boat to get a feel for working with it.

Thickening epoxy: I tried a lot of fillers. I now prefer West System's 404, a high density filler that dries "off-white" and is good for the deck to seal fastener holes through the deck, under winches, around thruhulls, and for filleting fiberglass parts. I use 405 which is brown for bonding or filleting wood. I always prime the surface with unthickened epoxy to create a better bond. The thinner liquid gets wicked up by balsa or wood and gets into voids where the thickened epoxy can't. I warm the substrate or core area with a heating gun beforehand to encourage the balsa to wick up more epoxy and strengthen the bond.

Fairing: Total Boat's Total Fair is waterproof and easy to sand and leaves no pin holes. A set of different width spackle knives worked well to smooth the material. 2", 4", 6", 10" and a long steel straight edge too. The more you smooth the compound, the less you have to sand.

Sand paper: A 4" wide roll of adhesive sand paper worked best. One roll of 120 grit and another of 220 worked for most of the tasks. Sheets of 150, 220, and 320 too.

Long boards: Harbor Freight sells a good 18" board. I liked using a 16" rubber sanding board by DuraBlock, an automotive product.

The secret to getting the Non-Skid to pop is taping. You first paint all the glossy areas and tape along the edge, around hardware and fixtures and cut with a sharp utility knife to get a fine edge. Here I used different sized washers, soup cans, bowls; whatever fit the curve I needed to create.

After taping where you don’t want non-skid, you paint the non-skid areas.
This shows the sharp line left by the blue painter’s tape
Faired with Total Fair

Primed

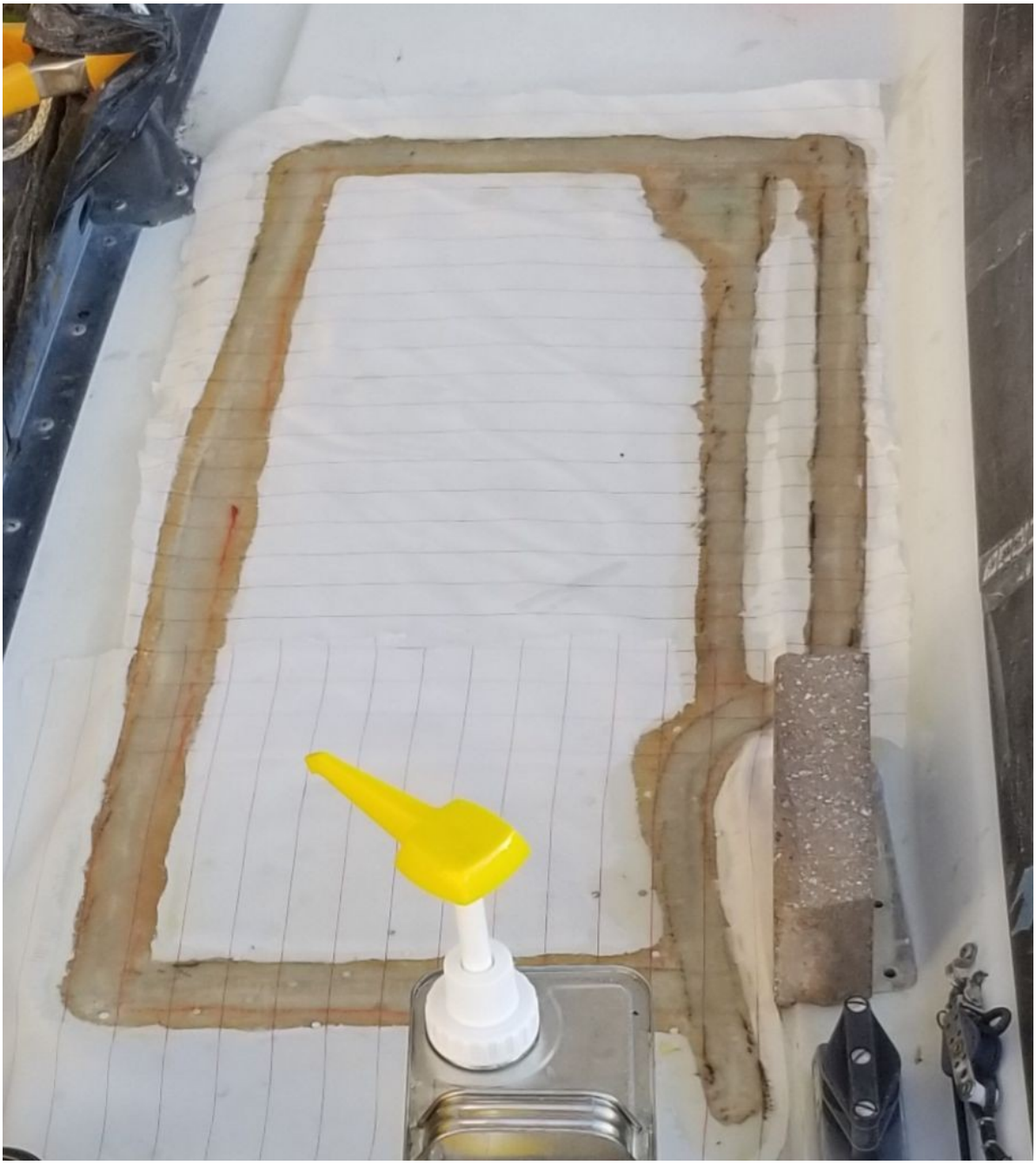
Port side deck; skin lifted showing wet balsa core

Port side balsa removed

Port side; new balsa dry fitted. Some pieces were marked for location because they got brushed with epoxy and stuffed into the void around the perimeter. These were all epoxied in place before fitting the larger center rectangle of balsa. All voids were filled with West System epoxy thickened with 404

Port side; Top skin back on

Port side; joint ground down to 12:1 bevel



Port side; joint bevel filled with two layers of 1708 and covered with peelply

Port side; Area faired using Pettit EZ-Fair which is white.
Photo taken before sanding.

Port side; looking from bow; faired, sanded, primed and painted

Starboard side; top skin removed showing wet balsa

Starboard side: New balsa installed, sanded and ready for top skin

Starboard side;
Top skin being epoxied back on, weighted with bags of birdseed and buckets of water placed on plywood scraps to spread the load. Sticks helped shim the edge flush with the deck

Starboard side; top skin back on

Starboard side; 12:1 bevel ground around the joint

Starboard side; two layers of 1708 epoxied into bevel, covered with peelply

Starboard side; after several cycles of fairing and longboard sanding

Starboard side; after a coat of primer, more fairing and a 2nd coat of primer

Adjustable screw jacks used to support the starboard side deck while working on it. Installed before cutting the top skin out of the deck, this trick supported all the weight used to bond the top skin back on and key to getting the final shape to match.

Supporting the cabin top and maintain a proper camber while repairs were made above. Adjustable painter’s pole, a swifter mop and a screw jack.