HOME

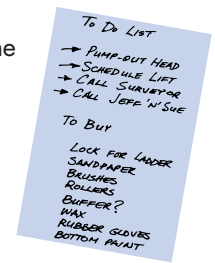
DIY boat owner

WINTER 1996-97

the MARINE MAINTENANCE MAGAZINE

SALTWATER MAINTENANCE

An itemized checklist of all the information you need to prepare for your annual haulout.



Columns

Engine Troubleshooting

Noise Control: A complete guide to engine soundproofing.

Good Boatkeeping

Hints, tips and projects for boatowners.

Departments

Talkback Repairing holes in fiberglass; Solving engine overheating; Builder of Coast 34; Diesel oil pressure; Anti-siphoning device; Keeping barnacles off props; Repairing water tank leaks.

Tech Tips Boat-tested tips.

ANNUAL BOAT REFIT

DIY PROJECTS

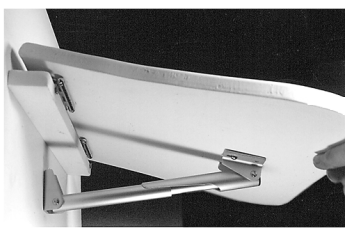
CANVAS Custom fitted sheets, Sew a boom cover.

WOODWORKING Wooden bookshelf, New cabinets from old sliders.

KING STARBOARD Tool organizer, Fishing rod racks, Hatch board seat, Folding jump seat, Swim platform.

LAMINATING Make a tiller, Tips and techniques for working with epoxy.

FIBERGLASS Easy-to-build oil-drip pan, Build a hard dodger.



For more on information working with epoxy gluing, bonding, and filleting see DIY 1998-#4.

Refer to DIY 1997-#4, 1998-#4 and 1999-#4 for more StarBoard projects.

TALKBACK Q&A

HOLE IN ONE

Q: I just purchased an Irwin 25 which discharges black water directly overboard. I'm planning to install a holding tank or replace the head with a portable version. Either way, I'll need to plug up at least one thru-hull in the hull. What are my options for plugging the holes? I really don't want to grind and refiberglass the hull. Are there any products on the market that will simply plug the hole?
Ralph Brescia, Newtown Square, PA.

A: The simple answer to your question is "No." When plugging holes above the waterline you can get away with a quick fix — an epoxy putty or a wooden plug covered on both sides with a layer of fiberglass. But below the waterline you need added structural strength. Fiberglass flexes, especially when pounding through heavy seas, and when you install something rigid in the hull, such as a wooden plug, it creates a high-stress area that can cause cracking and water seepage. A patch comprised of multiple layers of fiberglass cloth cured with epoxy resin is your only safe option. Check our SPRING '95 issue for a comprehensive step-by-step repair of holes in cored and uncored hulls.

OVERHEATING BLUES

Q: I have an overheating problem when idling my MerCruiser 4.3-litre 205-hp engine. The impeller, the hose on the outdrive and the thermostat have all been replaced, but the engine still runs hot at idle. I can cool down the engine by increasing rpms, but that isn't always easy when docking. Can you tell me what the problem is? I'm also looking for information on winterizing the engine.
Joe Kennedy, Scarborough, Ont.

A: Overheating at idle indicates that the engine isn't pumping enough water at low rpm; water is getting up into the engine but not going anywhere once it gets there. All MerCruisers, with the exception of the Bravo drive, have two pumps. One pushes water up from the lower unit to the engine, and there's a secondary recirculating pump on the front of the engine. As rpms increase, the pumps force water through the engine faster, which accelerates cooling. If your problem was the thermostat, the engine would run either cool or hot all the time, regardless of rpm. So, that leaves a weak water pump or two, or a warped plastic impeller housing or worn plate that was not replaced with the impeller. The worst-case scenario would be a cracked or blown head gasket or exhaust manifold. Both can cause overheating. Pull the spark plugs and check for water on the plugs. If you detect water or the engine oil is creamy in color, you may have blown a head gasket. *DIY's* **Engine MRT Workshops** this winter will cover water pump replacement, winterizing and more. Full details are on page 3, or check our web site at www.diy-boat.com for information.

MISSING BUILDER

Q: Can you help us find the Canadian builder of a Bruce Roberts-designed sailboat called a Coast 34?
Scott Shuler,* Blue Wave, *West Grove, PA

A: The Coast 34 is actually the Roberts 341, a canoe-sterned sailboat. it's built by Cape Yachts, 20030 Stewart Cres., Unit 6, Maple Ridge, BC V2X 0T4; Tel: (604) 465-9133.

POUND FOR POUND

Q: We have a 1974 Willard 30 diesel trawler with a reliable Perkins 50-hp 4.107 engine with 1,200 hours' running time. The engine starts at all times and the oil pressure runs just a shade below 60lb and stays right on the mark for about an hour while running at 1,800 to 2,000 rpm. The oil pressure then drops to just above 50lb and oscillates between 50lb and 55lb. Is this normal? The top end, valves, gasket and injectors were all rebuilt about 250 hours ago.
Stu Round,* Jean Latino, *Bellingham, WA

A: According to George Cherry, sales manager for Perkins products, it's normal for oil pressure to drop and a reading of 55lb is average for your engine. Below 50lb, you've got an engine problem, such as a faulty relief valve. Cherry was more concerned about the rpms when your engine is running. The Perkins 4.107 is designed to run at 3,000 rpm. You'll have carbon buildup and other problems running at rpms below 2,500.

ANTI-SIPHONING DEVICE

Q: I recently read that the vented loop used with inboard engines can get clogged with salt over time. Is there a system with a manual valve and some sort of sensor to remind you to turn the system off post-sail?
Jonathan Dawes,* Tir na n0g, *West Palm Beach, Fla.

A: A vented loop prevents water from siphoning back into the engine cylinders. It connects to the manifold and attaches to the exhaust hose. We're not aware of any

system that has a manual shutoff. Besides, there is no reason to close a vented loop system if it's installed correctly. The trick is to install the air vent high enough to form an air lock — at least 30cm (12') above the waterline. (Check the manufacturer's specs; some units must be installed even higher.) A vented loop has a ball or rubber disk that can clog with salt crystals if it's not cleaned periodically with warm fresh water. If cleaning is a concern, Vetus offers an air vent (model H) with a ventilation line that installs in the hull with a thru-hull and tubing.

REPELLING BARNACLES

Q: Is there a method of keeping barnacles off a prop? I have tried antifouling paint but without luck.
Egret, Beaufort, SC

A: As you discovered, antifouling just doesn't work on a prop and, unfortunately, there's nothing else available on the market to keep barnacles off props. If you don't use your boat for three or four weeks, the growth can be enough to stop the engine dead, especially along the warmer waters of the eastern seaboard. Barnacles can't grow in the dark, however, and some boaters put a green or black plastic bag over the prop when they leave the boat. (If your boat is an inboard, you'll have to get wet to do this.) If you do cover the prop, remember to remove the bag when you return before starting the engine and dispose of it properly.

LEAKING TANKS

Q: I've noticed the interior ceramic-like lining of my water tank has several cracks concentrated at the bottom of the V-shaped tank. The cracks have a rusty appearance. The tank doesn't leak but water stored in it has never had a very pleasant taste. How do I fix the tank? Also, my holding tank appears to have a minor leak. it's made of the same metal as the water tank but doesn't have the lining. Can it be repaired easily?
Jacques Guerette,* Peregrine, *Toronto, Ont.

A: Your tanks are most likely made of aluminum that has become pitted and corroded. The metal becomes very soft around the welds and, over time, will corrode (causing the telltale rusting) and eventually begin to leak. Once tanks reach this stage, there's not much you can do to patch the holes. You could apply an epoxy coating to the inside surface, as is done with hot-water tanks, but the tank must be absolutely clean and free of any dirt or you'll have adhesion problems. And if you get one little pin hole in the liner, the tank will start to leak again. You're better off to scrap your old aluminum tanks and replace them with polyethylene or stainless steel ones which will last the life of the boat. *Hint: To determine if the tank is made of aluminum or stainless steel, scrape the surface with a nail. If it scratches easily, it's aluminum.*

CALLING SCIROCO OWNERS

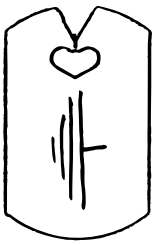
Reader Al Jurgenfeld is interested in locating other owners of Sciroco 15s to exchange information and form an Ontario fleet. Contact him at (613) 389-4288 or fax (613) 389-5966.

JET SEARCH

Karl Hunter of Plano, Texas, sent us an E-mail message requesting information on the Avenger and Taylor jet boats. Send E-mail replies to him at hk@onramp.com.

TECH TIPS

CODING WIRES: Use plastic tags, the kind used to seal bread, milk and vegetable bags, to identify wires on your boat. Remove any printing on the tags with acetone or nail polish remover, then mark them with an indelible marker to identify the wires and snap in place. They won't corrode or fray the wire and will be of great help later when you need to identify the circuit again.



Charles Monroe,* mehitabel, *Saugerties, NY

A STARCHY IDEA: To place sealant exactly where you want it without getting it all over the boat (and yourself), cut a potato to the shape of the area you're caulking. After applying the sealant, smooth the bead with the potato; the sealant will not adhere to the spud. Wipe excess sealant off the potato with a rag or paper towel.
Michelle and Stu Round,* Jean Latino, *Bellingham, Wash.

***Tech Tips welcomes contributions from readers. If you have a boat-tested tip you'd like to share, send complete information along with your name, boat name and home port to:* DIY Tech Tips, P.O. Box 22473, Alexandria, VA, 22304 or E-mail to info@diy-boat.com.**

RODENT BEATER: To prevent rodents and other unwanted trespassers from entering your boat through the bilge blower vents, pack bronze-wool scouring pads into each vent. Sailboaters may also want to plug the butt end of the mast, a favorite nesting place of rodents and birds.
Anne-Marie Hendry, Beaverton, Ont.

GLAND WRAP: When your inboard propeller shaft packing gland is leaking badly, you can't tighten it any more and you have no packing available, roll cotton batting into long strips, coat the strips liberally with waterproof grease and add them to the gland packing. Then retighten the gland nut. Replace the cotton batting with proper packing when you're back in port.
Phil Friedman, Port Royal Marine, Pompano Beach, Fla.

DUCT TAPE REMOVAL : To remove the adhesive residue remaining when "cured" duct tape is pulled from fiberglass or wood surfaces, soak paper towels in turpentine and lay them on the residue for a few minutes to soften the adhesive. Use acetone or soap and water to remove the oily film left by the turpentine.

MAC ATTACK: Mac-Tac is a popular liner for shelves in boats (and homes) but is difficult to remove, especially if it's been attached for a long time. Slowly heat the surface with a hair dryer until it begins to bubble, then peel it off. You'll have to experiment to determine how much heat to apply.
Sheilah van Nostrand,* Dream Catcher, *Keswick, Ont.

SLICK-FLUSHING HEAD: When winterizing the head, add a 4oz. bottle of Sea Lube to the toilet bowl and flush. It will make your head pump as slick as Teflon.

SHARPER TOOLS: Rub ordinary candle wax on saw blades or drills every so often and they will stay sharp longer.

LEAKY HOSE: When your engine's water or exhaust hose develops a hole, wrap the affected area with friction or vinyl electrician's tape. Split a spare length of hose, wrap it around the taped section, then secure it with hose clamps.
Phil Friedman, Port Royal Marine, Pompano Beach, Fla.

SALTWATER MAINTENANCE

Use this boat-tested checklist to prepare for your annual haulout.

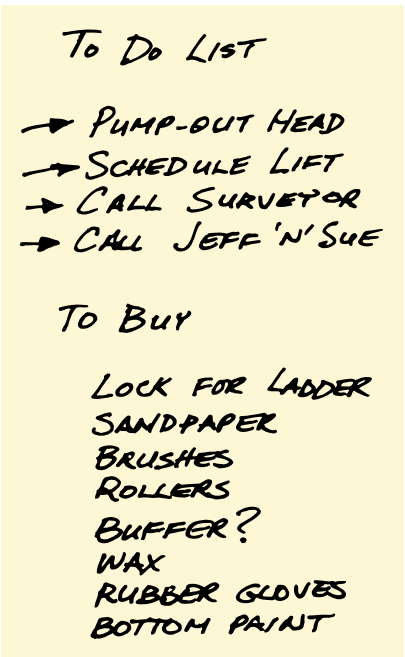
By Peter Doherty

For boat owners along the West Coast and seaports south of the Chesapeake, the myth of the annual two-day haulout lives on, perpetuated by most local boatyards which include "two days on the hard" free with the cost of the Travelift round trip.

Many years (and one boat) ago, our first-ever two-day haulout turned into a frantic week's work with the discovery, after the boat was securely chocked in the yard, that we had some non-structural but significant osmotic blistering in the hull plus a massive blister on one side of the encapsulated ballast keel. Further probing of the blister revealed several gallons of sea inside the ballast cavity as well. We had no repair materials, no tools, no experience with fiberglass repair work (that was remedied before the week was out) and no budget to deal with something this major. But for an understanding employer, some banked vacation time and a fairly clean credit card, we might have spent months in the yard at $30 per day!

Our most recent haulout included all the usual stuff plus some planned, major fiberglass repairs. We'd organized ourselves well (so we thought) and everything went like clockwork — right up to the morning of the relaunch. All that was left to be done was to reinstall the propeller and zincs. With the prop securely bolted and pinned in place, I dived into the spares locker for the zincs and found...none! Panic stations! With the scheduled launch only a couple of hours away, the scramble began. All but the last of the eight chandleries I visited had 20 or more different types and sizes of zinc anodes in stock — all but the one we needed!

Thus was born the resolution to be even better organized in the future and to create a haulout checklist so that, henceforth, such panic scenarios could be avoided. The checklist that follows is based on our experience with sailing vessels, but I've tried to include all items that would be applicable to both sail and power.



Getting Ready

1. Review your to-do list — you do keep one, don't you? Extract all items that can only be done when the boat is out of the water. Call this the "A List." Make a second, or "B List" of those jobs which are easier to do with the boat out of the water.

2. Inspect the boat to determine what other work needs to be done and add to your lists. Survey the hull inside and out — get out your wet suit and snorkel or hire a diver for the underwater survey. Items to be checked are divided here into three categories: external (underwater), external (topsides) and internal.

External (underwater)

- ❍ Gelcoat or planking condition
- ❍ Antifouling paint
- ❍ Transducers
- ❍ External heat exchangers
- ❍ Rudder fittings
- ❍ Propeller for damage — will it need shop attention or replacement?
- ❍ Cutlass bearing — if the shaft moves 3mm (1/8") or more, it's time for replacement.
- ❍ Grounding plates (if you have them)

- ❍ Strake runners and the underside of the keel and skeg — remember that grounding you had last summer?
- ❍ Bow thruster impeller and bearings for damage or looseness

External (topsides)

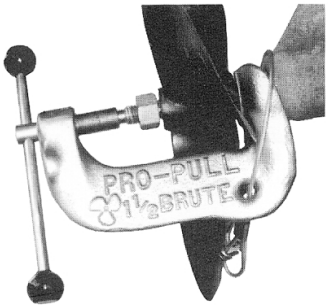
- ❍ You'll need to wash and wax for sure, but check whether you need cut-polishing too. (Repainting is not a project for a short annual haulout.)
- ❍ Dings and scratches to be touched up
- ❍ Name or registration numbers to be touched up or replaced

Internal

- ❍ Thru-hull fittings for weeping or corrosion
- ❍ Seacocks for ease of operation and watertightness
- ❍ Condition of propeller shaft seal — is repacking needed?
- ❍ Shaft log — is the short length of reinforced hose that retains the shaft seal sound, or does it need changing?
- ❍ Rudder shaft seals and bearings

3. There are a number of **administrative matters** to be taken care of prior to the haulout:

- ❍ Make an appointment with the yard — especially if you're doing this in the springtime, like everyone else!
- ❍ If your boat is approaching 10 years of age, arrange for a surveyor. Most insurance companies now require a survey 10 years after a boat's initial launch, and every five years after that.
- ❍ Check your lists and add anything else that comes to mind.
- ❍ List all the parts and tools that will be required. Have them on hand before the haulout day (see sample list below).
- ❍ Arrange your A and B lists for an efficient work flow. For example, if the sealant you're using to rebed underwater fittings needs 24 hours for its initial cure, do this job as soon as possible — don't wait until launching day!
- ❍ Pump out the holding tank and fill the water tanks. Most yards have washrooms, but they may be a block or more away from where your boat gets parked.
- ❍ Get a ladder and a theft-proof cable lock to secure it when you go home for the evening. We had one stolen a couple of years ago and lost a day's work hunting down a replacement!
- ❍ Line up helpers if you need them. Even if they're not technically inclined, it's always handy to have at least one "gofer." Treat the hired help well or they won't be back next year.
- ❍ Pack or arrange meals and refreshments.



A prop puller makes removal almost effortless.

4. Special Tools (in addition to standard hand tools)

- ❍ Packing nut wrench(es) and packing extractor hook
- ❍ Propeller and cutlass bearing pullers
- ❍ Oversize wrenches to remove thru-hull fittings
- ❍ Hole saws the right size for new thru-hull or transducer fittings
- ❍ Sander and/or grinder
- ❍ Electric buffer and buffing pad; buy, borrow or rent one if you don't own one!
- ❍ Extension cords
- ❍ Duster brush, shop vacuum
- ❍ Power-drill paint mixer to dig the sediment off the bottom of the tin of antifouling paint
- ❍ Caulking tools (for wood boats)
- ❍ Welding equipment (for metal boats)
- ❍ Heaters or heat lamps if you're doing fiberglass or epoxy repairs in cool weather

Mechanical versus manual: The yard time saved when you use a power buffer will probably pay for its cost.

5. Materials and Parts

- ❍ Primers, paints and varnishes (for antifouling, topsides and brightwork)
- ❍ Sandpaper — buy twice as much

as you think you'll need. (Use open-coat paper when sanding antifouling paint.)
- ❍ Paint scraper(s) with extra blades
- ❍ Sealants to bed new or replacement fittings
- ❍ Shaft packing
- ❍ Fiberglass cloth, mat, resin, catalyst, fillers and gel-coat
- ❍ Lubricants
- ❍ Paint brushes, rollers, roller trays and liners
- ❍ Paper towels, rags and drop cloths
- ❍ Solvents
- ❍ Rubbing or polishing compound and wax
- ❍ Lapping compound for old-style seacocks
- ❍ Waterproof grease for seacocks and removable transducers
- ❍ Masking tapes
- ❍ Duct tape
- ❍ Talcum powder (for the rubber gloves)
- ❍ Zinc anodes as required
- ❍ New or replacement thru-hull fittings, transducers etc.
- ❍ Hose clamps and hose
- ❍ Fastenings and oakum (for wood boats)
- ❍ Replacement planking (for wood boats) or plating (for metal boats)
- ❍ Welding rods and fluxes (for metal boats)
- ❍ Coveralls (or old clothes), disposable caps, rubber gloves and dust masks
- ❍ Safety glasses or goggles
- ❍ Ear plugs, if you're doing a lot of work with power tools
- ❍ Rubber boots, gloves and an old foul-weather suit (if you're doing your own pressure washing)
- ❍ Barrier cream and hand cleaner
- ❍ Liniment and aspirin!

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Before the Boat is Blocked

- ❍ If the rudder has to come out for bearing or seal renewal, ensure that the boat is blocked high enough to allow the rudder to be lowered. If you forget, the yard might reposition the boat at a nominal cost. On the other hand, it might be cheaper to hire a back-hoe to dig a hole!
- ❍ Ensure support pads and blocks don't interfere with any planned work, such as removal of the lower rudder fitting, installation of a new transducer or thru-hull, repair or replacement of strake runners, or repairs to the underside of the keel or skeg.

Before Pressure Washing

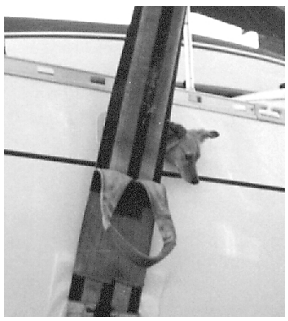
- ❍ Close seacocks. Omit this step and you may find your galley and head spattered with dead sea beasties and salt scale!
- ❍ Remove or mask anything that might be damaged by the high-pressure water, such as speed transducers.
- ❍ If you're doing your own washing, wear rubber

SALTWATER MAINTENANCE

boots, old foul- weather gear and safety glasses. Remember that metal-based bottom paints are highly toxic.

The Actual Work

- ❍ Pressure wash the underbody. If you used soft-sloughing antifouling paint, the pressure washer will strip it down to the primer. Watch out for osmosis blisters; although a pressure washer can be used to strip away blister-damaged material, if the jet is too strong it can also cause unnecessary damage to sound laminate adjacent to the blisters. Also take care when pressure washing a wood boat — get the water jet too close and you can strip out two feet of oakum in the blink of an eye!
- ❍ Do a close-up inspection of the hull to see if you missed anything during your underwater survey. Amend your A and B lists as required.
- ❍ Remove any hull-mounted equipment that requires shop work, such as the prop, rudder or instruments.
- ❍ Rebed thru-hull fittings (if necessary).
- ❍ Install new thru-hull fittings, seacocks and transducers (if necessary).
- ❍ Disassemble, clean, lubricate and reassemble seacocks (if necessary).
- ❍ Scrape and/or sand old antifouling paint (if necessary). Wear protective clothing, a mask and goggles.
- ❍ Do fiberglass and gelcoat repairs as required. Again, wear protective clothing.
- ❍ Replace cutlass bearing (if necessary).
- ❍ Replace external heat exchangers (if necessary).
- ❍ Recaulk or refasten planking (if necessary).
- ❍ Mask hull and apply new antifouling paint.
- ❍ Remove masking tape before paint is fully hardened.
- ❍ Complete any remaining A list items.



Peter Doherty

Murphy's Law No. 15: If you leave a pet aboard during haulout or launch, close the ports!

Before Relaunching

- ❍ Reinstall transducers.
- ❍ Ensure all hoses are reconnected and seacocks are open.
- ❍ Have extra antifouling paint and applicators ready to touch up the hull when the boat is in the slings and the support pads are removed.
- ❍ Pay the yard. Most yards have a "No cash, no splash" policy and you may lose your turn on the lift if your bill is still unpaid at launch time.
- ❍ Confirm launch time.
- ❍ Spend your waiting time (if any), working off B list items.

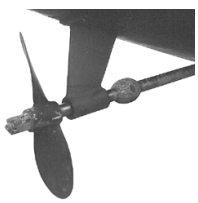
In the Water — before Removing the Slings

- ❍ Start the engine and ensure cooling water is coming out the exhaust.
- ❍ Check all new and rebedded thru-hull fittings, transducers, shaft packing and hoses for leaks.

Back at the Slip

- ❍ Clean up the mess. (You don't have one? Give me a call, I'll sign you up for my own haulout next year!)
- ❍ Again, check new and rebedded thru-hull fittings, shaft packings and hoses for leaks. Repeat this check daily for the first week. (Sealant failure on a new transducer resulted in a burned-out automatic bilge pump and nearly sank us a couple of years back.)
- ❍ While your memory is fresh, take a couple of minutes to note any glitches that occurred during the haulout so you can avoid them next time.
- ❍ Buy your work crew a drink (or dinner) and celebrate a successful haulout.
- ❍ Invite your work crew out for a sail next weekend.

Peter Doherty is an avid offshore cruiser and past commodore of the Bluewater Cruising Association. He and his wife, Glenora, currently live in Vancouver, aboard Wanderlust V, a Reliance 44 ketch which they built from a bare hull and on which they completed a shakedown cruise to Mexico, Hawaii and Alaska several years ago with their two teenagers.



Get wet — an underwater survey lets you pre-arrange propeller and shaft repairs and add shaft zincs to your shopping list if you need them.

ENGINE TROUBLESHOOTING

REDUCING ENGINE NOISE

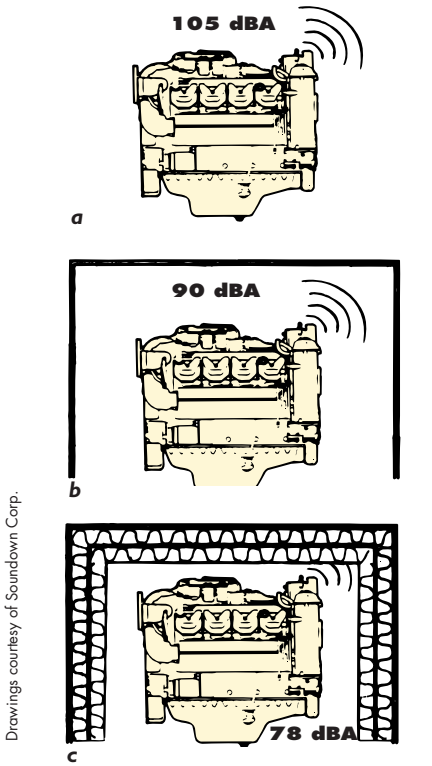
Controlling noise involves correct engine mounting and a well-insulated engine box.

Few production boats have adequately insulated engine compartments. The worst offenders are sailboats, which rarely have more than a plywood enclosure. With a carefully engineered soundproofing installation, however, it's possible to conduct a conversation in the cockpit or saloon without having to shout over the roar of the engine.

When it came to controlling engine noise on our own boat, we enlisted the help of Chris Murray, director of sales of Soundown Corp., in Marblehead, Mass. The company offers a toll-free technical support line (800/359-1036) to assist with questions concerning design and product selection.

Sound Patterns

The first step in controlling engine noise is to understand how it's produced and how to best contain it. There are two primary sources of noise in a boat: airborne noise that radiates directly from the engine, transmission, propeller and exhaust system; and structure-borne noise produced by vibrations transmitted through the boat. Typical sources of structure-borne noise are the propeller shaft or strut, and engines that are either hard-mounted directly to the engine bed or mounted on standard rigid mounts. The object of engine soundproofing is to eliminate the airborne and structure-borne noise in the boat so the exhaust is the dominant mechanical sound.



Drawings courtesy of Soundown Corp.

Figure 1

Decibel levels from engine noise relative to insulation: a) engine without any enclosure creates a loud 105 dBA; b) engine box made of 16mm (5/8") plywood reduces noise in the boat to 90 dBA; c) a composite soundproofing material of 2.5cm (1") foam with 1lb/ft2 of lead reduces the noise to 78dBA or better.

Airborne noise is minimized with an effective acoustic insulation.

Noise is measured in decibel units or dBA. An engine without any enclosure creates a loud 105 dBA, a noise equal to a running lawnmower or chainsaw (**Figure 1**). Simply enclosing the engine compartment with a box made of standard 16mm (5/8") plywood reduces the noise to 90 dBA. Replacing the plywood with a noise-reducing panel, such as dB-Ply from Greenwood Forest Products, decreases the sound level by about 4 dBA. It's a good choice for an engine enclosure, but is not intended to be used alone as the plywood's hard surface reflects sound back into the engine compartment causing a reverberation.

Installing 2.5cm (1") acoustical foam on all sides of the engine box reduces the reverberation and drops the noise in and outside the box to about 87 dBA, a sound level equal to that of a truck without a muffler. Alternatively, adding a composite soundproofing material — a single sheet of lead sandwiched between two layers of 5cm (2") foam (or fiberglass on boats over 15m/50') — reduces the noise to 78 dBA, a sound typically produced by an electric shaver or alarm clock.

Composite noise-control materials consist of four layers that block, absorb and reflect noise. The innermost foam layer, or decoupler layer, reflects noise back into the other layers. Against this layer is a flexible lead or vinyl barrier layer that provides a second noise reflecting wall in addition to the decoupler layer and the engine box. Another layer of foam, referred to as the absorption layer, absorbs sound in the engine compartment. A reflective aluminized mylar or optional white urethane facing protects the foam and gives a smooth, easy-to-clean surface. Composite materials are sold in full (4x6) and half (4x4) sheets or by the foot, depending on the supplier.

The thickness of the absorption and decoupling layers and the weight of the barrier determine the efficiency of sound-absorbing materials. Foam layers range in thickness from 2.5cm to 5cm (1" to 2"). The thicker the foam layer, the better the noise absorption and the higher the cost. In installations where there is

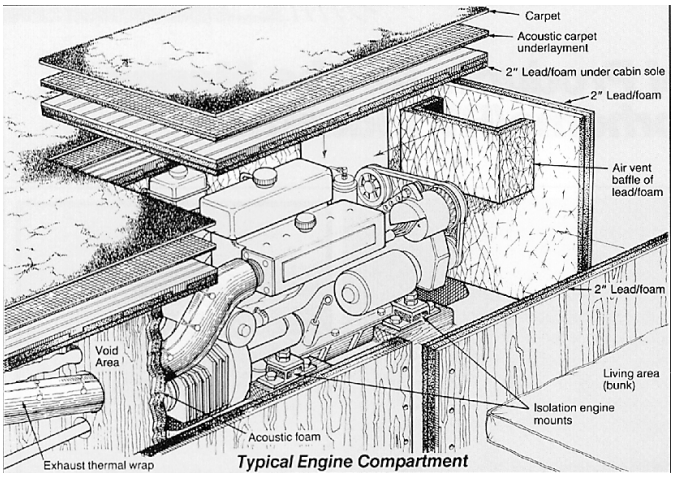


Figure 2

limited clearance around the engine, select the foam size that best fits the available space and your budget, always opting for the thickest material possible.

The other variable affecting performance is the density of the lead barrier layer which is available in weights of 450g or 900g (1lb or 2lb) per square foot. The heavier, more costly 900g (2lb) lead material does a better job of blocking bass and mid-frequency noise, typical of diesel engines.

Steps to Noise Control

Controlling noise means containing it at its source. This involves a number of steps: reducing structure-borne noise by reducing vibration; building a tightly sealed enclosure around the engine; lining the interior surfaces of the engine compartment with a sound-reducing material; sealing noise leaks from vents, hatch openings and cracks in the engine room; adding acoustic carpet underlay and headliner on cruisers; and installing exhaust wrap.

Soundown's soundproofing kit includes: insulation material, spray adhesive, mylar edge-sealing tape, gaskets and mechanical fasteners: pan-head screws with oversize washers for attaching to cored fiberglass or wood; or hanging pins (left foreground) for metal or uncored fiberglass.

To reduce structure-borne noise, the engine must be separated from the hull by flexible rubber isolation mounts. Such mounts reduce engine vibration, thus reducing noise; unless you're willing to take the time to install flexible mounts, it doesn't make sense to spend the extra dollars on a thicker, denser composite foam/lead material.

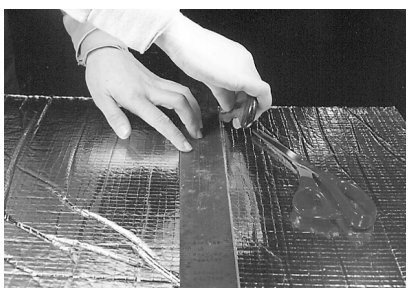
When you enclose the engine compartment, you may need to reduce the volume of space with plywood bulkheads or a hanging insulated curtain. The compartment must then be completely lined with insulation — adding soundproofing to only the sides or deckhead just leaves a big hole for noise to rattle around in. Any where air can get in, noise can get out, so all noise leaks must be tightly sealed with neoprene gaskets. Soundown offers numerous styles of gaskets that cost less than a dollar per foot.

Noise radiating from the engine through the cabin sole makes for loud living quarters. An acoustic carpet underlay (similar to a carpet pad) installed under the carpeting creates an effective barrier. Adding a foam-backed headliner absorbs sound in the cabin and provides thermal insulation as well. Finally, you'll need to tame noisy wet exhaust pipes and silencers with a noise wrap.

The average cost to properly insulate a 7.2m (24') stern drive-powered cruiser varies from US$200 to US$300, while a 10.5m (35') flybridge cruiser ranges from US$300 to US$500. Because sailboats typically require more material, installations are the most expensive, ranging in price from US$600 to US$700. Prices include insulation material, spray adhesive, fasteners, mylar edge-sealing tape and gaskets.

Silencing the Roar

Boats with stern drives are expected to be quieter than outboard-powered boats, but many are not. On some boats, a thin foam pad mounted on the underside of the engine hatch is all that separates the cockpit from a cavernous engine compartment. Engine noise is reflected off the transom and, because the box is not sealed tight against the transom, noise escapes underneath the coamings and travels forward under the floorboards. Reducing the size of the engine compartment with plywood bulkheads, including one at the front of the engine box that extends down to the hull and forms a tight seal, will cut the noise in half. Where there is no aft bulkhead behind the engine, you'll need to make one of plywood or add a hanging "bulkhead." This is a flexible quilted fiberglass curtain mounted with Velcro or hooks.



To cut thicker foams, use a circular saw with paneling blade or use a utility knife and cut the top foam layer, reverse the material and cut the bottom layer, then cut the lead with scissors.

Custom-made, the cost for a curtain that measures 3.3m (11') wide and extends .9m (3') under the deck is about US$300.

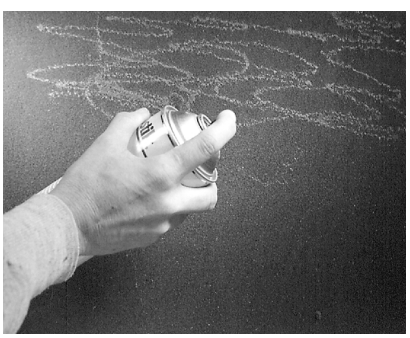
Lining the engine box with additional insulation further reduces cockpit noise. A 7.2m (24') cuddy-cabin cruiser, for example, requires 2.5cm or 3.8cm (1" or 1-1/2") foam with a 450g (1lb) lead barrier. Vibration damping tiles, 6mm (1/4") thick and glued to the transom where the outdrive penetrates the transom, lessens any structure-borne noise.

On boats with twin engines, Murray doesn't recommend installing a baffle between the engines. The marginal gain in noise control does not warrant the extra labor involved in fabricating two individual engine boxes.

On aft-cabin and flybridge cruisers, where the engine room is located under the saloon, noise from vibration often radiates through the floor. Carpet underlay combined with a headliner, so noise is absorbed rather than reflected, greatly improves living conditions.

Sail-Proofing

Most of the standard soundproofing practices we've talked about also work for sailboats with diesel inboard engines. In addition, if your boat has a Perkins, Atomic-4 or Universal engine, which is bolted directly to the engine beds, replacing the beds with rubber-in- sheer-type flexible mounts (from Vetus, Yanmar and others) will dramatically reduce structure-borne noise.



Apply a light coating of foam and fabric adhesive to both surfaces. Work in a well-ventilated area.

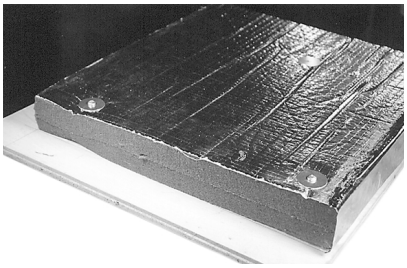
On sailboats, the engine is generally located under the companionway in a large compartment that continues aft to the transom, with pilot berths or storage located on either side. Insulating only the front of the engine box does little to reduce noise. Again, for effective sound control you'll need to shrink the size of the engine compartment with plywood bulkheads, possibly adding an aft bulkhead or a hanging curtain forward of the transom. These must extend down to the hull so that noise doesn't escape underneath. Once the box is tightly sealed it should be lined with 3.8cm (1-1/2") or 5cm (2") foam — the best choice if space allows. On boats with flexible engine mounts, Murray recommends using the denser 900g (2lb) per square foot lead barrier for better reduction of low-frequency noise.

Insulating the Engine Box

Whether you're upgrading an existing installation or starting from scratch, it's a good idea to make paper or cardboard patterns of each panel to minimize waste. Allow for overlap of the sections: the top panel is installed first, so the height of the side and end pieces will be shorter by the thickness of the top piece. The last panels that you install (sides or ends) will also be shorter in width.

Any old insulation material must be completely removed before adding new material. Wipe the surface with solvent to remove residual dust, oil or grease and to re-tack the old adhesive. On bare fiberglass, epoxy or painted surfaces, a light wipe with solvent is all that's needed. Remove all cables, hoses and wiring that are attached to the engine compartment.

Foam composites cut easily with a utility knife, razor blade, scissors or an electric carving knife. For thicker 5cm (2") materials, a circular saw



Use an awl to make pilot holes in the insulation material then attach the pan-head wood screws with oversize washers spaced every 38cm.sq. (15sq.in.) to the plywood bulkhead. The exposed lower edge is covered with mylar edge-sealing tape.

with a cheap ($5) paneling blade gives a straight, clean edge. Lay the insulation on a piece of scrap plywood and set the saw depth so it just nicks the plywood as it cuts. (Wear safety glasses.) If you don't have a paneling blade, cut the top foam layer with a utility knife, reverse the material and cut the bottom layer, then cut the lead with scissors.

To eliminate the chance of moisture or other vapors migrating into the foam, cover all exposed edges with mylar edge-sealing tape before installation. For better adhesion, apply a small amount of adhesive (see below) to the exposed edge, then wrap the tape around the foam, working from front to back, pulling the tape tight so you get a smooth edge.

Next glue and mechanically fasten the insulation to each panel. On wood or cored fiberglass, use pan-head wood screws with oversize washers. Use an awl to make pilot holes in the insulation material. Uncored fiberglass or metal surfaces use custom aluminum hanging pin fasteners that are bonded in place with thickened epoxy or polyurethane adhesive sealant. Space the pins about every 38sq.cm. (15sq.in.). Let fully cure before attaching the insulation.

Apply a light coating of a brush-on or spray-on foam and fabric adhesive (3M, Bostick or an other brand) to both surfaces and lay the insulation in place while the adhesive is still tacky — after about one minute, depending on air and surface temperatures. If you're not using a manufacturer-supplied adhesive, do a compatibility test first. (Some adhesives contain VOCs, so work in a well-ventilated area.) If you're using hanging pins, push the material over the pins, slide the retaining washer over the pin, cut the pin to length with wire cutters and then install the cap. Once it's mounted, you cannot remove the cap without cutting the pin, so be sure the pin length is correct.

Install the top piece first so that it's supported by the sides. Where wires, cables or hoses pass through the engine box, you'll have to make a hole in the insulation that will be filled later with material scraps or a spray-on expanding foam. Another method used by the professionals is to slice an "X" in the material and then mold the lead back around the object. Electrical panels which face into the engine compartment should have a wood backing plate covered with insulation. When all the insulation is in place, cover inside corners and exposed seams with mylar tape. Using longer fasteners, reattach any hoses and wires that were removed.

Since the enclosure must be airtight, you'll need to attach gaskets to the lower edge of the engine box, hatches and any other sources of noise leaks. Air-ventilation ducts carry noise as well as air, so you'll also need to build a noise trap as shown in **Figure 2**.

Soundproofing materials are built to withstand high moisture and hot temperatures without crumbling for 10 years or longer. A once or twice-yearly wipe of the facing with a water-soluble cleaner, such as Spray 9, is the only maintenance required.

Now, sit back, pop a cold one and enjoy the peace and quiet. You certainly deserve it.

DIY PROJECTS

BOAT REFIT

Illustrations by Anne-Marie Hendry

GETTING STARTED

The shop-tested projects detailed in the following pages have been grouped together in five categories: canvas, woodworking, King StarBoard, laminating techniques and fiberglass. Some of the projects apply only to powerboats; others are only for sailboats. Our instructions assume that you have mastered basic skills and techniques.

Once you've selected a project, you need to plan and organize everything carefully. This involves a number of steps: develop a materials list; purchase materials; make the necessary patterns; cut and assemble; and install.

You'll need to consider the suitability of a particular project, quality, durability and cost. Make a list of materials, tools — everything you require — before you start. For some projects, you'll have a choice of materials, color and design. After deciding what materials to use, determine how much you'll need. If you can afford it, purchase a little extra. (Remember the last time you got partway through a job and discovered you didn't have enough material to complete it?)

There are several methods for making patterns and care should be taken to avoid mistakes, because they can be costly: measure twice (or three or four times) and cut once. Pattern making is somewhat of an art and frequently means the difference between a sloppy and professional-looking result. Make notes: don't trust anything to memory. Take your time and do it right.

After you have checked measurements and patterns carefully, transfer cutting lines and all necessary marks from the pattern to the material, arranging the pattern to keep waste to a minimum. After a final check of the marked lines, you're ready for cutting and assembly.

Although we have given the most common method for doing these projects, our ways are not the only ones. You may come up with a better method for your particular purposes. This is the creative part of doing it yourself!

CANVAS

Shop Tested

1. To Make Fitted Sheets

Take the following measurements: length of cushion, width of cushion and depth of cushion (**Figure A**). Note any unusual angles or curves. Measure accurately so the sheet will fit the berth perfectly.

2. Top sheet: Trace the shape onto cotton sheeting or make a pattern. To the width add twice the cushion depth plus twice the drop length (the distance from the bottom edge of the cushion to the bottom of the sheet), usually 7.6cm to 10cm (3" to 4") below the cushion. If the sheeting is the correct width for the berth, selvages do not need finishing; otherwise, add 3cm (1-1/4") to each side for a double-wide fold. To the length, add the cushion depth plus the desired drop length and an extra 30cm (12") for a double-fold hem on the top and bottom edges. If the sides are not prefinished (selvage edge), stitch a 15mm (5/8") double-fold hem: turn under 15mm (5/8"), fold again and stitch near the folded edge. Stitch a double-fold hem, 7.6cm (3") wide at the top. Use an embroidery or zigzag stitch for a decorative finish. On the bottom edge sew a 2.5cm (1") wide double-fold hem. Slipstitch folded edges together at the ends.

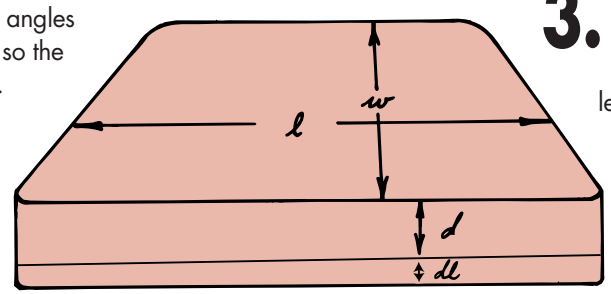


Figure A

Measuring for sheets: w = width; l = Length; d = depth of cushion; dl = drop length.

3. Fitted sheet: To the width and length add twice the cushion depth, twice the drop length (or as desired) plus a 3cm (1-1/4") hem allowance on all edges. To form a mitered corner (Figure B), fold the fabric where the top meets the cushion side and crease, extending a few inches out from the corner. Fold, right sides together, matching the crease lines. Draw a line perpendicular to the corner then stitch along the drawn line. To reinforce the corner, sew again 3mm (1/8") inside the original stitch line. Trim, leaving a 12mm (1/2") seam

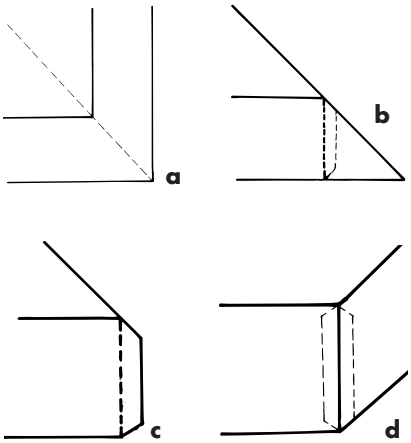


Figure B

Making of a mitered corner: (a) Fold the fabric where the top meets the cushion side and crease; (b) Fold, right sides together, matching the crease lines, then draw a line perpendicular to the corner and stitch; (c) Trim, leaving a 12mm (1/2") seam allowance and clip the corners; (d) Press seam open.

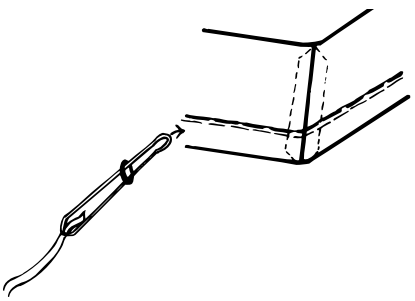


Figure C

Thread elastic in the corners with a bodkin (available at sewing supply stores).

allowance and clip the corners. Press seam open. Repeat this step on the remaining corners. Turn under 15mm (5/8") along the bottom edge, then fold again. Stitch close to the folded edge. Leave openings for the elastic, about 25cm (10") on each side of the corner seams. Cut four, 20cm (8") lengths of 12mm (1/2") elastic and thread the elastic through the casings at the corners with a bodkin (**Figure C**) or large safety pin. Secure with safety pins, then stitch all ends.

Sew a Boom Cover

When it's time for a replacement or an all-new boom cover, why not make it yourself? The material of choice is acrylic — a durable, water-resistant synthetic fabric that comes in an assortment of colors and patterns. It also comes in different widths and is usually sold by the meter (or yard) for about $25.

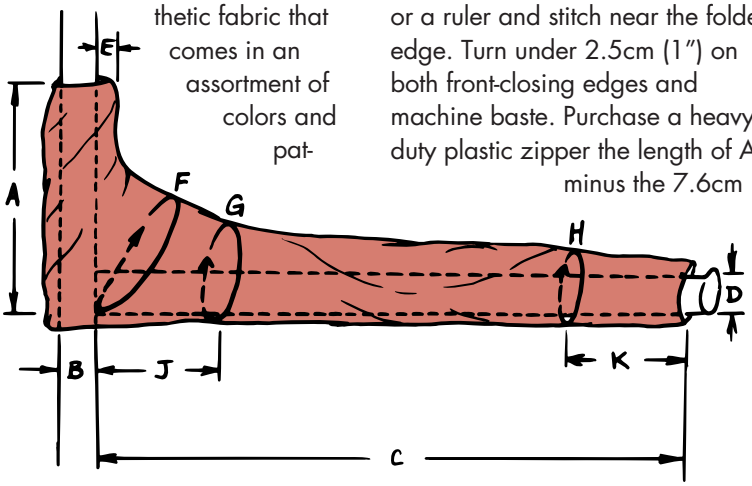


Figure 1

Boom cover measurement guide.

Use your existing cover as a pattern or measure the furled sail on the boom, following our diagram (**Figure 1**) and noting the following measurements: A, bottom of boom to head of furled sail; B, circumference of mast; C, aft edge of mast to end of boom; D, circumference of boom; E, distance from aft edge of mast to outer edge of headboard; F, circumference of furled sail taken at a 45° angle; G, circumference of furled sail .9m (3") from mast (J); H, circumference of furled sail .9m (3") from end of boom (K). (Allow extra girth for mast or boom-mounted winches and cleats.) From these measurements make a pattern out of kraft paper. Add a 19mm (3/4") seam allowance on the top edge. On the front closing add a 2.5cm (1") seam allowance. On all other edges — bottom, top around the mast and boom end — add an extra 7.6cm (3") for a double-wide hem and casing.

With right sides together, sew the cover together along the top edge or centerline. Turn under 2.5cm (1") on the bottom edges, then fold again, crease with scissors or a ruler and stitch near the folded edge. Turn under 2.5cm (1") on both front-closing edges and machine baste. Purchase a heavy-duty plastic zipper the length of A minus the 7.6cm (3") hem allowance at the top edge. Now sew on the zipper. Turn under a double-wide hem at the boom end and top edge around the mast (**Figure 2**), insert polyester cords that have been cut the length of B and D, respectively, plus an extra 30cm (12") each, and sew a hem. Knot the ends of the cords so they won't pull out accidentally.

Lay the cover over the furled sail and make sure everything fits.

TIPS *SEWING TIP*

When sewing heavy acrylic or canvas, use a 100/16 or 110/18 regular sharp needle, 100% polyester thread (not cotton-wrapped polyester) and decrease tension on the pressure foot. Always begin sewing with the needle down in its lowest position.

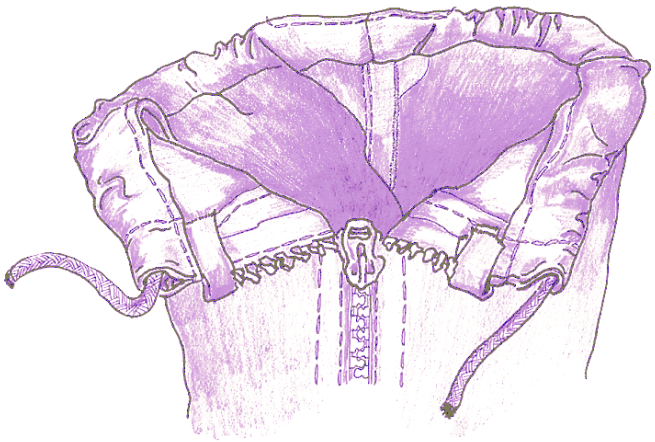


Figure 2

Turn under a double-wide hem at the top edge around the mast, insert cord, then stitch close to the edge.

You may need to provide cutouts for the topping lift or lazy jacks, depending on your setup. (If you didn't allow extra girth for mast-mounted winches, you can make cutouts in the main cover, then sew on a custom cover sized to fit over the winches.) Now mark the locations of fasteners on the bottom edges. These are spaced about 30cm (12") apart. (Allow clearance around the vang and mainsheet.) Attach twist-type (Common Sense) or snap fasteners or sew on 19mm (3/4") webbing ties. Another fastening option is to install metal or plastic hooks on one edge and grommets with a shock cord loop secured with a slip knot (**Figure 3**) on the other edge. The adjustable shock cord makes it easy to wrap any furled bundle.

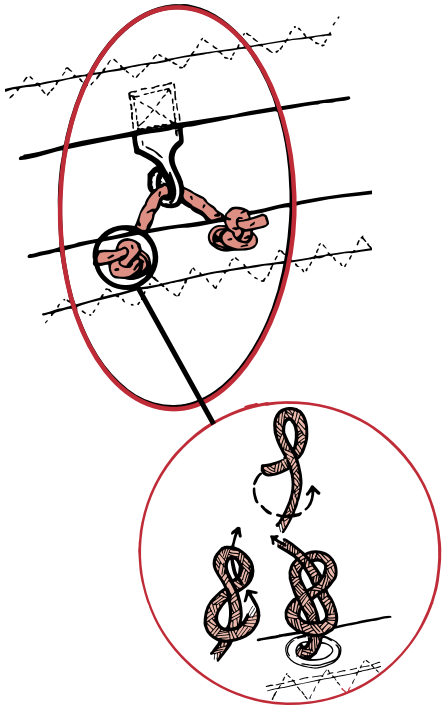
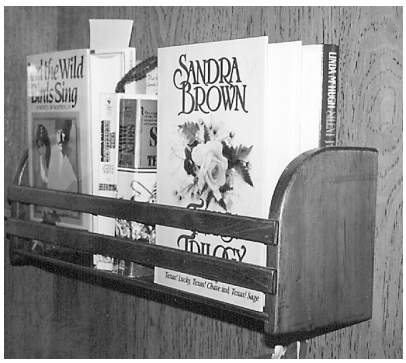


Figure 3

The mainsail fits snug inside a cover that's secured with adjustable loops of shock cord tied with a slip knot (bottom).

WOODWORKING

Shop Tested



SHEILAH VAN NOSTRAND

Easy-to-make bookshelf holds both hardcover and softcover books.

BOOKSHELF

By Sheilah Van Nostrand

MATERIALS

- 2 Bookends 15cm x 11.4cm (6" x 4-1/2")
- 2 Front slats 48cm x 14mm (19" x 3/4")
- 1 Shelf 47cm x 11.4cm (18-1/2" x 4-1/2")
- 1 Backplate (optional) 48cm x 15cm (19" x 6")
- #6 and #8 woodscrews
- Assorted sandpaper
- Stain, varnish, oil or paint

This simple shelf for paperbacks and small hardcover books mounts against a bulkhead or closet. These plans make a shelf that measures 48cm long and 11.4cm deep (19" x 4-1/2"). To accommodate larger hardcover books and cruising guides, increase the width to 23cm (9").

Cut the shelf and back plate (if you're using one) from 6mm (1/4") mahogany marine-grade plywood. The ends and front slats are made of 12mm (1/2") pine, or you can use mahogany or teak — whatever scraps you have in the shop. Before you cut, be sure the grain all runs the same way. Using a large juice can, or something with a similar radius, scribe an arc on the top outside corner on one of the ends. Tape the two ends together with masking tape or double-sided tape to make a single block. Carefully cut the scribed arc on a band saw or with a jigsaw to create matching bookends.

Using either a dado saw blade or a router, cut a 6mm (1/4") wide groove in both bookends, approximately 6mm (1/4") deep and 12mm (1/2") from the bottom edge on the inside. This groove accommodates the plywood shelf. Round the front edges with a router, a block plane or a cornering tool, then finish with sandpaper. Drill a #6 countersunk hole in the end of each front slat, 6mm (1/4") in from the edge, then round the top and bottom edges. Sand all parts, finishing with 120-grit paper.

Assembly

To mount the shelf on a bulkhead, first drill two countersunk holes in the sides of the back plate, 6mm (1/4") in from each end and 2.5cm (1") from the top and bottom edge to accommodate #8 19mm-long (3/4") flathead wood screws. Fit the back plate to the back edge of the bookends and drill matching pilot holes. Attach the back plate to the bookends with #6 screws. Apply wood or epoxy glue to the precut notches in the bookends and slide the shelf into place. Remove excess glue immediately with a putty knife then wipe with a clean rag. Screw (#6 screws) the front slats to the front edges of the bookends. Lay the shelf flat on its back edge and clamp with pipe clamps, heavy rubber bands cut from an inner tube or commercial-grade packing tape, or wedge it between two heavy objects until the glue sets. (*TIP: Lay cardboard under the jaws of the clamps to protect the surface of the shelf.*)

To complete the bookshelf, finish-sand all surfaces, then apply oil or stain then varnish for a rich natural-wood texture, or paint to match the decor.

Screw the bookshelf to a bulkhead through the back plate, use two "L" brackets under the shelf, or mount the shelf on top of a wood cleat attached to the bulkhead.

If you plan to fasten the bookshelf to the outside of a closet, eliminate the back plate and attach the bookends directly to the closet by carefully marking where the shelf will hang and pre-drilling holes to secure it from inside the closet.

NEW CABINETS FROM OLD SLIDERS

Story and photos by Steve Wight, Perth, Ont.

MATERIALS

- Cardboard
- Shelf: 12mm (1/2") marine-grade plywood
- Door trim: 5cm x 19mm (2" x 3/4")
- Fascia and partitions: 3mm (1/8") marine-grade plywood
- Fiddle: 2.5cm (1") mahogany or teak
- Cleat stock
- Sandpaper
- Varnish or paint
- #8 wood screws
- 8 inset hinges

Original sliding panels.

A more functional cupboard with horizontal and louvered doors and a lower shelf with fiddle.

Many boats were built with cabin shelves enclosed by sliding panels. These were cheap, worked well, kept the contents in place in all conditions and were of a style appropriate for the time. Now, such panels provide the basis for adding more functional and attractive cabinets: the top and bottom slides are precisely the same distance apart for the total length, and the bottom slot is directly below the top slot. With these difficult steps of construction already provided, replacing the sliding panels with real cupboards is a simple-enough task for amateurs to tackle.

There are four major parts to the cupboard: the shelf, fascia board, flat doors and louvered doors. First, design your layout. On my Corvette sailboat, the space enclosed by the existing sliding panels was large enough to accommodate two shelves. I kept the existing shelf, leaving it as an open bin, and added an enclosed shelf about a third of the distance up. I settled on two louvered, vertical panels in the center and two horizontal doors on either side. This arrangement, I reasoned, would easily accommodate a portable stereo that was higher than the horizontal doors and use up some stock I had at hand.

To begin, remove the old sliding panels (you'll use them to make patterns for the new pieces) but leave the original top and bottom supports. Using heavy cardboard, make patterns of the new shelf, cupboard doors and fascia board. To allow for the hull curves, both top and bottom and fore and aft, cut the cardboard patterns the proper length but wider than you need.

Forming The Shelf

The new top shelf need not be level, but it must line up with the existing shelf. Place blocks (I used scraps of 2x4s for shims) on the bottom shelf to support the cardboard shelf at the desired height. Use the old top and bottom supports to mark the inside edge, then make a rough cut. Lay the pattern against the hull and scribe the edge with a compass or washer (see *Making Things Fit* on page 22) to get a precise fit. Transfer the position of the shelf on the hull and mark the ends to locate the supports. Before removing the template, mark all position identification (top, hull, front, bow, stern, and so on) on the cardboard.

Cut the shelf from 12mm (1/2″) plywood and check the fit. Cut or drill whatever holes you need for wires or drainage. Glue and screw cleat stock — a 19mm (3/4″) square piece of mahogany — along the bottom front edge of the shelf to add support for the fascia. Now paint or varnish the shelf. Cut two

DIY PROJECTS

end supports to length from the cleat stock.

The design of the front of the cabinet depends on your personal taste. As it's the most prominent piece of cabinetry in the boat, you'll need to spend some time drafting an acceptable design. The pattern must show the design of the cupboard doors. I sketched numerous designs and, when I thought one looked acceptable, produced a full-scale template on cardboard. For whatever reason, the right look to scale was the wrong design full-size and I was back to the drawing board. Designing a cabinet that's pleasing to the eye is a lot of work, but well worth the effort.

Shaping the Fascia

Make a cardboard template for the fascia leaving cutouts for the doors, then trace the template on wood. I used 3mm (1/8") mahogany-faced plywood, which is very flimsy, but sufficient when well supported. This thin stock allowed me to use the cutouts as insets surrounded by a teak frame for the two horizontal doors. If you do this, mark which piece was cut from which hole so the grain in the door matches the fascia. Reinforce the fascia where the hinges are mounted with 12mm (1/2") hardwood cleat stock glued to the inside.

Secure the fascia in position temporarily then make cardboard templates for the vertical partitions (optional). Cut these panels from 3mm (1/8") plywood, glue cleat stock to the back, front and bottom edges, then paint or varnish. I decided to make one long shelf, so omitted these panels.

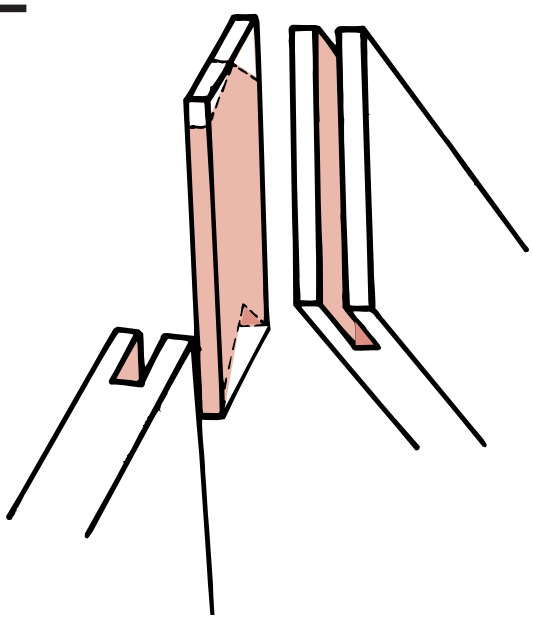


Figure 1

Enlarged view of a splined mitre joint.

Building the Doors

Cut the frames for the doors from 5cm (2") teak or mahogany stock, 19mm (3/4") thick. Using a router, shape the outside edge of the frame before cutting to the finished size and gluing if you want square corners, or shape after assembly for rounded corners. Join the corners using a splined miter joint (**Figure 1**). With the help of a miter box and saw, cut the corners at a 45° angle. Dado or router grooves in the ends the width of a hardwood spline. Apply glue to the spline and corners and secure with clamps. When the glue dries, trim the spline flush with the edges, then router a decorative trim on the inside edge with a beading bit. For the horizontal doors, cut or router the inside back edge, about 12mm (1/2") wide and the depth of the plywood insets (3mm or 1/8" on my doors), so the plywood nestles

TIPS

MAKING THINGS FIT

It's easy to transfer curved shapes of the hull or ceiling to a heavy non-corrugated cardboard or plywood pattern using a variety of flat metal washers and a sharp pencil.

Let's consider making the shelf pattern for the cabinet described on page 21. Position the pattern so that it's level and as close to the hull as possible. The pattern will probably touch the hull in only a few areas. Temporarily support the pattern with braces so it doesn't move. Select a flat washer that is large enough to cover the widest gap between the pattern and the hull. Place the washer on the top of the pattern, put your pencil in the hole and, holding the washer against the hull, run it along the pattern. This draws a line parallel to the hull that you can then cut and transfer to the finished piece.

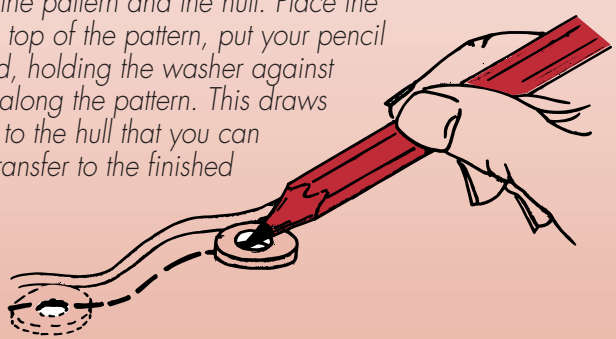


Figure 2

Hinge detail.

inside the frame. For the wood strips on the louvered door frames, cut slots in the inside edge at a 30° angle before assembling the frames. Cut or router slots on the back of the frame for the semi-concealed inset hinges (**Figure 2**) and mount them. Lastly, cut 2.5cm (1") finger holes in all doors.

Assembly

Slide the shelf in place and support with blocks. Glue and screw the end supports to the shelf, bulkhead and hull. (Do not first attach the supports to the shelf as they will prevent the rotation necessary to fit the shelf.) Now glue and screw the vertical partitions in place (if you're including them). Install the fascia board, gluing it to the original top slide, front shelf support and partitions (**Figure 3**) and secure with C-clamps or screws. Lastly, install the cupboard doors. I used spring-loaded hinges which I thought were very secure until the windy, bumpy day I showered the kids with the contents of the cupboards. I've since installed door latches.

The original bottom shelf is very handy for tossing stuff so I added a fiddle — a strip of teak on either edge — leaving an opening in the center. The final satisfaction was the installation of the 'boom box," but it didn't fit! The hole was large enough, but the sloping deck reduced the height in the back and it wouldn't slide in far enough.

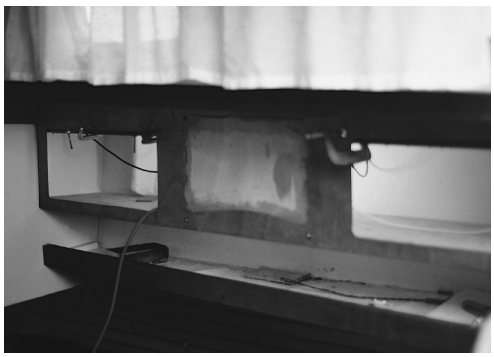


Figure 3

The fascia is glued and clamped to the shelf support and the existing top slider.

KING STARBOARD

Shop Tested

BUILDING WITH MAINTENANCE-FREE KING STARBOARD

If you're tired of stripping, sanding and painting or varnishing exterior wood trim, or you need to replace decayed wood components, King StarBoard* is the ideal choice. It can be used in many items normally made of wood — cockpit tables, folding seats, swim platforms, stowage boxes, rod holders, countertops, handrails, grates, cabinets — the possibilities are endless.

A strong and durable UV-stabilized polymer, King StarBoard won't absorb water, delaminate, rot or splinter and requires no painting. Its mat-textured finish won't fade, resists scratches and repels stains; remove dirt with a scrub brush and a light abrasive cleaner. And being less dense that water, it floats.

King StarBoard comes in six standard colors that match most gelcoats, and in thicknesses from 6mm to 2.5cm (1/4" to 1"). A lightweight and less expensive version, King StarLite XL*, weighs 40% less and replaces plywood as an upholstery backing but comes in black only. The all-new King ColorCore* is a multi-layer polymer sheet with a contrasting color core available in a variety of standard and custom colors.

Sold in full or half sheets, King StarBoard costs about the same as marine-grade mahogany plywood and is comparable in weight. On smaller jobs, where you need less than a sheet size, you'll save money by purchasing offcuts if you can find them, although I'm sure you'll eventually find uses for any excess material.

While it can't match the beauty of oiled teak or varnished mahogany, once installed King StarBoard is maintenance-free.

Fabricating Techniques

King StarBoard is a soft material, more akin to the pine family than its acrylic or Plexiglas cousins. It's easily cut, routed, shaped and drilled with standard woodworking tools.

When transferring cutting

***King StarBoard, King StarLite XL, King ColorCore and King StarBond are registered trademarks of King Plastic Corp.**

DIY PROJECTS

lines and reference marks, use chalk or a wax fabric pencil (sold at sewing supply stores). Keep the pencil sharp to a chisel point with a knife so a thin cutting line can be made close to the edge of the pattern. Do not use pencils or pens which leave a permanent mark.

The front of the material has a protective masking that should be left on until the work is completed. I prefer to work from the wrong side, but this involves reversing the pattern, matching the two wrong sides together. King StarBoard's uniform color lets you lay out the pieces so there's little waste. (Save offcuts to make waterproof cleats, turnbuttons, shims, spacers and the like.)

Cut King StarBoard with a table or radial arm saw, using a carbide blade with 70 to 80 teeth. A jigsaw with a 10-teeth-per-inch blade also gives a clean, smooth edge that requires little finishing. King StarBoard performs best under high-speed cutting, unlike Plexiglas which melts unless it's cut slowly.

King StarBoard has a very fine, sharp edge that must be rounded with a file, sander or a router, if you have one. A 1/2-round carbide router bit or a decorative bit such as a double bullnose gives the best edge finish. Finish sanding any uneven edges with an orbital sander and 120-grit paper (**Figure 1**). Always wear safety goggles when cutting or shaping and a mask when sanding to prevent inhaling plastic dust.

Use a brad-point bit to drill the material to prevent drill travel. For holes larger than 6mm (1/4"), drill a pilot hole first. Drilling heats up the material — especially if you're using a drill-mounted holesaw — leaving a rough edge on the underside that can be removed with a utility knife or file. Because King StarBoard contracts and expands with temperature changes, you must drill oversize holes for fasteners, adding 1/32" for every linear foot of length or width. Screws can be countersunk (**Figure 2**) or counterbored and the holes filled with plugs cut from King StarBoard with a plug cutter.

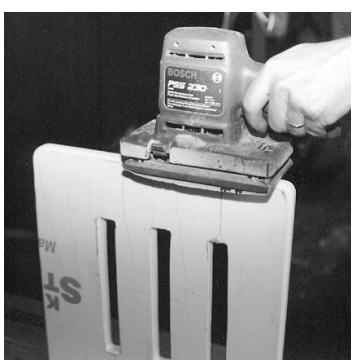


Figure 1

Finish sanding any uneven edges with 120 grit paper.

King StarBoard bonds to fiberglass, aluminum, steel, wood, plywood and itself with King StarBond*, a specially formulated two-part urethane adhesive dispensed from a custom cartridge-type gun. Bonding surfaces are lightly sanded with 120-grit paper, cleaned with solvent (acetone), then flame treated with a propane torch: Pass the flame over the surface at a distance of 5cm (2") or less at a rate of 30cm (12") per second (**Figure 3**). Don't scorch the surface. (It's a good idea to practice first on a some scrap.) Ideally, flame treating should be performed within one hour of bonding. StarBond adhesive is then applied to both surfaces (**Figure 4**) and spread evenly with a putty knife or old slot screwdriver.

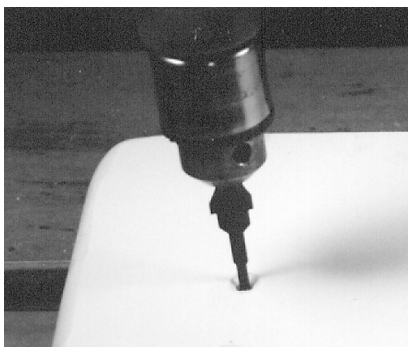


Figure 2

To countersink screw heads, use a combination bit that drills and countersinks in one operation.

DIY PROJECTS

Clean up any spilt adhesive with acetone. Because I don't like to rely entirely on a glued joint, I recommend using a lap, rabbeted or similar joint along with mechanical fasteners that double as a "clamp," holding the joint firmly until the glue sets. Depending on the temperature, StarBond's working time is about 10 minutes, clamps can be removed in six hours and it reaches a full cure in 24 hours.

Following is a sampling of projects made of 12mm (1/2") and 19mm (3/4") King StarBoard. Each uses less than $30 worth of material and can be cut and assembled in an afternoon. Patterns are provided for a fishing rod rack, hatch board seat and half swim platform.

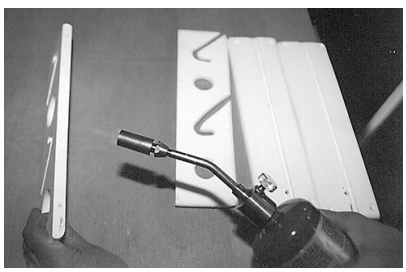


Figure 3

To prepare the King StarBoard for gluing, pass a propane torch over the surface so the blue portion of the flame just kisses the surface.

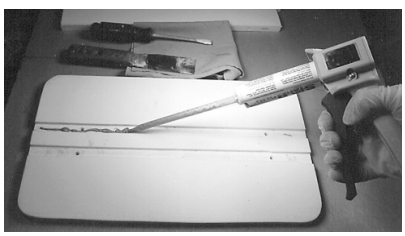
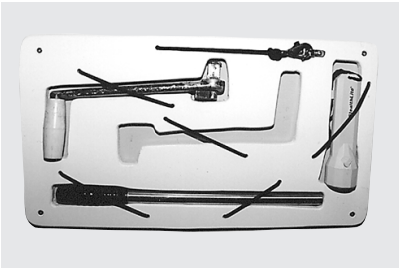


Figure 4

After treating the surface, apply 8 to 12 mils of StarBond adhesive to both surfaces with a specialized dispensing gun.

Tool Organizer

This tool organizer is an adaptation of one on the Gozzard 44 sailboat built by North Castle Marine. It installs under the lid of a cockpit locker, giving quick access to frequently used tools. This one measures 28cm wide by 50cm long (11" x 20") and holds two winch handles, a bilge pump handle and flashlight, but it can be easily customized to hold any tool assortment. It's made of 12mm (1/2") King StarBoard; you'll also need four #8 fasteners of suitable length, a stainless-steel eye strap, 3mm (1/8") shock cord and a hook. Total materials cost is about $20.



To start, measure the cockpit locker, allowing for any obstructions, then make a pattern. Trace the outline of each tool on the pattern, adding an extra 3mm (1/8") on all sides. Transfer the pattern to the wrong side of the King StarBoard (**Figure 5**). To make the cutouts for the tools, first drill 9mm (3/8") holes in the corners, inside your traced outline (**Figure 6**), then "connect the holes" with a jigsaw.

Now, cut out the finished piece. Turn it over and finish all edges with a 1/2-round carbide bit. Drill and countersink for fasteners in all four corners. Drill holes for the eye strap and shock cord. This last step takes a bit of planning; you may have to drill more holes for additional shock cord support after installing your tools. Remove the raised drill edge, then sand all edges smooth. Tie a slip knot in one end of the shock cord then thread the cord through the holes; leave a little extra for adjustment later.

Now, install your tool organizer on the locker lid with screws fastened with a dab of sealant. A nut slipped on the screw between the King StarBoard and the lid acts as a spacer so you can easily adjust the shock cord. Beginning where the shock cord is tied off, install each tool and pull the cord tight. Adjust to fit, cut the cord, and attach a hook.

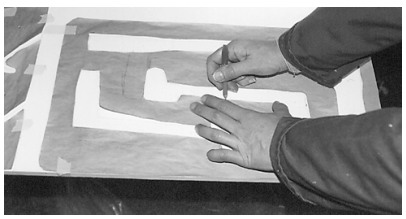


Figure 5

Work from the wrong side — King StarBoard is soft and any slip of the file or other tool will gouge the surface.

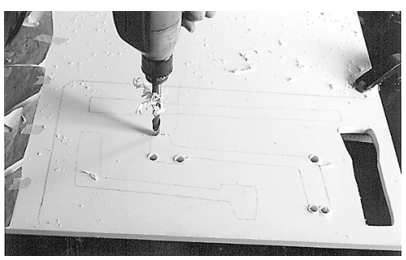
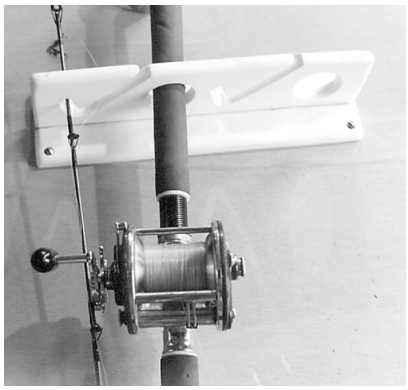


Figure 6

To make cutouts, first drill 9mm (3/8") holes in the corners, inside your traced outline, then "connect the holes" with a jigsaw.

Fishing Rod Racks

The pattern for this double fishing rod rack was taken from one that I originally made of mahogany. Measuring 29cm by 7.6cm (11-1/2" by 3"), it uses about $12 worth of 12mm (1/2") King StarBoard. It's designed to hold two, collapsible casting rods; you'll have to modify the pattern to fit trolling rods (see next page).

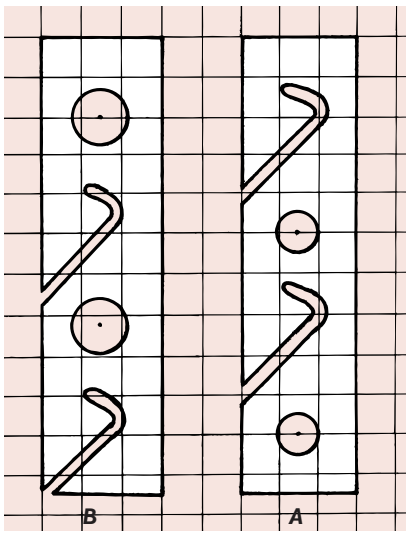


Following the pattern above (the scale is 1 square equals 1″), make a paper template, then carefully trace pieces A and B on the wrong side of the material. Draw two identical pieces (for backing plates) with the same outside dimensions, but without the cutouts. With a holesaw, drill four holes as marked on the pattern: piece A has 2.5cm (1″) holes; B has 3.8cm (1-1/2″) holes. Carefully cut the "J" slots for the rod ends with a jigsaw. To hold thicker trolling rods, cut the slots in piece A 9mm (3/8″) wide. Now, cut out the four pieces. For professional results, round the corners and finish the edges of the holes and slots with a file and sander or a router (**Figure 7**). Do not round the inside (unnotched) edge of pieces A and B.

On each backing plate cut a 12mm (1/2″) rabbet, 4mm (3/16″) deep, on the right side along the centerline with a table saw or a router with a straight carbide router bit. Slide A into the groove in one backing plate and check the fit. On the wrong side of the backing plate, drill and countersink for four #8 screws in all corners. Remember to drill oversize holes. Repeat for piece B.

Sand both matting surfaces, clean with acetone and flame treat. Apply StarBond equally to both surfaces and spread evenly. Join pieces A and B to their respective backing plates and clamp. Let cure.

Measure your rods and mount the backing plates the corresponding



1 square = 1"

distance apart, allowing for overhang at each end. To stow your rods, slide the hand grips into the holes in piece B, then into the corresponding slot in piece A. The thinner-tip section fits into holes in piece A, with the end nestled into the slot in B.

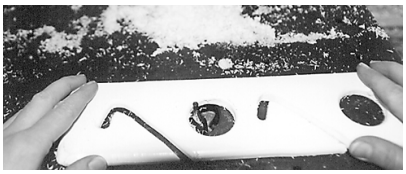


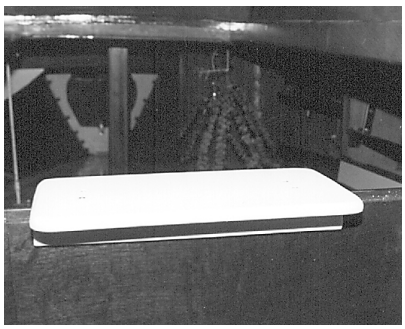
Figure 7

Round all exposed edges with a router and a 1/2-round carbide bit or other decorative bit.

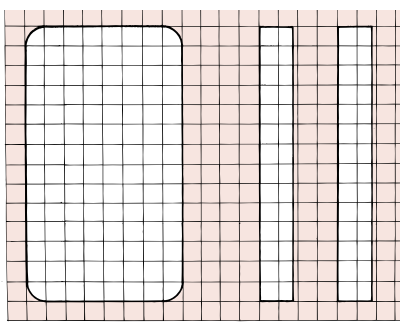
Hatch Board Seat

This nifty seat, made of 12mm (1/2″) material, sits on a hatch board. To start, cut one piece, 35cm wide by 20cm long (14″ by 8″), and two side supports, 35cm by 4.4cm (14″ by 1-3/4″). Round the top and bottom edges of the seat and the outboard bottom edge of each support. Working on the wrong side, draw two lines centered in the board that represent the width of your hatch board. Using the lines

DIY PROJECTS



as a guide, cut two 12mm (1/2") rabbets, 4mm (3/16") deep, with a table saw or router with a carbide straight bit (**Figure 8**). To hold the side supports until the glue cures, drill and countersink holes on the right side for four #8 2.5cm (1") wood screws near the ends of each groove. Clean and flame-treat the surfaces, then glue.



1 square = 1"

Figure 8

A straight bit with two or four spiral flutes works best when rabbeting as it ejects plastic chips away from the cutting surface.

You can also use the seat pattern to make a foam-filled cushion and fasten it to the underside with staples or snap fasteners.

Folding Jump Seat

I lifted the design for this folding jump seat off an antique "moaning" chair that sits in the shop. Rather than a square seat, it's narrow at the back and flares out in the front. It's made of 19mm (3/4") King StarBoard; you'll also need two heavy-duty stainless-steel hinges and one folding Rakego support (or make your own folding gusset).

Make a pattern for the seat using these dimensions: 35cm (14") in length with a width that varies from 38cm (15") at the front and narrows to 33cm (13") at the back, forming a smooth radius in the front corners. Cut out the seat plus one 3.8cm (1-1/2") wide cleat the length of the seat back (33cm/13" for this design). Round all seat edges and the top outboard edge of the cleat. Smooth with a sander, if necessary.

To assemble, position the cleat stock in place on the boat (I installed this one in the cockpit), and drill for #12 machine screws (fiberglass) or wood screws. Countersink the heads. Trace the outline of the cleat on the fiberglass then remove it. Lightly abrade the fiberglass with 120-grit sandpaper then clean with solvent. Mount hinges on top of the cleat stock as shown in **Figure 9** to prevent overloading, then attach hinges to the seat. Install the Rakego support (ours was obtained from Rekord Marine, Vancouver, B.C.),

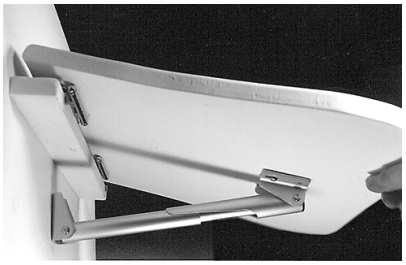


Figure 9

To unload hinges and screws, mount the hinge as shown.

following the instructions. Available in eight sizes, these telescopic aluminum supports are ideal for folding seats and tables. We used model 38830 (CDN$52) which supports a distributed load up to 95kg (209lb). Prepare the back edge of the cleat for bonding then glue and screw it to the fiberglass.

Swim Platform

Our walkaround cuddy, which we often use to test products for *DIY*, was sorely lacking a swim platform. Made of 19mm (3/4") King StarBoard, this design measures 38cm wide by 35cm long (15" by 14"). It's smaller than standard, but our outboard engine set on an offset bracket gave little room for a larger platform.

Using the pattern on the opposite page as a guideline, trace the shape on heavy paper. To make the center cutouts, drill 9mm (3/8") holes in each corner then cut out with a jigsaw along your traced lines.

King StarBoard is very strong, but it's not a structural material and must be properly framed or braced to support heavy loads. Measure the transom angle (ours was 10°) and have a metal fabricator build two

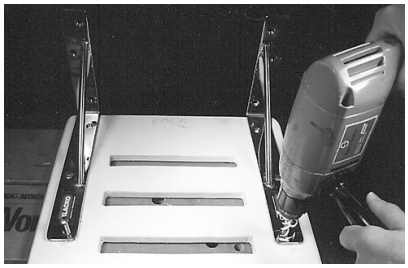
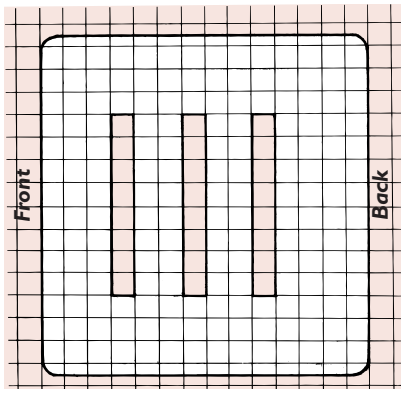


Figure 10

Use the bracket as a guide to drill the bolt holes.



1 square = 1"

stainless-steel brackets (CDN$170 each). Place these on the back side of the platform leaving a 4mm (3/16″) gap at the back for water drainage. Using the bracket as a guide, drill holes for #12 flat-head machine bolts (**Figure 10**). Turn to the right side and countersink the bolt heads. For a professional look, hide the fastener holes with wood bungs cut from King StarBoard.

Mount the platform on the transom 5cm (2″) to 7.6cm (3″) above the waterline so it sits out of the water when the boat is on plane. Use bolts if you have access to the transom from the cockpit; if not, use #12 screws. Either way, mount fasteners with polyurethane sealant. As a finishing touch you can add color-matched strips of non-slip tape for better traction.

LAMINATING TECHNIQUES

Shop Tested

For a few dollars and a bit of elbow grease, you can easily produce wooden components such as hatch frames, deck beams, bunk boards, a dinghy rudder, tiller, frames for a dodger and boom gallows. Multiple strips of hardwood, laminated with epoxy glue, are bent to shape in a custom form. Layers of wood and glue, much like plywood, make an extremely strong part, certainly much stronger than one made of solid wood.

Laminated wood and epoxy components will withstand most forces, except maybe an old willow tree that crash-lands during winter storage, which is exactly what prompted me to build a replacement tiller. The following assembly instructions are for a laminated tiller, but can be easily adapted to any woodworking project.

To make the tiller, you'll need five strips of hardwood, such as oak or mahogany, cut to the desired length and milled to a thickness of 12mm (1/2″). Working with wood that is ripped and milled to a finished size saves a lot of time and labor.

Make a pattern using the old tiller or customize a new shape; either way, you need to make a laminating form. Draw an outline of the desired shape onto a piece of heavy plywood. Cover with heavy, clear plastic or wax paper to prevent the glue from sticking to the wood. Fabricate seven or more square blocks from scrap wood 3.8cm (1-1/2″) thick, and screw or nail them securely along the outside perimeter of the line drawn on the plywood.

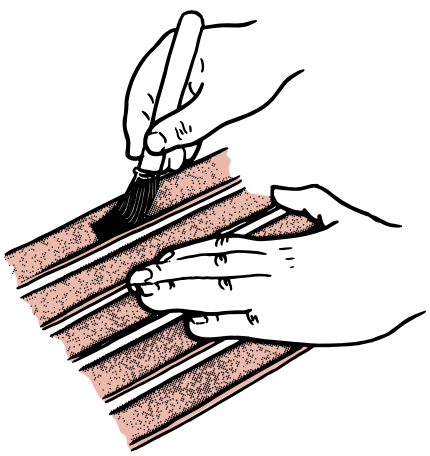


Figure A

Apply thickened epoxy to one side of the hardwood strips.

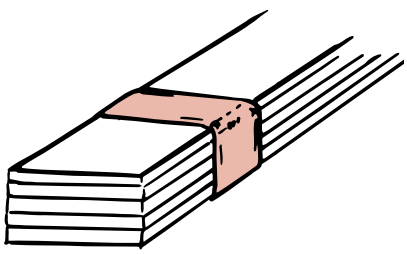


Figure B

Stack the pieces and tape the middle and ends to hold in place.

Lay the hardwood strips face down and apply epoxy glue, thickened to the consistency of mayonnaise (see page 31 for mixing details), to one side (**Figure A**). Stack the pieces and tape the middle and ends to hold them in place (**Figure B**). It's a good idea at this stage to wrap the bundle in plastic or wax paper. This prevents bonding of the stock to the laminating

Customize your tiller with an oversized knob on the end which looks nice and neatly holds self-steering or tie-off lines.

form. Turn the bundle on its side, lay it on the laminating form and clamp it with C-clamps to the blocks, beginning with the center block and working out to each side. Attach additional C-clamps directly to the wood bundle to provide extra pressure (**Figure C**). Place scraps of wood or cardboard between the clamps and the stock to protect the wood from the clamps' jaws. Remove excess epoxy with a putty knife, then wipe with a clean rag.

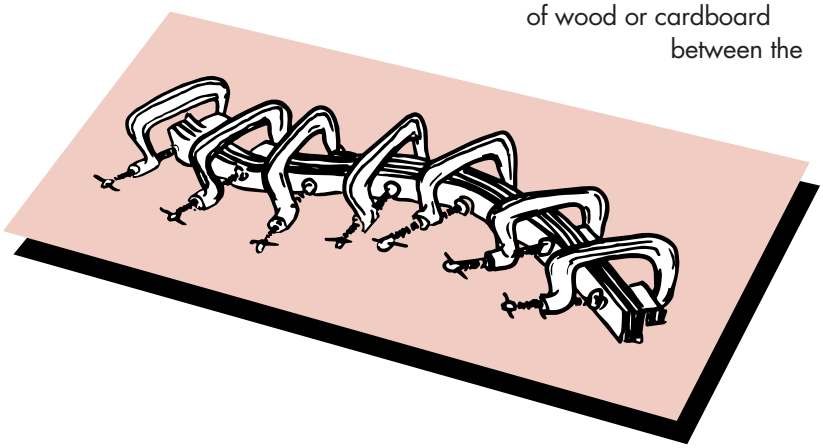


Figure C

Clamp the bundle to the blocks on the laminating form, working from the middle out to each side.

Let the glue dry, remove the clamps, then scrape or sand off any excess epoxy. Use a belt sander or hand tool, such as a jack plane, spoke shave or block plane, to form the desired shape.

Now drill a hole for the tiller bolt, give the tiller a final sanding with 120-grit paper and apply three or four coats of epoxy to waterproof the wood, followed by seven to 10 coats of marine varnish that's compatible with epoxy. (*TIP: Thread a piece of string through the bolt hole and suspend the tiller from the ceiling when coating.)*

Attach stainless straps on the sides to provide lateral support for the tiller and prevent it from breaking at the rudder head (**Figure D**).

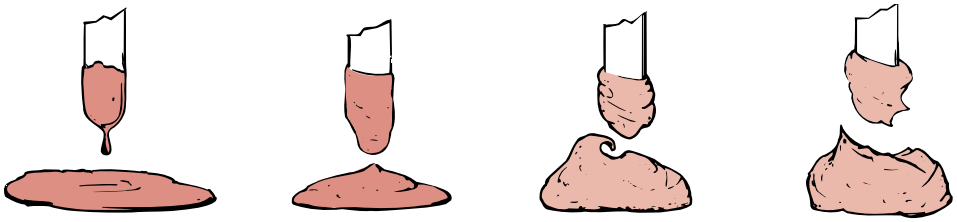
Figure D

Stainless side supports prevent the tiller from breaking at the rudder head.

Make a paper pattern of the finished profile of the tiller from the outboard end extending about 30cm (12") forward. Radius the forward edge and mark hole placements for the tiller bolt and a 1/4" bolt at the forward edge. Have a metal shop fabricate two 4mm- (3/16") thick stainless-steel pieces from your pattern. Thru-bolt these to the tiller with hex bolts and cap (or acorn) nuts, making sure to line up all outboard edges.

While you have everything set up, consider making a second tiller. You never know when you might need a spare.

Think of food when mixing epoxy: "syrup" for coating; "catsup" for laminating; "mayonnaise" for general bonding; "peanut butter" for filleting and fairing.

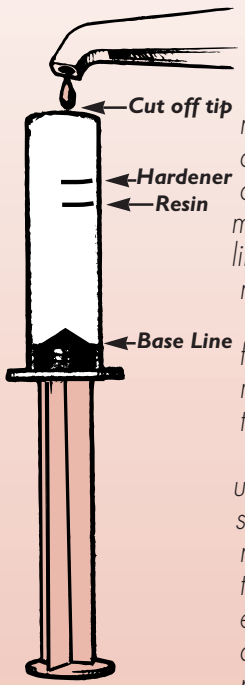


Drawings courtesy of Gougeon Brothers

TIPS

MIXING SMALL BATCHES

Building projects often involve a whole bunch of smaller tasks requiring small batches of epoxy. To avoid ending up with a whole bunch of glue pots with cured epoxy in them, here's a simple technique for mixing small batches of epoxy while retaining the correct mix ratio.



Cut off the tip of a large syringe (available at marine stores). Pull the plunger almost all the way to the end and mark with an indelible marker. That will be your base line. For a 5:1 mix, accurately measure and mark 3cm (1-1/4") and 3.8cm (1-1/2") up from the base line. Adjust the ratio according to the directions.

Pour or squirt (if you're using pumps) resin into the syringe until it's filled to the first mark. Then add hardener up to the second mark. Empty the epoxy mixture into a glue pot and stir thoroughly. This process will yield 8 grams (just over a quarter ounce) of mixed epoxy. The volume can be altered by adjusting the distance of the resin and hardener marks from the base line.

The syringe is reusable: extract the plunger to remove any cured epoxy in the syringe.

Adapted from* Epoxy Works, *J.R. Watson, Gougeon Brothers.

WORKING WITH EPOXY

Using Fillers

Fillers come in two types: adhesive and fairing. Adhesive fillers are strong but hard to sand and are used for bonding, gluing, filleting and structural applications. The most popular adhesive filler is colloidal silica. It can be used alone or mixed with other fillers to improve sanding and smoothness. Another adhesive filler is microfibers, used for general bonding or filling, especially with wood. Both cure to an off-white color. Fairing fillers are extremely lightweight and used for fairing hulls, keels, filling screw heads or other cosmetic repairs. Plastic beads, known as microballoons, are reddish-tan in color, easily sanded and make excellent fairing putties. Scotchlite 3M's glass microbeads have a higher crush strength than microballoons and are less expensive.

DIY PROJECTS

Unthickened epoxy is the consistency of syrup and will drip off vertical surfaces. It's used when the job involves coating or "wetting-out" before bonding, or applying fiberglass, graphite and other fabrics. A slightly thicker mixture about the consistency of catsup is necessary for laminating or bonding flat panels to large surface areas, or when injecting epoxy with a syringe. It, too, will sag down vertical surfaces.

Bonding, filleting or hardware bonding call for a moderately thickened batch (refer to the drawings on page 31). This mixture should have the consistency of mayonnaise; it clings to vertical surfaces but peaks formed by dipping a stir stick in the thickened epoxy will fall over.

When gap filling, filleting, fairing and bonding uneven surfaces, the epoxy and filler mixture should be as thick as possible. Such a mixture will cling to vertical surfaces and has a peanut-butter-like consistency.

Fillers are added after a minute or more, once you've thoroughly mixed the resin and hardener together. Begin adding the filler in small batches until the desired consistency is reached. Blend well before applying the mixture.

In from the Cold

In colder temperatures, epoxy becomes thicker and flows more slowly. This makes it more difficult to mix the resin and hardener and makes the epoxy harder to apply. It also increases the possibility of air bubbles becoming trapped in the mixture, which reduces bond strength and the epoxy's effectiveness as a moisture barrier.

Here are some tips for achieving the best performance when using epoxy in cold temperatures .

1. Use a fast-curing hardener that cures well at temperatures as low as 4°C (40°F).

2. Warm the resin and hardener with a heat lamp (or trouble light with a 60-watt bulb), or store it in a warm area before using to maintain an "aggressive" chemical reaction between the components. Warm epoxy is also thinner and flows better, especially when coating surfaces.

3. Use heat lamps to warm the bonding surface as much as feasible. Avoid using unvented heaters that burn fossil fuels, as unburned hydrocarbons can contaminate bonding surfaces and inhibit curing.

4. Stir the resin mixture thoroughly and longer than normal. A smaller-diameter mixing pot will improve the chemical activity.

5. Apply heat to speed or complete the cure after the epoxy has reached a partial cure at room temperature, but no higher than 48°C (120°F).

6. Allow extra cure time before removing clamps or stressing joints. The general rule: double the cure time for every 7°C (18°F) drop below room temperature (22°C/72°F).

7. Slow cures can cause a waxy film, called amine blush, to appear on some cured epoxy surfaces. (Canadian-made EAST Systems epoxy cures without blushing.) To prepare surfaces between applications, wash the surface with warm water and a 3M Scotch Brite pad just before applying subsequent coatings. Before the water evaporates, dry the surface with paper towels and sand any remaining glossy areas with 120-grit paper. Let the surface dry thoroughly.

TIPS

HOW OLD IS OLD?

Wondering if those cans of resin and hardener sitting on the shelf for who-knows-how-long are any good? Here's a simple longevity test. Working at room temperature, combine 100 grams of resin with hardener, at the proper ratio, in a 5cm (2") diameter container. Stir for exactly two minutes, then set aside. Still watching the clock, time how long it takes for the epoxy to gel. This marks the end of the mixture's pot life. (Don't touch the container; heat from your hands will alter the test.) If the pot life falls within the time frame specified by the manufacturer (check the label), the resin and hardener are still good. Unlike polyester resins that can turn into a useless jelly-like substance after about six months, some epoxies have a shelf life of 15 years or longer.

From J.R. Watson, Gougeon Brothers.

FIBERGLASS

Shop Tested

Easy-To-Build Oil-Drip Pan

By George van Nostrand

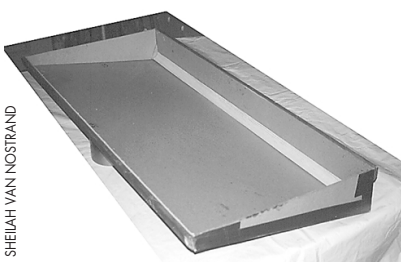
MATERIALS

Cardboard
50mm (2") masking or duct tape
Triangular cleat stock, 25mm x 1m (1" x 3')
Utility knife and scissors
61cm x 1.2m (2' x 4') heavy plastic
Fiberglass cloth or mat
950ml (1 qt) resin with hardener (epoxy or polyester)
2 76mm (3") foam rollers, small brushes, squeegee
Wood scraps
C-clamps
Sandpaper, flat rasp
Rubber gloves, mask, eye protection

Many boats, new and old, aren't equipped with a drip pan to catch engine or transmission oil. This is surprising, considering that legislation in both Canada and the U.S. prohibits boaters from discharging oil or oily waste into navigable waters. In the U.S., violators are subject to a penalty of US$5,000. In Canada, the maximum fine is CDN$100,000.

Apart from all the legal ramifications, it's environmentally irresponsible to knowingly pump bilge water containing oil into the waterways – especially when the alternative is quite simple and requires minimal skills. These instructions will make a drip pan to fit a V-hulled powerboat with twin MerCruiser engines. You can modify the size and shape accordingly to your hull design and engine configuration.

Using heavy non-corrugated cardboard, fashion a form 38cm wide and 86cm long (15" x 34"). Match the height and angle of the inboard side of the form to the hull where it meets the floor stringer. Cut the outboard side just low enough to slide, unobstructed, under the engine, then cut the wedge-shaped ends to meet the height of the two sides. Bind the parts together with duct tape to make a rigid mold (Figure 1). Glue a triangular cleat to the inside bottom edge at the back. This provides a smooth, rounder edge that you'll appreciate when you're cleaning the tray. Now dry-fit the mold, sliding it under the engine, and make any necessary modifications before proceeding any further. With luck, you may be able to use the same mold for the second engine (if you have one); otherwise, you'll have to make a second one to fit.

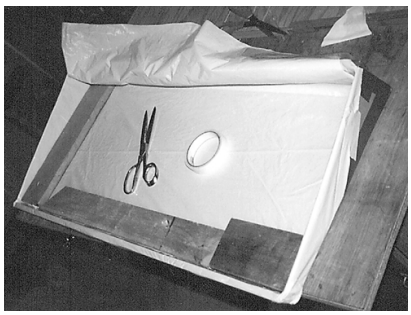


SHEILAH VAN NOSTRAND

Figure 1

Use non-corrugated cardboard to make the mold.

Line the mold with heavy plastic, smooth it into the sides and tape the excess firmly to the outside of the frame (Figure 2). Cut one piece of fiberglass cloth or mat large enough to fit the mold with several inches hanging over on all sides



SHEILAH VAN NOSTRAND

Figure 2

Cover the cardboard mold with thick plastic.

(Figure 3). Remove the cloth and set it aside.

Line a deep paint tray with plastic (to protect the tray), then mix in the resin and hardener according to the manufacturer's specifications. Mix no more than you can use in 15 minutes or less. Use a small foam roller or brush to apply a moderate coating of the resin mixture over the plastic, covering the bottom and sides. (When using resins, remember to always work in a well-ventilated area and wear gloves, a mask and eye protection.)

SHEILAH VAN NOSTRAND

Figure 3

Prefit the fiberglass cloth allowing extra material for around the edges.

Now, return the fiberglass cloth to the form. Press it into place, letting the excess hang over the sides. Pour a generous portion of the resin mix into the center of the cloth.

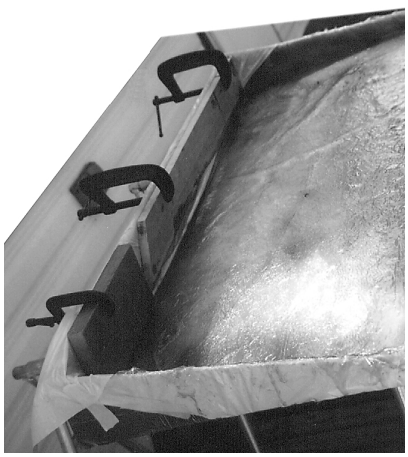
DIY PROJECTS

Work the resin into the cloth with a brush or squeegee, spreading it toward the edges. Smooth the cloth with a brush or roller to remove all air bubbles and wrinkles. Saturate the overhanging cloth about 2.5cm (1") above the edge. Use your gloved fingers, popsicle sticks, a putty knife or similar tools to work the cloth into the edges and define the corners. Mix and apply more resin as needed. Alternatively, apply the cloth using the dry method: Place the cloth in the mold and smooth it until it lies flat, then tape the edges. Pour the resin mix into the center of the cloth and follow the same steps for spreading the resin. Work with small batches of resin and add more as needed to completely wet-out the cloth. This method is somewhat easier as it gives you a longer working time to insure the cloth is completely smooth and wrinkle-free before the resin begins to "kick-off."

You may find that the fiberglass droops – particularly on the inboard side. To prevent this, secure the overhanging edge with masking or duct tape or place a piece of wood, backed with plastic or high-grade wax paper to keep it from adhering to the glass, against the side and secure with C-clamps to the mold (Figure 4). If necessary, repeat this step on the outboard side and ends.

Allow time for the glass to cure – between four and six hours depending on the type of resin and the air temperature. If you're using epoxy resin, trim the edge with a sharp utility knife while the resin is still "green" (semi-cured). With polyester resins, wait until the fiberglass reaches a "solid" cure, then remove the pan from the mold and trim the overhanging edge with heavy-duty scissors, metal shears or a jigsaw. (Wear a mask and goggles.) Now, turn the pan upside down. If the resin failed to fill the weave of the fiberglass, mix up a batch of resin and hardener and roll on a generous layer. (If using epoxy resin, you must first remove the amine blush, a waxy bi-product of the curing process, with water and a 3M Scotch Brite pad before coating, then follow with multiple coats to fill the weave.) When the resin is fully cured, smooth the rough edges and remove any fiberglass "barbs" on the inside of the pan with a rasp, or sand them with #80 grit paper. Dry-fit the pan and drill holes for one or two screws near the top back edge, or in another spot that is dry and accessible so it can be easily removed.

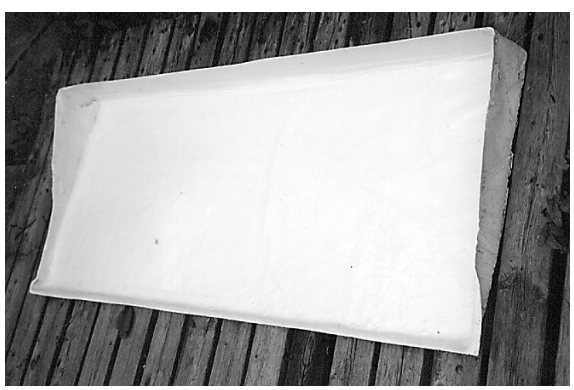
Spray the pan(s) with a couple of coats of white enamel paint (Figure 5) and screw it in place. If you're fastening to a stringer that could be water prone, bed the fasteners with silicone. Drips from the engine or transmission will now be easy to detect and you'll keep your bilge and, ultimately, our precious waterways free of oil contamination.



SHEILAH VAN NOSTRAND

Figure 4

Plastic-backed wood, clamped to the mold, holds the resin-soaked fiberglass in place.



SHEILAH VAN NOSTRAND

Figure 5

A cured, trimmed and painted oil-drip pan ready for installation.

TIPS

SAFETY TIPS

- *Always work in a well-ventilated area and avoid breathing vapors.*
- *If you get uncured resin on your skin, wipe with waterless skin cleaner. Do not use solvents!*
- *Always wear a dust mask when sanding cured fiberglass or resins.*
- *Wear gloves when working with resins or fiberglass. A barrier cream provides extra protection.*
- *Wear goggles to protect your eyes from airborne particles and resin or paint spills.*
- *If you develop a rash or other side affects when working with a resin, paint, cleaner or solvent, stop using it!*

Building a Hard Dodger

By Paul Shard
Photos by Sheryl Shard

MATERIALS

Mold: 2 sheets pressboard
Dodger: polyester or epoxy resin and hardener, 1 oz. fiberglass mat, 18 oz. roving, balsa core, acetone, fairing putty, paint.
Hardware: window rubber, Lexan, 2 hinges, 2 hatch adjusters.

If you rarely remove your canvas dodger, why not make a hard dodger instead. We found that in heavy weather during offshore passages, water often soaked through our canvas dodger. Visibility was also a problem. The plastic windows rippled, and despite great care, turned cloudy. So when we noticed various boats sporting near-pilothouses, we resolved to add one to Two-Step.

To match the fiberglass cabintop, we decided to make a lightweight, molded fiberglass dodger. This allowed us to design something that looked as if it belonged on the boat – not just an add-on.

A hard dodger improves visibility, is watertight and the flat roof offers an ideal surface on which to mount solar panels.

Taking Shape

I started with the dimensions from the original canvas dodger, but it was just a bit taller than we wanted and I

DIY PROJECTS

also planned to extend the new one a little farther back to make an improved sunshade. I spent quite a while sketching the basic shape, where the windows would go and how it would look at the back and sides. For help with your design, look at the boats that have hard dodgers. (The lines will obviously be quite different for different boats.) Most Amels, Gozzards and some Hallberg-Rassys have them installed right from the factory and these may be a source of inspiration.

Once I had my preliminary dimensions, I began to plan the construction of the mold.

Making the Mold

My plan was to build a female mold in position on the boat, then carry it off to a table where I could flip it upside down to do final fairing and the actual lay-up of fiberglass. Using a female mold meant that the outside of the dodger would be formed by the inside of the mold, so the exterior of the finished dodger would be smooth and attractive. The inside is a little rougher, but hey, that's not what's on display.

Since I was building just one dodger, I didn't need to spend a lot of time constructing the mold; it would have to survive only one use. The mold was made of smooth, shiny pressboard (sometimes called Beaver board in Canada) which is flexible and allowed me to form smooth curves. I made the roof out of a single piece of pressboard, formed into a curve by four preshaped external frames glued in place. These frames were just pieces of pressboard with a gentle curve cut in them (Figure 1).

With the sides and the three windshield panels in position on the boat, I tacked them to the deck with a glue gun (the kind used for making crafts). Do a spot test with the glue first to be sure you can easily remove it later. (Remove the glue on a cold day with a chisel or a hardwood block, then follow with a cleaner and wax.)

It's important to get the general structure symmetrical at this point; I took lots of measurements from various key points to check that I wasn't uneven or adding a big warp anywhere.

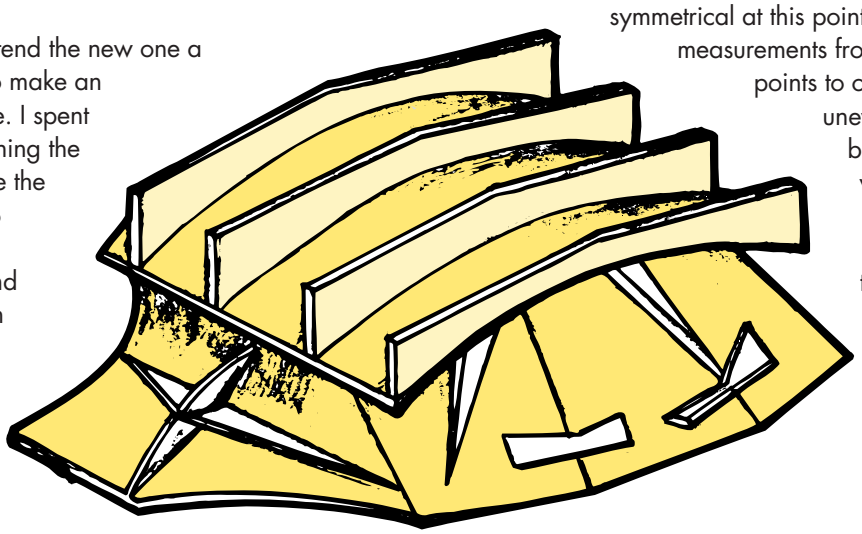


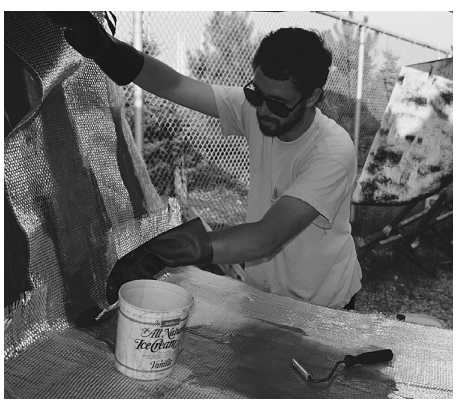
Figure 1

The mold was made of pressboard with reinforcing pieces glued on the outside to form the desired shape.

Next, I glued external supports to the mold to stiffen the structure, trimmed the sides to the correct level in preparation for the prefab top and, with the roof resting in place, went crazy with the glue gun, securing all edges and contact points. I also added stiffeners and connections to the sides to make sure the mold would survive the trip off the boat to the workbench (Figure 1).

With a couple of helpers, we lifted the rather heavy mold off the boat, carried it to the bench and added extra wood reinforcements. Next I faired the mold, using a fairing putty of resin, microballoons and Cabosil (though any cheap auto fairing putty would suffice). The shape of the mold is the most critical part of the operation; any flaws or unfair lines will show up in the finished product.

It was at this point that I made a couple of mistakes that cost extra work later on. The shape of the roof was uneven and, when the final dodger was pulled from the mold, I had to use fairing compound to form a nice curve that



Fiberglass mat was first laid in the mold to create a smooth outer finish when cured.

mimicked the shape of the cabintop. In hindsight, I should have put more time into making a fairer mold; the finished product would have been much lighter and easier to fair.

After a couple of rounds of sanding and fairing, I coated all surfaces with mold-release wax in preparation for fiberglassing.

Lay Up

I had already decided to use balsa core and had a general idea of how to do the glass lay-up. If you aren't confident with fiberglass, most suppliers can recommend a lay-up schedule and could probably also recommend video tapes or books for reference.

Since I had used fiberglass and polyester resin extensively in the finishing of Two-Step and subsequent hull relaminating (see DIY SUMMER '96), I decided to go with that, but I now regret not using epoxy and some of the newer exotic materials. Again, I'm sure I could have acheived a lighter dodger of the same strength.

Our lay-up started with 1-oz. fiberglass mat to get a smooth outer finish. I planned the lay-up so we could complete it in two days and guarantee a good chemical bond between each layer. The mat was followed by 18-oz. roving; another layer of 1-oz. mat; 12mm (1/2") Baltek end-grain balsa core; 1-oz. mat and then finished with 18-oz. roving.

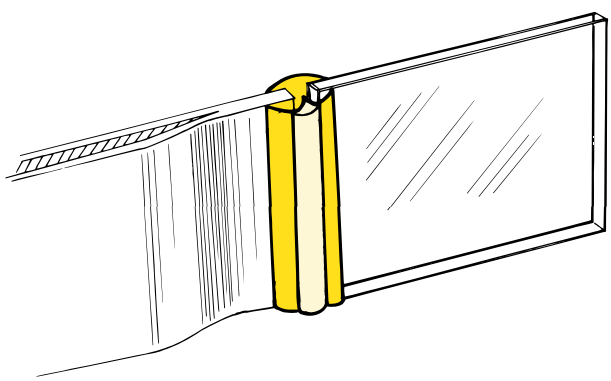


Figure 2

Details of the window installation.

The mat layers on either side of the balsa were thoroughly wet out to insure good adhesion. In retrospect, I think the 1-oz. mat was too heavy; 3/4 oz. would have saved weight with little loss in strength. The balsa core was laid on the roof and in most of the side panels. Near the edges and windows, I beveled the balsa and

DIY PROJECTS

joined the two skins together. (See Figure 2 for an example of edge beveling.)

After the dodger fully cured, I trimmed the rough edges and removed the mold, which had to be completely destroyed to get it off.

Fit and Finish

During the trial fit on the boat, the new hard dodger only needed a bit of grinding to get it in place. I fabricated stainless brackets – bent to match the angles of the deck and dodger – to hold the dodger permanently on and then started trimming, measuring window cutouts, adding wood trim for the back edge hand-

Halyard conduits were fashioned by wrapping fiberglass around an oval plywood form with rounded edges, then coating it with resin. Note the opening front window.

hold and, in our case, making fancy line conduits for halyards that run back to the cockpit.

The windows were quite easy after I discovered a product I refer to as window rubber. This material is often used in recreational vehicles, and lets you easily mount acrylic or Lexan windows with a professional look. Cut the window opening with radiused corners so the rubber can be installed in one continuous piece. Then cut the window smaller than the opening, and push it into place with the rubber. Finally, using a neat little tool ($10 from the rubber supplier), you stuff a filler strip into a groove that expands the rubber, locking everything firmly in place (Figure 2).

A view from the inside.

I faired and painted the dodger after cutting out the windows but before actually installing them. Again, I used a home-brew fairing compound (polyester resin, microballoons and a small amount of Cabosil) but a commercial fairing putty would probably be fine; check with your supplier to be sure that it will be compatible with whichever paint system you'll be using. (Note that only certain paints can be applied over epoxy.) I used Interlux Brightside in Hatteras Off-White which just happens to match our gelcoat perfectly. After two coats of Brightside over the primer coat I installed the windows.

Building our own hard dodger was an involved undertaking, but has been very rewarding. We started the project hoping for improved visibility and watertightness – which we acheived. In addition, since we installed our mini pilot-house, we have realized some benefits we hadn't considered. We now have a great place to mount solar panels. We hinged one of the front windows and installed Perko windshield adjusters that let us have the window open in light to medium rain (a great benefit). It's much cooler under the white cored roof than it was under the former blue canvas dodger. And finally, we have the do-it-yourselfer's best reward: the compliments we get on a job well done.

Paul and Sheryl Shard's book, Sail Away! A Guide to Outfitting and Provisioning for Cruising (CDN$24.95), and the video documentary of their three-year voyage to ports around the Atlantic Ocean, Call of the Ocean (CDN$29.95) are available from the DIY EMPORIUM. To order, see the form opposite page ??.

COST ESTIMATE

The following is the price in Canadian funds to build our hard dodger. The cost will vary dramatically with the size of the finished dodger. Ours is fairly large, measuring 1.35m wide, 1.2m long and ? high (4.5' x 4' x ?). Using epoxy instead of polyester resin adds $100 or so, but will give you a lighter structure.

Mold materials	$100
Polyester resin and hardener, fiberglass mat and roving, balsa core, acetone, putty, paint, roller and brushes	$400
Window rubber, Lexan offcuts for windows	$150
Window hinges and adjusters	$50
Labor	Free
Total cost	$700

Good Boatkeeping

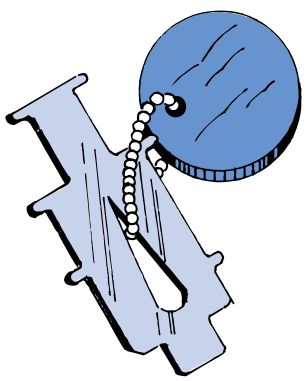
By David and Zora Aiken
Illustrations by David Aiken

Deck-plate Openers

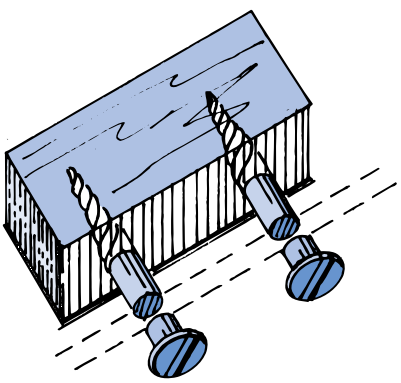
When you're installing deck fills, use the same size caps so one key opens all.

A metal deck key is handy, but it doesn't swim. Attach a colorful foam float (a keychain type works fine) so you can retrieve it easily when it does dive in.

You can make your own floating deck-plate keys with a wood block and two screws. Use wood screws and be sure their diameter fits the holes in the deck caps.

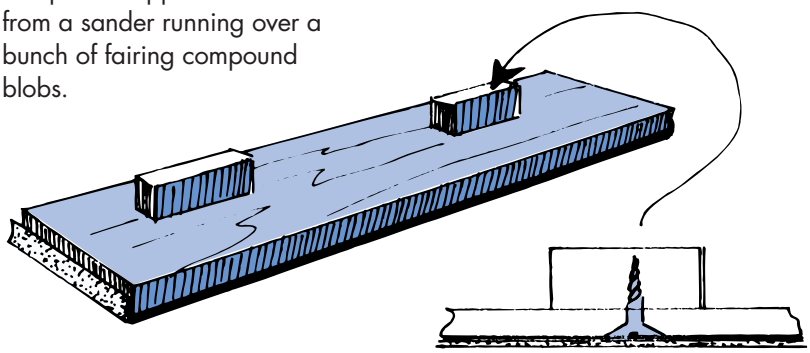


Work the two screws partway into the wood, spaced the proper distance apart so they'll fit the cap holes. Cut off the screw heads with a hacksaw.

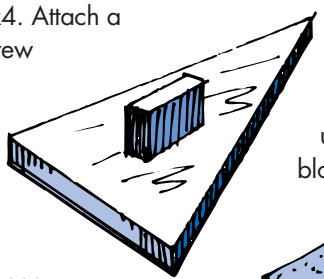


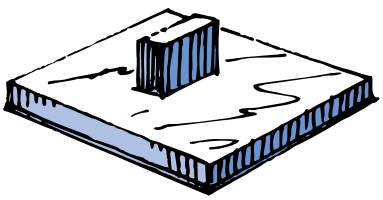
Hand Sander Helps

If you've patched a lot of dings while preparing the hull for a new coat of paint, you'll need to sand a long area uniformly, avoiding the bumps and ripples that can result from a sander running over a bunch of fairing compound blobs.



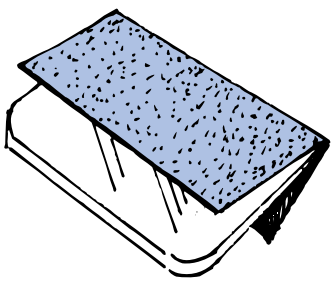
Make a sanding board from a 61cm (2') piece of 1x4. Attach a couple of handles: screw them into the top of the board, countersink the screws and fill the holes with a plug, or glue the handles to the board with epoxy. Attach sandpaper strips (the sticky stuff) to the bottom of the board. Put an exercise tape into the cassette player and do back-and-forth stretches to the limits of your sanding block's length.





Many boats have places that are inaccessible to a standard sanding block. Make a couple of custom wood blocks for those places on your boat. A small square or a narrow rectangle can fit along that strip of deck between the non-skid and the toe rail. A narrow triangle can sneak into boat corners.

When an inaccessible V shape is between the overhead and an angled support frame, fold the sandpaper around a plastic scraper. Wear gloves to protect your fingertips when you're using small sanding blocks.



Since leaving Chicago nearly 22 years ago, David and Zora Aiken have lived aboard numerous boats and written about their adventures. Their most recent book,* Good Boatkeeping, *published by International Marine, is a compilation of hundreds of tips and hints designed to make boating more comfortable, safe and fun. They currently live aboard a 1963 10.5m (35') Chris-Craft sloop,* Atelier, *berthed in Virginia.