Good Old Boat™

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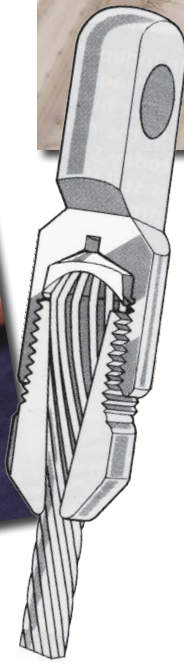
Articles by
Leslie Linkkila and Philip DiNuovo



Enjoy this collection of articles written by Leslie Linkkila and Philip DiNuovo

All articles were published in *Good Old Boat* magazine from 2008 through the end of 2015.

GOOD OLD BOAT™

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A Collection of Articles by
Leslie Linkkila and Philip DiNuovo

Good Old Boat magazine is for the sailor who owns and maintains their own sailboat. You're not afraid to tackle some upgrade projects. You like learning new things. You don't need a sailing magazine with ads for half-million-dollar boats, Caribbean charter companies, and Rolex Yachtmaster watches. You just want a magazine that tells it like it is, some DIY articles you can learn from, some boat talk, clever tips and tricks, and some wistful reflections on the magic that keeps us returning to the boat for another sail. This small, diverse collection of past articles by Leslie and Philip are representative of what we deliver in each issue. If this appeals to you, then you've found your magazine. Subscribe today.

- "Dinghy Chaps Made Easy"
- "Where There is no Rigger" We were anchored off Panama, making final preparations for crossing the Pacific in our Mason 33, Carina. Philip donned a climbing harness and I cranked him up to the mast-head to inspect the rigging. "Uh oh," he called down. "What?" I answered. "Its bad, very bad. . . " (a two-part article)
- "Chameleon: A Tender in Two Parts" A nesting hard dinghy that's enduring and endearing. . .
- "Seizing Slides and Slugs" T hose seizings that attach the slugs or slides to the luff of your mainsail have been slowly chafing. Eventually they will fail. Fortunately, re-seizing slugs or slides is a straightforward process you can master. . .
- "Salvaging a Dream" This is a story of disaster, struggle, despair, and dreams lost. But it's also one of friendship, creativity, redemption, and triumph through sheer stubbornness. It begins with a cyclone. . .
- "Why Sails Fail" One word, plastics. It's what modern cruising sails are made of, and plastics are polymers, meaning they are composed of small organic molecules (monomers) chemically bonded together to form very large, very strong molecules. If the bonds are broken, the polymers break down and the material falls apart. . .
- "To Sew, Or Not to Sew" We're talking about repairing failures: rips, tears, chafe, and broken or lost hardware. But does the sailcloth have sufficient service life left to justify the repair. . .?
- "Sail Repair Essentials" Every sail-repair project is unique, but most require the same techniques, which are easy to master, and employ the same tools. . .

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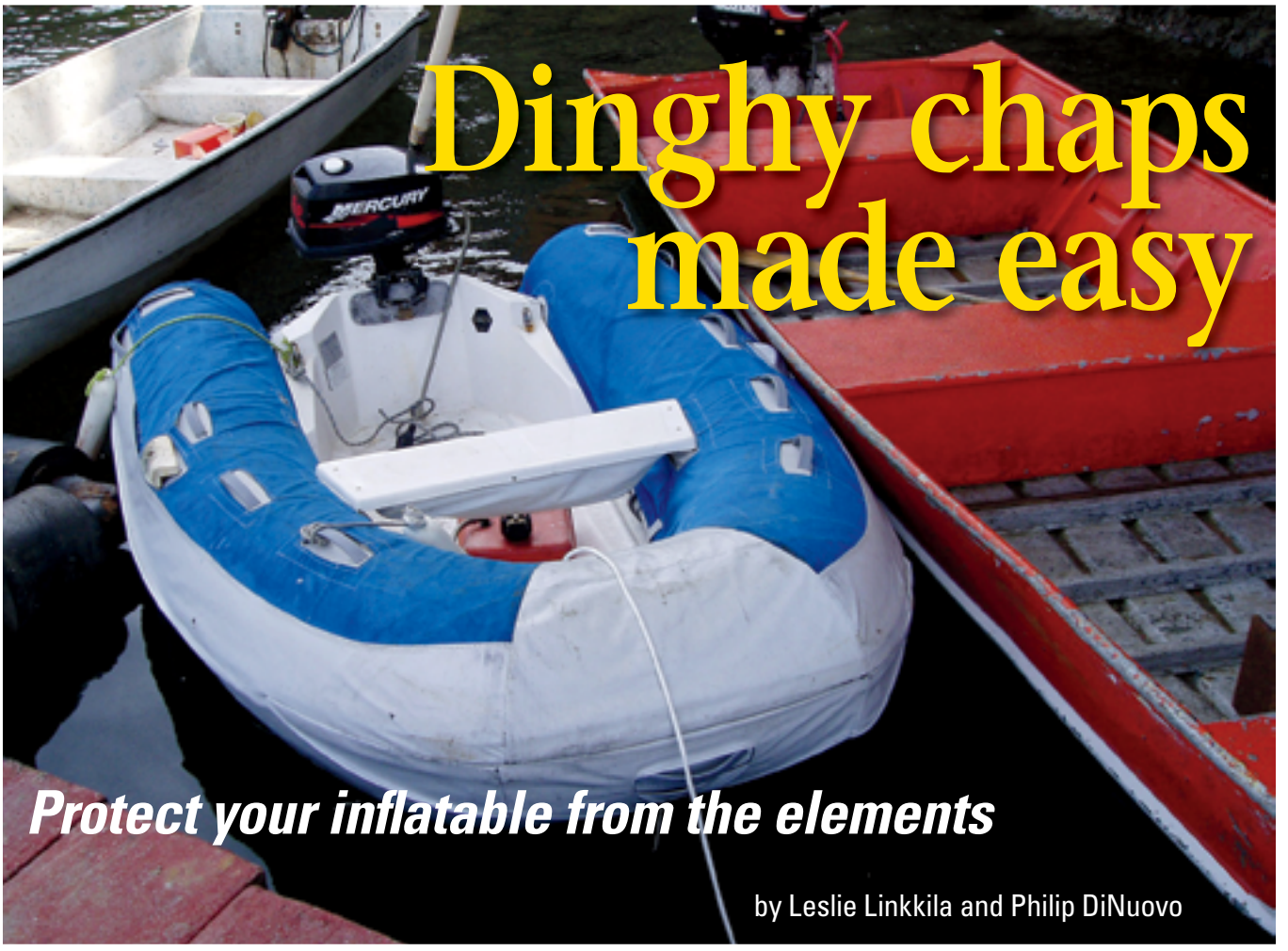


Dinghy chaps made easy

Protect your inflatable from the elements

by Leslie Linkkila and Philip DiNuovo

PHOTOS BY LESLIE LINKKILA

Inflatable dinghies, sport boats, and roll-ups are the most common types of cruising boat tenders in use today. Their popularity is related to the fact that they can get up on plane and cover great distances when driven by large outboard motors. Their large inflatable tubes also make them inherently stable, allowing for easy entry from a boat, a dinghy dock, or the water after snorkeling or diving. Many inflatable dinghy design options allow for stowage in a small space on deck or in cockpit lockers

Most inflatables are constructed of fabrics coated with Hypalon (chlorosulfonated polyethylene) or polyvinyl chloride (PVC). Hypalon dinghies are much more resistant to the sun's ultraviolet (UV) rays and abrasion than PVC.

Yet all inflatable sport boats that are used regularly will eventually suffer from UV exposure, especially when used in the tropics. To preserve these inflatable tenders, it is necessary to cover them with chaps constructed of a durable, UV-resistant fabric.

UV protection is the main reason for chaps, but there are other benefits as well. A cover will also protect the inflatable tender's rubber structure against abrasion and dirt from dinghy docks, hulls, and fuel spills. In addition, because rubber surfaces of inflatables get extremely hot in the tropical sun, a cover constructed of an appropriate material will protect passengers from discomfort or burns. Deteriorated rubber tubes can also become very sticky, leaving ugly, dirty stains on anything they touch. Maybe the best reason for dinghy chaps, from a practical standpoint, is that they allow for the incorporation of pockets for dinghy anchors, personal flotation devices, hand-held VHF radios, flashlights, and other gear.

The many inflatable boat designs available on the market today have made it impossible for mass production of dinghy chaps, so construction of a set of chaps is a custom project. Your favorite canvas shop will accommodate your needs and you'll get a wonderful product, though prices vary widely. We think the better option for budget-minded cruisers with modest skills is to make their own dinghy chaps. All you need is a sewing machine, a few supplies, and a little time and patience.

Note: many cruising friends have used tapicerías (upholstery shops) in Latin America to produce an acceptable set of chaps at a modest cost. Others weren't so pleased with the results, so if you choose this option, ask for cruiser references before committing to purchase.

Choosing materials

Pattern – You need clear, non-porous, low-stretch plastic patterning material (polyester) with enough thickness to maintain shape when tugged snugly and taped down. Clarity is critical because details for the location of seams,

Without protection from dinghy chaps, inflatable sport boats are damaged by abrasion, fuel, and UV radiation, especially when used in the tropics. These dinghy chaps, on facing page, incorporate extensive areas constructed of vinyl material for protection against chafing hazards.

cuts, hems, and cutouts are drawn directly on this pattern and pattern pieces can be overlaid to match seams and create a tailored fit. In Latin America, we have found suitable materials in convenient widths up to 10 feet at modest prices (27 to 70 cents per foot) in upholstery shops and hardware stores.

Cover – Choose a cover material that provides maximum UV protection. It is also important that the material is easy to work with, is water- and stain-resistant, and won't become slippery when wet. Lighter colors are preferable since dark colors absorb more heat and can be hot to the touch, though bright white can create uncomfortable glare in the tropical sun. A solution-dyed acrylic material, such as Sunbrella, is a perfect choice. However, materials as diverse as cotton/polyester blends and waterproof denim have also been used successfully. Another option is Vivatex, also known as Sunforger, which has a nice soft hand and is easy to work with. If expense is an issue, generic solution-dyed acrylic materials are available, although we've observed that the water resistance of these materials is poor.

Thread – A high-quality UV-resistant thread in appropriate weight is necessary. Bonded polyester in V92 weight (or B92 depending on manufacturer) is commonly used with fabrics such as Sunbrella. We prefer to use white thread for all applications, but many colors are available.

Chafe guards – For reinforcement and edge finishing of details such as handholds, inflation ports, or oarlocks, use premium marine tanned leather or a heavy exterior-grade vinyl. Leather is more durable but more expensive and difficult to work with.

You may also wish to use leather or vinyl to finish the exterior of cutouts in combination with a less expensive material, such as Shelter-Rite or reinforced dry bag material, to finish the interior. Webbing may also be used for finishing edges of cutouts, but use only nylon or polyester webbing for maximum life; polypropylene webbing (the type commonly used for sail ties) will disintegrate quickly in the sun.

Also beneficial to long service of dinghy chaps is the incorporation of a generous chafe guard completely around the outside to prevent damage to chaps from dinghy docks and barnacle-encrusted pilings. Exterior-grade vinyl or wide heavy webbing may be used for this purpose.

Tube ends aft – For tube ends aft, you may also need a swatch (approximately 1 yard) of open-weave synthetic mesh material, such as the vinyl-coated polyester, Phifertex. Mesh allows water to escape when the dinghy is under way prior to getting up on plane. Otherwise, water may be caught under the chaps and inhibit forward progress.

Securing chaps to the inflatable – You may use spur grommets (attached with die and installation tools), snaps (cloth-to-cloth or cloth-to-surface), webbing and side-release buckles, or Velcro or shock cord (for the external hem), depending on your design. Most cruisers utilize a shock cord or line that runs through a channel around the outer perimeter of the chaps to secure the chaps to their dinghies.

Taking measurements

Minimum material width – With the dinghy in the water and loaded normally, measure the circumference of the inflated tubes from the waterline, up and around the tubes, to the desired hem height inside. Then add a minmum of 6 inches to the measurement to allow for hems. This will determine the minimum width of patterning and cover materials required for your project.

Estimating pattern material – Measure the total length of the dinghy's tubes around the outside of the dinghy at its widest point. If the dinghy has a rubrail that stands proud, this is a good place to measure. Purchase a length of pattern material (of suitable width) that is at least 75 percent of this length. For example, if the total outside dimension of the dinghy at its widest point is 22 feet, purchase a length of pattern material that is at least 5 yards (15 feet). The reason that you do not need a full length of pattern material is that

A good chaps design option may include an additional panel that extends below the rubrail at the bow to incorporate the area around the lift handle.

This dinghy chap design includes Velcro tabs to secure the cover to the inflatable. This option requires a compatible adhesive.

These chaps incorporate handy features such as a splash guard, as well as pockets for storing safety equipment.

mirror-image panels of the dinghy can be cut from the same pattern piece, so only the bow panel and the panels of one side require a pattern.

Estimating cover material – For cover material, take the total length of the dinghy's tubes (as determined for the pattern material) and add approximately 50 percent to determine the overall length of cover material needed. For our theoretical dinghy that is 22 feet around at its widest point, a minimum of 10 yards (30 feet) of material length should be purchased. This generous amount of cover material will allow for proper alignment of fabric pieces to avoid bias stretch, to account for cutting errors, and for construction of accessories such as pockets, plus a bit of extra material for future patches in high-abrasion areas.

Estimating finishing supplies – For finishing edges of cutouts for oarlocks and towing lines, measure each cutout, then add 4 inches to the length and 4 inches to the width to allow for borders. Convert this area measurement to square inches and double this value to determine the minimum amount required in square inches. We advise purchasing 30 percent more of the material than this calculation to account for cutting or sewing errors, plus additional or future abrasion patches. This amount of material will allow for reinforcement patches on both sides of the cover material at each detail. Note: a yard of 45-inch material consists of 1,620 square inches (36 inches per yard multipled by the 45-inch width).

To add a perimeter chafe guard, add a quantity of reinforcement material that is approximately 6 inches wide times the total length of the outside dimension of the dinghy, plus a 1-inch seam allowance for each seam. For our theoretical dinghy with an outside dimension of 22 feet (264 inches) and reinforcement material that is 60 inches wide: 264 inches/60 inches = 4.4. Therefore, five pieces that are 6 inches wide by 60 inches long, joined by 5½-inch seams, would be sufficient. This would be ⅞ yard of 60-inch-wide material. If you are using wide webbing for this purpose, 7½ yards would be sufficient (264 inches/36 inches per yard = 7.33).

Tube ends aft – Regardless of the size of your dinghy, a yard of mesh material should be sufficient.

Other supplies – To facilitate the patterning process, make sure you have a roll of high-quality duct tape, sharp scissors, and a set of water-resistant markers in at least three different colors. Note: markings made with green markers have, for some unknown reason, faded very quickly.

You will also need a stiff ruler, available from sewing stores, or a small 6-inch hand-held steel ruler with an adjustable sliding reference point (Snap-on Tools, ruler 602; also available at fabric stores), which allows for more rapid and accurate marking of seam allowances. A plastic bucket is also useful for carrying these items and for holding small pieces of cut duct tape prior to their use.

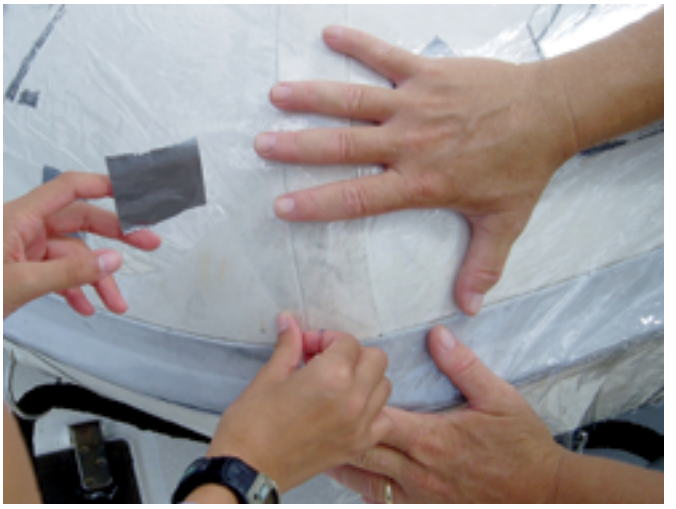
Making a pattern

Accurate patterning of the tubes is critical. Some tailoring is generally necessary after the panels are assembled, but an accurate pattern will reduce the effort necessary for final fitting.

Assemble a team of at least two others to help you make your pattern. Bring your dinghy to a place where you and your helpers can easily walk around and climb inside it. Select a cool, calm day since strong afternoon breezes make working with plastic pattern material a challenge and the hot sun can make duct tape sticky and messy.

For inflatables with blunt bows, make a pattern for the bow section and only one side since the dinghy's structure is symmetrical and side sections are mirror images. So both sets of side panels may be cut from one set of patterns. Inflation ports and other features may not be present on both sides of a dinghy, but cutouts for these may be incorporated into the cover at a later stage in the construction.

For dinghies that are configured with a point joined by a seam at the



PHOTOS BY GABRIELLA AMBERCHAN

Use a small metal ruler with an adjustable reference to rapidly label a panel cut line relative to a seam line, at left. Use small pieces of duct tape to secure clear plastic patterning material to the dinghy for a snug fit, above.

bow, begin at the bow seam and pattern each tube section on either the port or starboard side. As with a blunt-bow dinghy, one set of plastic patterns can be used to cut mirror-image pieces for the other side.

Beginning at the bow, cut a piece of pattern material roughly the shape of, but much larger than, the bow section. Begin by laying this on the bow and taping it to the rubber dinghy tubes with small (roughly 2-inch) pieces of duct tape. This is the most difficult pattern piece to make. You will do quite a bit of manipulation before you get it placed where you want it. The goal is to mimic, in this plastic, the individual tube sections of your dinghy from inside at deck level, completely over the top, and down to the waterline. As a design feature, you may also wish to consider securing the chaps at the bow to the tow ring using a strap or an additional piece pattern. You should make this decision before determining the cut line of the bow-section panel.

Provide for a wide margin (3 to 4 inches of pattern material) for the overlap onto adjacent sections of tube. Excess material can be cut away later. Fold back areas of excess pattern material, and cut slits, if necessary, for details such as handholds. The trick is to lay the pattern plastic flat.

Note: if it seems impossible to lay a pattern piece flat over the entire surface of a blunt-bow section, it may be necessary to pattern exactly half of the bow section. When it comes time to cut your fabric, you will lay this half-pattern on a folded edge of fabric (a doubled piece of fabric) during cutting to acquire a full piece.

Next, label the pattern piece with helpful hints such as the name of the piece (e.g., "bow section"), orientation (using arrows to indicate starboard, port, inside of dinghy, bow, or stern), and a large cross to show the linear lay of the fabric for layout. Also note on the pattern material how many of this particular panel you will cut: one only or two as mirror images.

Using a different colored marker, begin making a dashed line on the pattern material down the center of the boundary between the bow section and the adjacent section. This will be your seam line, so label it as such. Note the marker color you have chosen for seams and always use this color for drawing seams. Once seams are drawn, take a ruler and yet another color of marking pen, then mark on the pattern material the seam allowances ½ to 1 inch outside of the seam lines. Label these as cut lines. Use that marker color only for cut lines.

To align where panels intersect, use letters and arrows to indicate the meeting point, A to A or B to B and so on, writing the first matching letter on one piece and the second on the adjacent piece exactly where the pattern pieces match. We cannot emphasize enough the importance of information written directly on pattern pieces since, once removed from the dinghy, the pattern pieces by themselves become a difficult puzzle.

Next, outline design details (safety lines, oarlocks, filler caps, seat supports) that require cutouts, and label them appropriately in yet another color of pen. Also note whether the design element is present on both sides (port and starboard) of the inflatable. Make slits or holes in the pattern to accommodate elevated design elements while allowing the pattern material to lie flat. Optionally, tape another piece of pattern material over the panel pattern and trace on it the outline of the reinforcement patch. This creates a separate pattern for leather or vinyl reinforcement pieces. Note on the pattern the border of reinforcement or abrasion patches you will add to your chaps.

Next, climb inside the dinghy, tug the pattern material snugly, and mark the inside hemline in yet another color marker. Depending on your cover material, you can then determine how much you need to allow for a hem. Materials such as exterior vinyl may not require hemming, while Sunbrella requires a generous hem or edge finishing to avoid unraveling. For Sunbrella, 4 inches is generally sufficient. Measure and mark the cut line below your hemline in the color of pen you have

SHIRLEY DUFFIELD

GABRIELLA AMBERCHAN

SHIRLEY DUFFIELD

Pattern pieces should be labeled generously with information such as panel name, orientation, fabric lay, and so on, at left above. Notes for cut lines and seam lines should be made in different colors and the chosen labeling scheme should remain consistent throughout the pattern, at right above. All pattern pieces should be left secured to the dinghy until the patterning process is complete, at left.

designated only to be used for your cut lines.

To complete this panel's pattern, step outside the dinghy and determine the outside chap border that best suits your dinghy's design. If you have a rub-rail that stands proud, this feature offers a natural boundary. Allow at least 4 inches of fabric below this desired outside border for your cut. Measure and mark your cut line.

Without removing the pattern you just created, move down the port or starboard side of your dinghy to the next panel, lay pattern material over the next section, roughly cut a piece that completely covers this next panel (inside floor to outside at the waterline), and generously overlap the panel you just made. Cut, fit, and tape this pattern material until it is flat and secure, making sure you have not affected the location of the first panel pattern. Give this panel a name and generously label the piece with helpful hints about orientation, again using arrows (to indicate such things as port, inside of dinghy, bow, and stern), then generate a large cross to show the linear lay of the fabric. Indicate mirror images, if appropriate.

Through this new pattern piece, you will see the seam line you drew on the first pattern piece at the intersection of this panel and the adjacent panel. Using the color marker you selected for seams, trace the seam line of the first panel onto the new pattern piece. Label the seam line. Then, using a stiff ruler, measure and mark the seam allowance (½ to 1 inch beyond the seam line) in an appropriate marker color, and overlap the first panel. Label this as the cut line. Measure and mark for inside and outside hemlines and cut lines as described above.

Continue this sequence for all tube sections of the dinghy, leaving all pattern pieces taped in place while you work. Continuously check pattern piece alignment to prevent shifting during the manipulation. When you reach the transom, place a vertical slit in the pattern material to accommodate the transom's thickness. This allows you to continue this panel beyond the transom to its natural boundary. This slit will require reinforcement with vinyl or leather material.

The final panel, at the stern end of the inflatable where the tubes narrow to a rounded or pointed end, is best constructed of an open-weave material, such as Phifertex. Create a cone shape in the pattern material (including the seam allowance to the adjacent cover panel) with a snug-fitting cap that can be secured with shock cord or strapping. Don't completely encircle the end piece since it may catch water while under way.

Finally, if you wish to create patterns for the vinyl or leather abrasion patches, make them by layering and taping pattern material over the panel patterns while the panel pattern is still taped to the inflatable.

Before removing the pattern from the dinghy, walk around the whole thing and confirm that every seam, hem, cut, and dinghy design detail is labeled. Then, beginning at the last pattern piece you made, gently lift the duct tape from the dinghy and fold the excess tape under the edge of the pattern piece. Do not try to remove the duct tape from the pattern piece. Lift the pattern pieces and gently fold them.

Creating the layout

Trim all pattern pieces of excess material but avoid cutting away any labels you made. Place your cover fabric on a flat surface and lay out all your pattern panels (except the end caps, if they are to be made from a different material), making sure to follow the guides you made for pattern orientation relative to the linear orientation of the fabric. Mirror-image pieces may be cut from a double thickness of cover material. However, if the material has dissimilar properties top and bottom, the like sides need to be facing each other to create mirror-image panels. Generously staple or pin the plastic pattern panels to the fabric and carefully cut out along your cut lines. (If you're using a fabric such as Sunbrella, seal the cut fabric edges with a hot knife.) Using pins or a long-arm stapler (available at office-supply stores) facilitates cutting panels from the pattern. Leave the pattern pieces attached to all pieces of cut fabric until assembly.

Cut reinforcement pieces from leather or vinyl, two per detail to allow for reinforcement of both sides of the fabric. You may use leather or vinyl on the outside and a reinforced rubberized material on the inside.

Assembling the chaps

Preparation – Adjust your sewing machine tension by sewing test scraps of cover material fabric in a thickness that represents the thickest layers your project will require. Consider replacing your machine's needle with a new one and using specialty cutting needles (such as Schmetz DI or SD1) for leather or vinyl detail-reinforcement material.

Panels – Begin with the bow section or sections. If your bow is constructed as part of two mirror-image side panels, join these panels by sewing them together at the bow. Then proceed to the next set of panels. A double row of stitching will ensure long seam life. After each set of panels (port and starboard) is sewn to the previous pieces, test-fit your unfinished chaps on the dinghy. It is easier to fix major mistakes while the assembly is in progress.

Tube ends aft – After all panels are assembled but not yet hemmed, add the tube end caps of mesh material. Rounded tubes may have a darted end piece, while pointed tubes may require an open-ended design. Either way, this piece may require the greatest amount of creativity to achieve a snug fit. Phifertex and similar mesh fabrics are easy to work with and may not require hem-

Resources

Beacon Fabric & Notions
<http://www.beaconfabric.com>
800-713-8157

Great Lakes Fabrics
<http://www.glfi.com >
800-652-2358

Outdoor Fabrics
<http://www.outdoorfabrics.com>
800-640-3539

Sailmaker's Supply
<http://www.sailmakerssupply.com>
877-374-SAIL

Sailrite Enterprises
<http://www.sailrite.com>
800-348-2769

Seattle Fabrics
<http://www.seattlefabrics.com>
866-925-0670

Snap-on Tools
<http://www.snapon.com>
877-762-7664 (U.S. customers only)

PHOTOS BY SHIRLEY DUFFIELD

Alignment points of adjacent panels should be labeled clearly, at left. This greatly facilitates proper panel alignment later during chap assembly. Plastic patterning panel pieces should overlap generously so that cut lines may be accurately determined. The red cut line for the transom panel, at right, appears to be on the tube end panel when, in fact, it is showing through the plastic pattern piece from the piece underneath.

ming, so if you are not satisfied, reworking of tube ends is not onerous.

Reinforcement patches – Assemble all panels, including mesh-material tube end pieces, before adding any detail reinforcements since a slight shifting of location can occur. It will likely be necessary to cut an X-shaped opening in the cover fabric to accommodate oarlocks, rings, fill ports, and other details.

After all the pieces are assembled and fit to your satisfaction, cut the final openings for cutouts using a hot knife, and sew on reinforcement patches. Stapling or pinning leather or vinyl reinforcement pieces to fabric is preferred but gluing is also possible. Be careful: excess glue will permanently stain dinghy chaps. Working with leather or vinyl can be tricky, as it may not move easily through your sewing machine's feed dog mechanism. To mitigate this problem, sandwich waxed paper or plastic bag material above and below the material and reinforcement pieces during sewing. The paper or plastic can be torn away later.

Hems – Once the pieces are assembled and reinforcement patches have been added, measure and pin or staple the inner hem. Unless you finished your fabric with a hot knife, a double hem is advisable for woven materials such as Sunbrella, though webbing may also be used to finish raw edges. You could also use a zigzag stitch around unfinished fabric edges before sewing the hem.

Chafe guard – If you wish to incorporate a sacrificial chafe guard around the perimeter of your finished chaps, add this before completing the outer hem. A wide strip (approximately 6 to 8 inches) of exterior-grade vinyl, sewn with its lower edge along the desired exterior hemline and abutting the tube end caps, is perfect for this application. Once this piece is in place, finish the outside hem.

Exterior hem – It is common to incorporate a piece of shock cord or line into the exterior hem to allow the chaps to be secured to the dinghy, particularly at a pronounced rubrail. The location of the channel to contain this shock cord or line will have to be determined by fitting the chaps to the dinghy.

Sewing shock cord or line into the channel during assembly is easier than trying to pull the cord through the channel after sewing. Add large grommets to the outside of the chaps to allow the shock cord to exit the channel and to facilitate shock-cord adjustment once the chaps are completed.

Extras – A splash guard or a covered pocket at the bow creates a convenient place to stow water-sensitive equipment (such as cameras and phones) and towels, plus anchors, chain, cables and locks. Interior pockets may also be designed to carry equipment.

Enjoying your handiwork

May your new dinghy chaps protect your inflatable tender from damage by sun, chemicals, fuel, and abrasion!

Leslie Linkkila and Philip DiNuovo, cruising sailors since 1991, dreamed for years about sailing out of the executive fast lane. In 2003, they and their cat, Jake, moved aboard their Mason 33, Carina, *and cast off their docklines in Kingston, Washington, on an open-ended international voyage. Their experiences have made them strong proponents of cruisers helping other cruisers, as shown by the hours spent on their sewing machine. And although they have helped many cruisers construct dinghy chaps (and repair canvas and sails), their own tender, ironically, is a stitch-and-glue nesting dinghy, the second they have built themselves.*

Read more . . .

Canvaswork & Sail Repair by Don Casey (International Marine, 1996) is an outstanding collection of projects for sailors, including projects like leecloths, handy pockets, cushions, duffel bags, dodgers, sailcovers, and a range of do-it-yourself sail-repair projects. *The Complete Canvasworker's Guide* by Jim Grant (International Marine, 1992) is a classic bestseller from Sailrite, with projects like sea anchors, awnings and enclosures, spinnaker socks, tote bags, and wind catchers. Your editors never begin a sailcover, a sailbag, or a winch cover without having this book open. Go to <http://www.goodoldboat.com/books_&_gear/good_old_boat_bookshelf> to order both books. If you'd prefer to talk to a human, call 701-952-9433.

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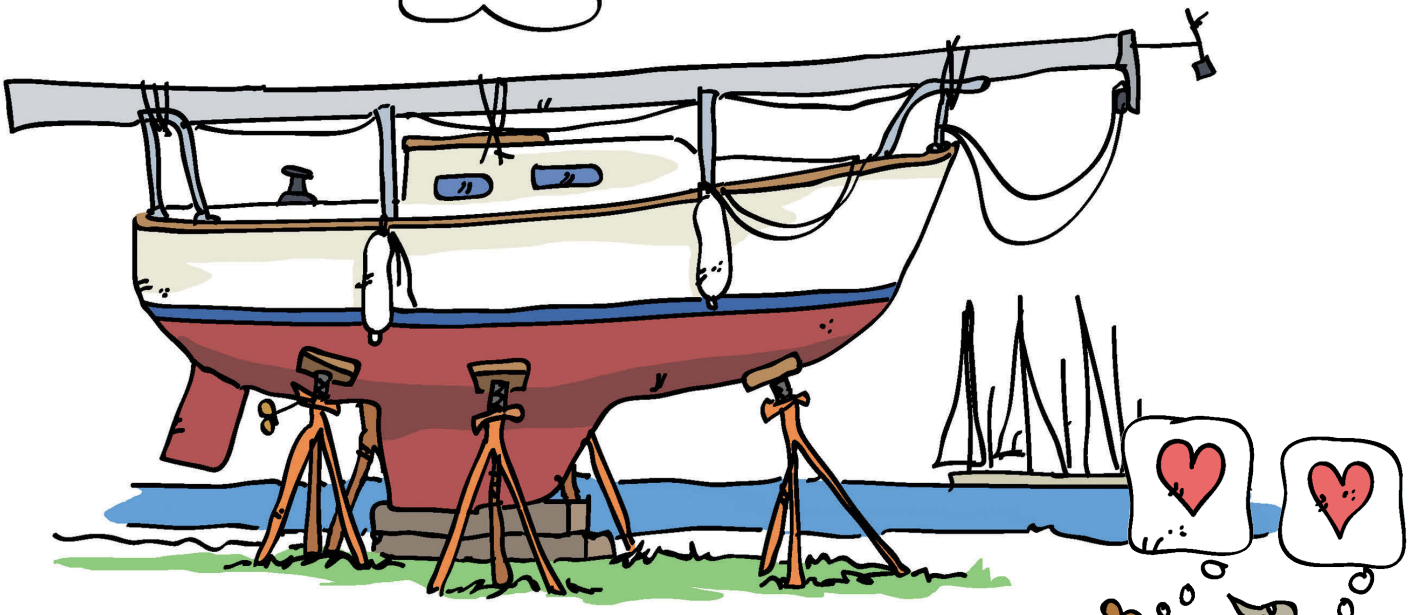

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PART ONE

Where there is no rigger

A rigging repair is a community effort

by Leslie Linkkila and Philip iNuovo

In this, the first of two parts, authors Leslie Linkkila and Philip DiNuovo describe what happens when rigging fails in paradise, how they kept their mast up, and the choices available to sailors when replacing standing rigging themselves.

We were anchored in the ultra-calm anchorage nestled between Isla Del Rey and Isla Espiritu Santo in Islas Las Perlas in the Gulf of Panama, making final preparations for crossing the Pacific in our Mason 33, *Carina*. Before taking off on the 4,000-mile passage to the Galapagos and on to the Marquesas, we wanted to inspect the rig, so Philip donned a climbing harness and I (Leslie) cranked him up to the masthead.

"Uh oh," he called down.

"What?"

"It's bad, very bad."

"You're kidding, right?"

"*No, I am not kidding!* We only have a couple of wire strands left holding up the forestay."

We were roughly 50 miles south of Panama City, where — despite its status as the crossroads of sailing — there is no rigger.

Our standing rigging is made of 1 x 19 stainless-steel wire rope with Sta-Lok mechanical terminals and had been professionally installed in 1999. Since we had been diligent about cleaning and inspections and had replaced *Carina*'s chainplates in 2007, we were (unwisely) confident about our rig's integrity.

Of the many spares we had on board, we had no wire rope, Sta-Lok terminals, or spare wedges for the terminals. In hindsight we had been irresponsible . . . but that was the situation. Getting back to Panama City would be difficult against episodic winter northerlies and short steep seas. These conditions could cause the forestay to part, taking the roller furling unit, and possibly even the mast, with it.

Other cruisers offered us their spare (used) wire, but its age was similar to *Carina*'s failed wire. We decided to motor back to Panama City, where obtaining supplies would be easier than anyplace we had cruised or would be cruising. We used our SSB radio and modem to email a Seattle marine supplier and ordered wire rope and fittings to be shipped to us in Panama City.

Our immediate need was to reduce the tension on the failing forestay. We moved both spinnaker halyards to the bow, secured them to the forward port and starboard cleats, and winched them tight. We then eased the backstay a bit. To reduce weight on the forestay, we dropped the genoa and flaked and stowed it. We returned the Profurl swivel to the top of the extrusion with the genoa halyard so it was tucked under the stop. We moved our two main halyards aft, attached them to pad-eyes, and winched them tight. We set up our running backstays in their working positions and tensioned them. We hoped these steps would be enough to keep the rig intact while we motored to Panama City for 12 to 15 hours under potentially rough conditions.

A better plan

Friends on the other boats in the anchorage conferred, kibitzed, and offered suggestions. Finally, friend Royce, of the schooner *RDreamz*, recommended we take down the forestay while at anchor. His argument was that by lowering and disassembling the furling system on his expansive deck, we could prevent a catastrophic failure that would cause serious damage to the furler and possibly the mast. Luckily, his boat's deck was longer than our forestay.

We assembled and met with crews from *RDreamz*, *Tao 8*, and *Bluebottle* to carefully plan the steps needed to remove the damaged forestay. The following morning dawned breezy but the water in the anchorage remained flat calm. We pulled *Carina*'s anchor and slowly motored up to *RDreamz* and passed a line from our

Leslie and Philip discovered this damage at the upper end of their forestay while anchored in a remote anchorage hundreds of miles from the nearest rigging supplier.

A team of helpers, assembled from cruising boats in a remote anchorage in Panama, watches as Philip prepares to lower *Carina*'s forestay onto the deck of the schooner *RDreamz*.

bow to the stern of *RDreamz*. Once this line was cleated on both vessels, we put *Carina* in reverse at low rpm and locked her wheel.

Philip donned his climbing harness once again and we cranked him to the masthead. Using a rolling hitch, he tied a second halyard to the furling extrusion about 5 feet below the furler wrap stop. After tensioning this halyard, the team on *Carina*'s deck removed the clevis pin from the tack of the roller furler, swung the furling drum and forestay over the bow pulpit, and handed it to the team on *RDreamz*. When ready to lower the forestay, Philip snipped the remaining wires . . . they were so few he only had to use lineman's pliers. Though supported with a halyard and with the backstay eased, there was still enough tension that the wires parted with a sharp "Sproing!"

A team of two managed both halyards, slowly lowering the top of the forestay as the team on *RDreamz* walked forward on deck, carrying the furling drum while supporting the extrusion to clear the stern rail as it came down.

Soon *Carina*'s forestay was resting safely on the deck of *RDreamz*. We then attached the spinnaker halyards to *Carina*'s bow pulpit to support the mast and lowered Philip to the deck along with the upper Sta-Lok terminal and the frayed end of the forestay.

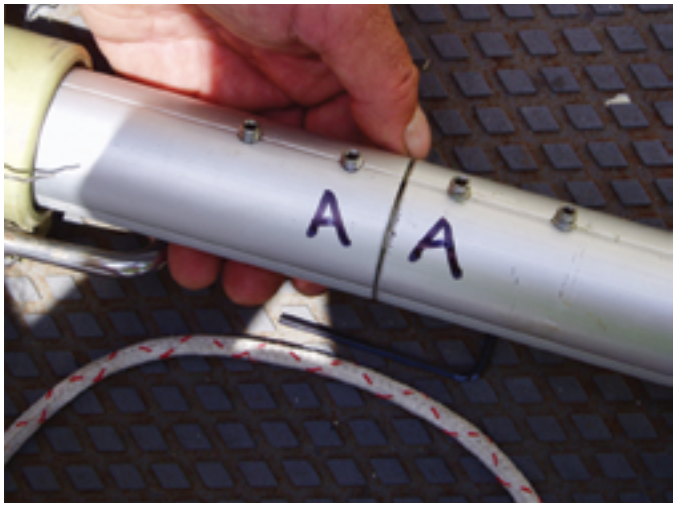
Later, while disassembling the extrusion sections, we cleaned and inspected the furling drum, extrusions, extrusion bearings, and setscrews. We were careful to label where sections intersected. We also took care to measure, to the millimeter, the full length of the original 1 x 19 wire rope.

With the parts of the furling system safely stowed in *Carina*'s main saloon, padded with pillows and tied down, we began our trip to Panama City. There we would meet the shipment of rigging supplies we had ordered by email.

Our original plan had been to bring *Carina* into the marina at Panama City, where we could lay out the new forestay, install the Sta-Lok terminals, and assemble the Profurl extrusions using a stable and relatively clean dock. This option seemed less appealing as we approached the city. The marina was tightly packed with megayachts, the management unfriendly, and the slip cost shocking. The idea of using the parking lot near the anchorage was even worse — it was filthy and served as the staging area for crowds of island-bound ferry passengers. So when friend John of *Nakia* suggested that we might be able to install a new wire and then reassemble the furler directly on the wire as it hung from the masthead, we agreed.

A collaboration of cruisers

To do this, we would need help. Once we received our parts shipment, we assembled another team of eager volunteer cruisers from the vessels *Susurru*, *Iwa*, and *Nakia*. All the boats involved had rigs with mechanical terminals — either Sta-Lok or Norseman — but none



The team on *RDreamz*, at left, walked forward on deck carrying *Carina*'s furling drum while supporting the extrusion to clear the stern rail as it came down. Leslie and Philip labeled the components as they carefully dismantled and inspected the Profurl furling assembly, at right.

To tie a rolling hitch onto a stay, take two turns around the stay in the direction the load will be applied, at left, cross the end over the standing part, and take another turn, tucking the end under, center and right. Long link plates, bottom right, allow access to the forestay turnbuckle.

of these cruising sailors had actually assembled a terminal. For that matter, neither had we. In addition, most of our team also owned Profurl roller furling, so everyone was interested in that aspect of the project too.

To prepare for reassembling the roller furler, we made sure that the inner-extrusion bearings were at the top of each extrusion section. This would allow us to slide the bitter end of the new wire through the constriction of the bearing, push the extrusion over it, and have the bitter end of the wire emerge at the lower unconstricted end of the extrusion bearing assembly.

We also assembled the Sta-Lok stud terminal fitting to what would be the masthead end of the new forestay wire. We did this in our cockpit the night before our team arrived so we could learn how to assemble a Sta-Lok fitting in privacy. The process seemed pretty straightforward and — on our first try — we assembled a nearly flawless terminal.

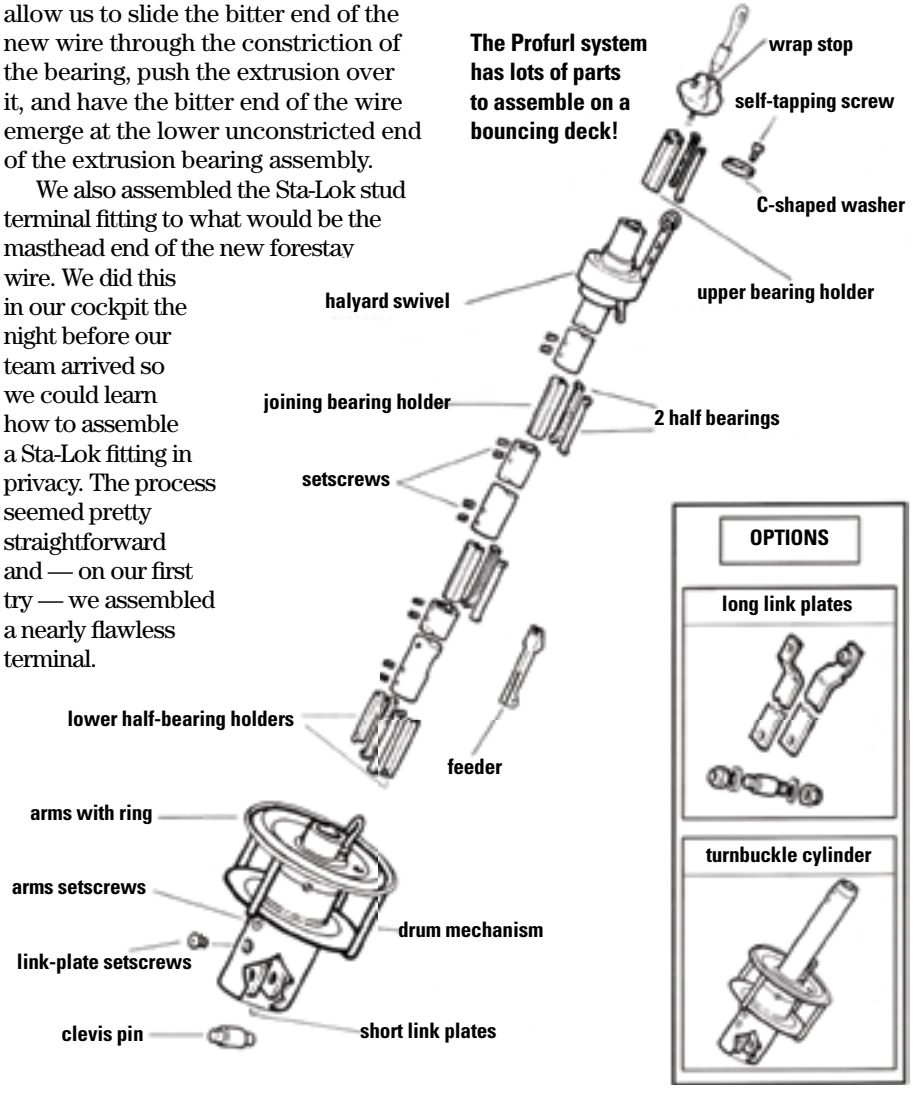
When our team was assembled, using the old wire as a measure, we cut the new forestay wire, allowing for the damaged wire we had cut off during disassembly and the fact that the new wire would stretch a bit.

We again winched Philip aloft, where he and the masthead crossed the sky in wide arcs in the rough conditions — we were in the La Playita anchorage amid wakes created by workboats and vessels transiting the Panama Canal, all the while being buffeted by 20- to 25-knot winds. We considered postponing the project, but everyone was enthusiastic and we proceeded.

Using a rolling hitch, the deck team attached a halyard to the new forestay and hoisted the forestay wire fitted with the Sta-Lok eye to Philip, who slipped it onto the masthead tang and secured it with a clevis pin and cotter pin. We then lowered Philip to the deck.

We assembled the Profurl by slipping each section of extrusion onto the forestay in succession, beginning with the top section. The genoa halyard was attached to the swivel and we periodically took up on the halyard to raise the swivel up the foil column. We had a messenger line attached to the swivel so we could retrieve it later.

As each section of extrusion was added to the growing furler foil on the forestay, we pushed the assembly slowly



upward. One person was the assembler, sliding each extrusion over the bearing of the adjacent extrusion and securing the setscrews with (red) thread locker. A support person handed him tools and materials when needed. Another team member fetched and aligned the next extrusion section, and the last held the bottom end of our increasingly weighty assembly as it swayed around in the wind, waves, and boat wakes.

The final section was longer than the others, due to the long link plates of our Profurl unit. Reaching as high as possible, grunting and groaning as *Carina* danced around her anchor, the assembler was finally able to get the setscrews in place. In retrospect, we could have made this easier by removing the furler link plates or by hoisting our assembler up the staysail stay to the height of the joint.

With the assembly complete, we attached a halyard to the drum and winched the Profurl assembly as far up the forestay as it would go, to expose the lower end of the 1 x 19 wire. Our team, eager to learn, watched and helped as we assembled the lower Sta-Lok fitting, a stud which fit the turnbuckle.

To complete the assembly, we threaded the stud into the turnbuckle, then secured the tack with the clevis pin and tensioned the forestay. The final touches were to reattach the Profurl link plates at the tack and the wrap stop at the masthead and, lastly, to tune the rig. We were all satisfied with the successful completion of our first do-it-yourself rigging project.

Rig care and inspection

Rigging life expectancy depends on many factors including the grade of the stainless-steel wire, terminal type, the quality of the workmanship used in constructing and installing terminals (swages or mechanical terminals), maintenance, the environment (temperature, humidity, and salinity), rig tuning, and boat usage (frequency and racing versus cruising). We recommend an inspection of all standing rigging components at least annually, preferably more often, but especially before every ocean passage!

Although we don't know the exact cause of our failure, we suspect it was an incident in which a spinnaker halyard that had been stowed at the bow pulpit wrapped the forestay as we attempted to furl the genoa while sailing downwind in fresh conditions.

To clean and inspect our rig, we use WD-40 (a moisture-exclusion agent and lubricant available everywhere we have cruised) along with a fine synthetic scrub pad and a soft cotton rag to remove dirt and surface rust. After cleaning, we carefully scrutinize the full length of our stainless-steel wire-rope stays and shrouds, turnbuckles, tangs, and terminals, looking for corrosion, pitting, cracks, broken strands, and wear. Any questionable areas, we examine more closely by magnification. We have no dye penetrants aboard but these products, when available, are effective in amplifying the visual signs of damage, such as cracks or pitting.

It is also advisable to periodically invert rigging wire and terminals since seawater, dirt, and acidic pollutants run down the wire and accumulate at a wire's lower end, causing corrosive breakdown in the terminal. Internal corrosion in terminals causes the swelling that leads to cracking and failure, a problem more pronounced with swaged terminals. Mechanical (compression) fittings, such as Sta-Lok, provide greater internal space for expansion in the event of internal corrosion.

Also, depending on the age of your boat, pulling and inspecting your chainplates is prudent. Six of *Carina*'s eight chainplates were dangerously cracked, something we discovered during a refit when she was 20 years old. When viewed from above and below, they appeared serviceable. It wasn't until we pulled them that we could see the failures just below deck level. We were very lucky we discovered the problem in time to prevent a catastrophic failure.

Mechanical or swaged?

Mechanical terminals offer the hands-on sailor a distinct advantage over swaged terminals by permitting replacement of rigging wire and terminals without the need for specialized swaging equipment or tools. This is critical to the long-distance cruiser, since a failed fitting will inevitably happen hundreds, if not thousands, of miles from the nearest rigger and rigging supplier.

Recently, we replaced the remaining old wire of *Carina*'s standing rigging

Resources

Blue Wave
Blue Wave A/S
www.bluewave.dk

Hi-Mod
Petersen Stainless Rigging
www.petersen-stainless.co.uk

Hayn Enterprises
www.hayn.com

Norseman
Navtec
www.navtec.net

Quick Attach
Suncor Stainless
www.suncorstainless.com

Sta-Lok
Sta-Lok Terminals, Ltd.
www.stalok.com

Internal corrosion in swaged terminals, caused by the accumulation of seawater, dirt, and acidic pollutants, leads to cracking and failure. Note the small vertical crack at the top of this fitting, at left. Pulling and inspecting chainplates is prudent because, when viewed from above and below, they often appear serviceable, as this upper shroud chainplate did, above. If this crack had remained undiscovered, the rig was destined to suffer a catastrophic failure.

while at anchor in the rural island group of Vava'u in the Kingdom of Tonga. We were able to tackle this project, necessitated by the discovery of corrosion and more broken strands in our rigging wire, because all our stays and shrouds are fitted with Sta-Lok mechanical terminals.

When disassembled, the 11-year-old Sta-Lok terminals appeared to be in very good condition. We cleaned, inspected, and reused them, replacing the old wedges with new ones. Our experience has made us appreciate the Sta-Lok system sold to us by a rigger who also happened to be a former cruiser.

Swaged terminals may be less expensive than mechanical terminals and they have a reputation for superior strength. However, the process of swaging results in work-hardening of the stainless steel, which causes brittleness and susceptibility to stress corrosion, and the specialized equipment needed to form swaged fittings is impossible to find in remote areas anyway.

The extra cost of mechanical terminals is mitigated by the fact that they can be reused when re-rigging, generally with the need to replace only the wedge, a minor expense. Any of the available mechanical systems, if appropriately sized, will be more than adequately strong. All currently marketed brands of mechanical terminal claim operating ranges between 90 and 100 percent of the breaking strength of the wire. At least two brands offer Lloyd's listing or certification.

With mechanical terminals, the same terminal body may be used with an end fitting of a threaded stud, fork, or eye. This universality allows for the wire of a stay to be end-for-ended without the need to change any terminal fitting.

Based on our experience, we would highly recommend using mechanical over swaged rigging terminals.

Mechanical rigging options

The most common brands of mechanical terminals are made in the UK: Sta-Lok (Sta-Lok Terminals, Ltd.), Norseman (Navtec), and Hi-Mod (Petersen Stainless Rigging, distributed by Hayn Marine in the USA), a relatively new product that is gaining in popularity. Blue Wave terminals (Blue Wave A/S) are made in Denmark and sold through dealers in North America. A previous relationship with Suncor Stainless resulted in the similarly designed product labeled Quick Attach, which seems to be intended primarily for lifeline applications. All these brands are constructed of type 316 stainless steel and are marketed for use with stainless-steel wire rope. Internet prices for the different systems at the time we were researching this article were similar.

> **"The extra cost of mechanical terminals is mitigated by the fact that they can be reused."**

All the brands work essentially the same way: a wedge or a cone (based upon wire type) is inserted on the end of the stainless-steel wire rope and then the wedge-wire assembly is compressed onto the wire as the two sections of the terminal are threaded together using hand tools. Wedge design for all systems varies with wire type, except in the case of the Blue Wave and Quick Attach systems, which have a universal wedge (that they call a "jaw") for each wire diameter.

One design distinction of note: the Sta-Lok wedge is compressed inside the male-threaded terminal section (called the socket), such that when the terminal is assembled, the wedge is internal to the walls of both the male- and female-threaded terminal sections (called the former), doubling the wall thickness securing the wedge. The Norseman, Hi-Mod, and Blue Wave wedges are internal to the wall of only the female-threaded body section of the fitting. What this doubling means in terms of breaking strength we cannot say, as little objective testing data is available.

Sta-Lok and Hi-Mod both claim to hold to the full breaking strength of the wire, though only Sta-Lok offers certification of this specification by Lloyds of London. Norseman literature makes no specific claims regarding strength and there have been reports of failure under testing (see *Good Old Boat*, March 2000). The Blue Wave product carries Lloyds certification of its breaking strength specification at 90 percent of the wire's breaking strength, though there is a note in their literature that indicates that wire breaking strength may be "decreased by 0 to 15 percent" when using these terminals. Most owners we interviewed seem happy with the performance of their fittings, regardless of which brand they own.

Philip DiNuovo and Leslie Linkkila came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professions and left the Pacific Northwest behind. Now in the South Pacific, Philip and Leslie have had to learn to service nearly every system aboard Carina, *their Mason 33.*

In the second part of this article, to be published in the September issue, Leslie and Philip will discuss lessons learned and the specific steps involved in replacing their rigging.

Where there is no rigger

Replacing standing rigging, step by step

by Leslie Linkkila and Philip DiNuovo

When our headstay almost parted in Panama, where there is no professional rigging service, we had to replace it ourselves. Since the standing rigging on our Mason 33, *Carina*, had been installed with Sta-Lok mechanical terminals, we used the same terminals on our new headstay. We found them easy to assemble using common hand tools, and that gave us the confidence to go ahead later and replace all the standing rigging, which we did while at anchor in Vava'u, Tonga. We hope our experience will be helpful to others who might wish or need to do the same.

PART TWO

In this article, the second of two, Leslie Linkkila and Philip DiNuovo describe the step-by-step process by which to renew stays and shrouds while the mast is in the boat. In the July issue, they described how they removed and replaced their headstay while at anchor in Panama.

One stay at a time

Plan on replacing only one wire rope at a time and make sure that throughout the rerigging procedure your mast is well braced with spare halyards.

When replacing an upper shroud, ease the tension on the port and starboard shrouds uniformly to avoid bending the mast. Although the mast should remain standing securely with just the lower shrouds, we always used halyards as guy lines for added security. Lubricate turnbuckle threads to avoid galling or other damage. We used Tri-Flow, which contains P.T.F.E. and is available as a liquid, since it leaves little residue that can later collect dirt.

Loosen the turnbuckle on the stay that is to be replaced until the stay is loose, but do not disconnect it completely. This will stabilize the bottom of the stay while you disconnect the top and lower the stay.

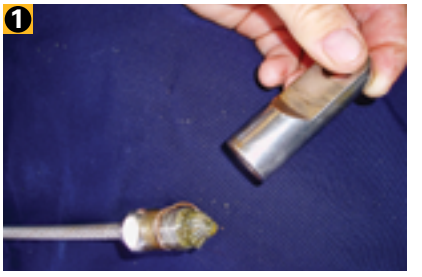
At the top of the stay, before removing the cotter and clevis pins, tie a line securely to the wire below the terminal using a rolling hitch (see Part One, in the July issue). Then slowly lower the stay to the deck.

At deck level, tie a line between the stay and the boat before detaching the lower end of the stay. This will prevent the stay from "snaking" over the side and into the deep blue while you're manipulating it. If you're at a dock, move the stay to the dock and lay it flat. If at anchor, bring both ends of the stay to your work area; we used our cockpit.

Removing an installed terminal

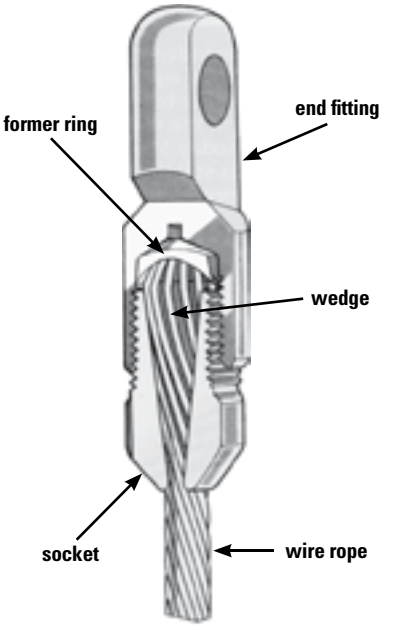
Our standing rigging was assembled with Sta-Lok terminals. The steps that follow will be similar in principle with other brands of mechanical terminals.

Unscrew the female portion of the terminal by holding the male portion with a box wrench and using a large



The first step in disassembling a terminal is to unscrew the two parts.

Inspect the female thread for signs of rust and traces of thread sealant.



This cutaway diagram shows the component parts of a Sta-Lok terminal

Clean the threads inside the fitting. A strand of wire works well for this.

If sealant was used in assembling the terminal, soften it with a little heat.

Select a long socket that will just fit over the end of the terminal.

The socket should rest up against the hex end of the terminal socket.

Tap the end of the socket with a hammer to loosen it from the wedge.

The terminal socket slides up the wire revealing the sealant inside.

screwdriver (for an eye) or second box wrench (for a stud).

Inside the female half of the Sta-Lok is a "former," a dome-shaped part that can be re-used if undamaged. The former may be difficult or impossible to remove from a used fitting, and you might damage it in attempting to remove it, so be sure to have spares.

If the terminal was assembled using silicone sealant and a thread-locking compound, clean the fitting of the residual material. A single strand of 1 x 19 wire works well for removing residual sealant from the threads and former. Periodic spritzing with WD-40 and wiping by twisting a rag into the threads also helps to remove old thread compound and sealant.

Disassembing the socket (male section) takes a little bit more effort, but only if the terminal was assembled with sealant. To avoid damage to the threads during disassembly, we used a long socket from our socket-wrench set. The socket should have a diameter smaller than the terminal cap but just large enough to pass freely over the threads.

Secure the wire in a vise or clamp it with locking pliers, such as Vise-Grip. Next, heat the fitting with a heat gun or propane torch just long enough to soften the sealant (approximately 1 minute with a heat gun on low setting). Slip the socket over the threads and use a hammer to dislodge the fitting from the wire.

We found no rust inside our disassembled 11-year-old fittings, only silicone sealant and red thread-locking compound.

Once you have loosened the male terminal sections at both ends of the wire, and before cutting the old wire, measure for the new wire against the old wire. This is the time to consider whether the new wire should be a trifle longer or shorter than the old wire.

To measure accurately, tape the old and new wires together every few feet along their lengths to prevent the two wires from "walking." Bracket, with duct tape, the location on the new wire where it will be cut, and carefully cut the end as square as possible.

This can be done with a cable cutter, hacksaw (tape either side of the cut and secure the wire in a vise), or a high-speed rotary tool such as a Dremel.

Now remove the male Sta-Lok terminal section from the old wire.

Installing a terminal

Before reassembling the terminal on the new wire, clean the male and female parts thoroughly with WD-40 or a similar solvent and a synthetic scouring pad, such as Scotch-Brite.

Ensure the threads are clean and that you can thread the terminal easily by hand. Inspect each piece carefully for corrosion or cracks.

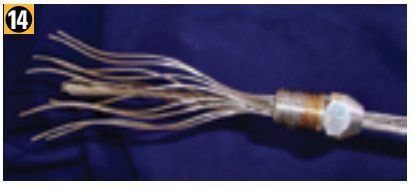
Tape the old wire, with the wedge still in place, to the new wire.

At the other end, wrap tape around the new wire and mark for the cut.

To remove the terminal socket from the old stay, cut the wire.

Slide the terminal socket off the cut end of the old wire.

Clean both threaded parts of the terminal before reusing them.



Slip the socket over the end of the new wire and unlay the strands.

Slide the wedge over the wire core and carefully re-lay the strands.

In this poor assembly, a strand is lodged in the slit in the wedge.

Properly assembled, the strands lie uniformly around the wedge.

Inspect the cut end of the new wire. The cut should be reasonably clean and none of the individual wire strands should vary in length more than 1 mm. Use a wire snipper to trim individual wires if necessary.

Slide the male terminal piece (socket) over the new wire (an important step). Using a small slotted screwdriver, begin to uniformly unlay the wire approximately 2 to 4 inches from the end. If you want, you can apply a wrap of thread or tape a few inches from the end of the wire to prevent the wire from unlaying beyond this point and to prevent the socket from sliding down the wire.

Slide the new wedge over the seven core wires until 2 to 4 mm (about ⅛ inch) of wire extends beyond the wedge (this distance depends on the wire diameter and is specified in the Sta-Lok instructions). Do not reuse old wedges unless no other option exists.

Re-lay the wire. Push the male terminal fitting up the wire and rotate it with the lay of the wire to gently re-lay individual strands.

Take care that the wedge does not slide out of position (off the end of the wire), that strands are uniformly spaced around the wedge, and that no individual strand is lodged in the wedge slot. If the pre-assembly is poor, pull back the male terminal piece and use a small slotted screwdriver to gently push the wedge back into position and realign individual strands. A good tip for Sta-Lok fittings: hold the male terminal piece snugly against the wedge and rotate the male terminal in the direction of the lay of the wire rope as you align the individual strands. This helps to keep individual strands out of the wedge slot.

Once you have the wedge, wire strands, and male component assembled satisfactorily, thread the female terminal section on until you feel some resistance. Some riggers recommend using a thread-locking compound at this point to lubricate the threads and to avoid galling.

Using a vise and box wrench, or two box wrenches, slowly tighten the terminal, but just hand tight. You will hear a disconcerting "scritching" sound as the wires bend and lay with the former inside the terminal. Immediately disassemble the terminal fitting to check the quality of the assembly; the wire strands should be bent and lie neatly and uniformly around the end of the wedge.

Complete the assembly by applying a "grape-sized" dollop of sealant to the female terminal section. If you didn't do this during your test assembly, now's the time to apply Loctite or another thread-locking compound to the threads of the male terminal section.

Reassemble the terminal, tightening to hand tight with box wrenches. *Do not overtighten!*

Thread the female terminal end onto the socket and draw it up hand tight.

Unscrew the terminal end and examine the assembly for uniformity.

Make the final assembly with sealant and thread-locking compound.

The corroded wedge (left) indicates water ingress into a terminal.

To seal or not to seal?

There are arguments for and against applying sealant to mechanical terminals. Hi-Mod discourages the use of a sealant while Norseman endorses its use but advises against silicone sealants. Sta-Lok indicates sealant is not needed but, if used, it should be a polysulfide. Blue Wave recommends Sikaflex 221. Upon replacing our failing 11-year-old wire rope, every terminal we disassembled revealed a wedge that looked nearly perfect. These terminals had been sealed by our rigger with marine silicone sealant.

Alternative products

Norseman (Navtec) —
The Norseman system design has changed little with time. The company was purchased by Navtec, which is part of Lewmar. Lately, availability of Norseman fittings seems to be an issue with U.S. rigging suppliers. In our opinion, the industrial design of the Norseman is less refined and its finish compares poorly to the machining and brilliant polish of the other brands.

The wedge is similar in design to that in the Sta-Lok but a bit shorter and of slightly larger diameter. The wedge is inserted significantly deeper into the unlaid wire — 1.5 times the wire rope diameter — than with other designs. The terminal consists of three components: the body (female thread); the cone; and the end fitting (male thread) with its integral former machined to compress the end of the wire when the terminal is assembled.

Norseman terminals have similar components to Sta-Lok products but the threaded parts are reversed.

Hi-Mod (Petersen Stainless) —
The Hi-Mod system is the latest introduction into the market and has little history yet, though its manufacturer has a reputation for high-quality products and these cleverly designed terminals are rapidly gaining in popularity.

The industrial design and finish quality seems superior to the Norseman, though the form is similar. The Hi-Mod design is differentiated by its aluminum-bronze crown ring that sits on the wedge. This ring keeps the individual wire strands evenly spaced around the wedge and prevents the outer wire strands from bending, making all system

Resources

References

The Complete Rigger's Apprentice by Brion Toss; International Marine, 1998

Understanding Rigs and Rigging by Richard Henderson; International Marine, 1991

Rigging Services Guidelines published by Navtec Rigging Solutions

Inspection of Sail Rigging and Masts on Inspected Small Passenger Vessels, USCG Inspection Note #13, October 2008

"New Swageless Fitting Shows Promise" by Bill Sandifer; *Good Old Boat*, March 2000

Manufacturers

Blue Wave
www.bluewave.dk

Hi-Mod
www.petersen-stainless.co.uk

Norseman
www.navtec.net

Quick Attach
www.suncorstainless.com

Sta-Lok
www.stalok.com

Tri-Flow Superior Lubricant
www.triflowlubricants.com

components reusable. The crown and the end fitting also help to ensure a flawless assembly by holding the position of the wedge to a precise depth.

Blue Wave (Blue Wave A/S) — The design of the terminal body components of the Blue Wave are similar to those of the Norseman and Hi-Mod, though their terminology is slightly different. The key differentiating design element is a jaw (called by others a wedge or cone) that slides over and compresses onto the full diameter of the wire rope, making it universal for a given wire diameter irrespective of wire construction (7 x 7, 7 x 19, 1 x 19, or Dyform). In addition, the system includes a compression ring that slides onto the bitter end of the wire and a locknut on the head that secures the assembled terminal. The design and construction are of high quality but the product's popularity (at least in the U.S.) seems limited.

Hi-Mod terminals use a "crown ring," far left. An assembled Hi-Mod alongside a swaged fitting, at left. In the Quick Attach (and the similar Blue Wave) terminals, above, the wedge fits over the entire wire.

Quick Attach (Suncor Stainless) — These terminals are of the same design as the Blue Wave terminals, although the installation instructions contain minor variations. They appear to be marketed primarily for lifeline applications by Suncor Stainless and for railings by Atlantis Rail.

Design note

Sta-Lok terminals have a design feature that distinguishes them from the other products listed above. In Sta-Lok fittings, the wedge is compressed inside the male-threaded socket and the female-threaded former. This doubles the wall thickness securing the wedge.

Proactive with rigging

When we left our home port on our open-ended cruise, we didn't give much thought to replacing our standing rigging. Our rig was new when we launched *Carina*, we had sought advice from professional riggers just before departure, and we cleaned and inspected our rigging regularly. Though we were proficient at most maintenance tasks aboard *Carina*, we had not given enough thought to the possibility we would need to become do-it-yourself riggers.

Our experience taught us valuable lessons and we feel that others can benefit from them:

- Know your rig and how to service and install every component.
- Clean and inspect rigging at least annually but preferably more frequently. Inspect your rig before departing on any ocean passage.
- End-for-end stays and shrouds when they have reached approximately half their expected life.
- Don't neglect to inspect chainplates, as cracks are usually well hidden.
- Be comfortable in your bosun's chair or climbing harness. Work out safety procedures with your crew and always use a safety line.
- When cruising, carry spare wire rope in all sizes represented in your rig, of a length and diameter suitable for replacing any stay.
- When cruising aboard a vessel outfitted with swaged terminals, carry enough mechanical fittings and suitable extensions or long studs to permit any swage to be replaced using the existing wire. For rigs already fitted with mechanical terminals, carry at least one representation of each fitting and terminal in the rig and possibly a connector that could be used to repair a section of wire in situ.
- Replace any rigging component — wire, terminal or chainplate — that shows any sign of degradation.

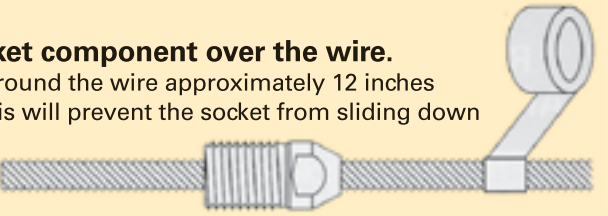
After learning by necessity while replacing first one part, and then all, of *Carina*'s rig without the help of professionals, we have become proponents of mechanical (compression or swageless) fittings. These systems are not difficult to master and working with them is certainly within the capabilities of most sailors. For offshore cruising, using them seems imperative, in case a rigging failure is discovered hundreds or thousands of miles from professional rigging services.

Philip DiNuovo and Leslie Linkkila came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professional jobs and left the Pacific Northwest behind. Now in the South Pacific, far from marine professionals, Philip and Leslie have had to learn to service nearly every system aboard Carina, *their Mason 33.*

Assembling a Sta-Lok terminal

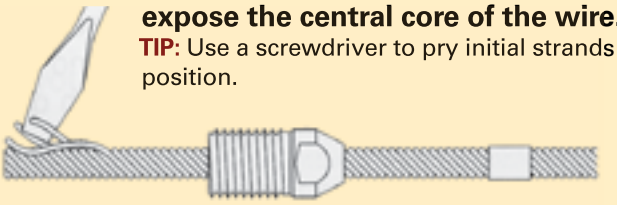
STEP 1
Slide the socket component over the wire.

TIP: Wind tape around the wire approximately 12 inches from the end. This will prevent the socket from sliding down the wire.



STEP 2
Unravel the outer strands 2 to 3 inches to expose the central core of the wire.

TIP: Use a screwdriver to pry initial strands out of position.

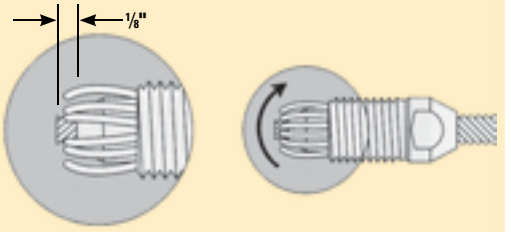


STEP 3
Slide the wedge component over the core.

STEP 4
Reposition the outer strands.

Turn the outer strands around the wedge, clockwise or counterclockwise according to the lay of the wire. Ensure approximately ⅛ inch of the core protrudes from the end of the wedge. Take care to ensure that a strand does not slip into the slit in the wedge.

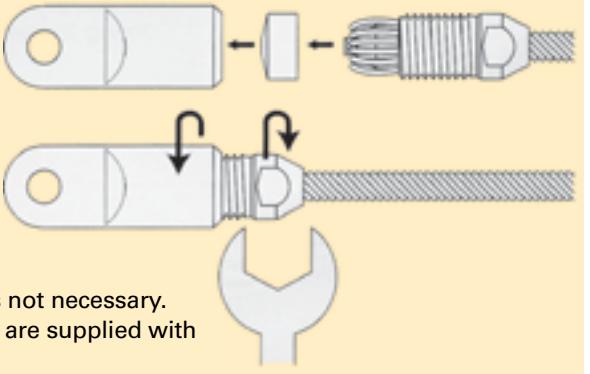
TIP: While repositioning the outer strands, push the socket toward the end of the wire. This will help control them. When the wire strands are in position, push the socket firmly down to hold them in place.



STEP 5
Final assembly

Place the former cup in the bottom of the end fitting. Screw the socket assembly into the end fitting and tighten it with wrenches. The assembly is now complete.

TIP: Undue force is not necessary. Fitting instructions are supplied with each terminal.



Chameleon:

A nesting hard dinghy that's enduring and endearing

by Leslie Linkkila and Philip DiNuovo

Bacio, the authors' modified Chameleon nesting dinghy, fits aboard *Carina* between the mast and the dodger.

Many years before we cast off our docklines, sailed out the Strait of Juan de Fuca, and watched Cape Flattery disappear astern, we debated our choice of cruising equipment. One of our most important decisions was a yacht tender.

Every option had advantages and disadvantages, but our first criterion was that we had to be able to stow it on the deck of our 34-footer where it would not interfere the with safe handling of the boat under sail. For this reason, we did not want to stow a dinghy on the foredeck but, rather, between the mast and dodger.

We had other attributes in mind for our tender. It would have the capacity and stability to carry both of us, and possibly heavy payloads, through choppy anchorages. It would tow easily and move well through the water, even plane, with the smallest possible outboard engine. We would be able to row it effectively, into a stiff wind and up-current, should the outboard fail. It would be stable enough for us to climb into it from the water after swimming or snorkeling. It would be light enough to carry short distances but rugged enough to be dragged up on stony beaches. For long-term service, it would resist degradation in the elements when used every day and would be easy to maintain and repair. As to the benefit of a dinghy with a sailing rig, we had differing opinions.

We briefly considered a roll-up inflatable, but its poor performance when rowed in windy conditions concerned us. Also, better-quality Hypalon inflatable sport boats were expensive and subject to UV degradation. This choice also seemed to mandate the purchase of a large, heavy outboard engine that would dictate carrying significant quantities of gasoline when going offshore. A large outboard would also necessitate some sort of lifting apparatus, a further deterrent.

Next we considered folding-dinghy options (such as the Porta-Bote or the German Banana Boot), but the long dimension when folded would dictate that it be stowed along the lifelines. This would pose a safety hazard in rough seas and create something to trip over when going forward; we discarded this option.

A solution in two parts

About this time (this was 1996), we became aware of nesting dinghies in general and Danny Greene's designs in particular while reading two of Dan Spurr's books: *Upgrading the Cruising Sailboat* and his biographical tale, *Steered by the Falling Stars: A Father's Journey*. A nesting dinghy is made in two or three separate sections that are bolted or clamped together to form the entire boat. For stowing aboard (or for transport), the sections are separated and nested together to take up minimal space.

The nesting hard dinghy seemed to us at the time, and in fact still does, like the perfect solution to the tender dilemma, particularly for smaller-sized cruising yachts. Eventually, we found an address for Danny Greene (a naval architect and nesting dinghy pioneer) and requested plans for Two Bits or For Pete's Sake. We learned these plans were no longer available. His designs had evolved over 20 years into the pram he called Chameleon.

Chameleon is a nesting pram,10-feet 4-inches long when assembled, with a gracefully angled bow transom and hard chines but with a pleasing sheerline.

a tender in two parts

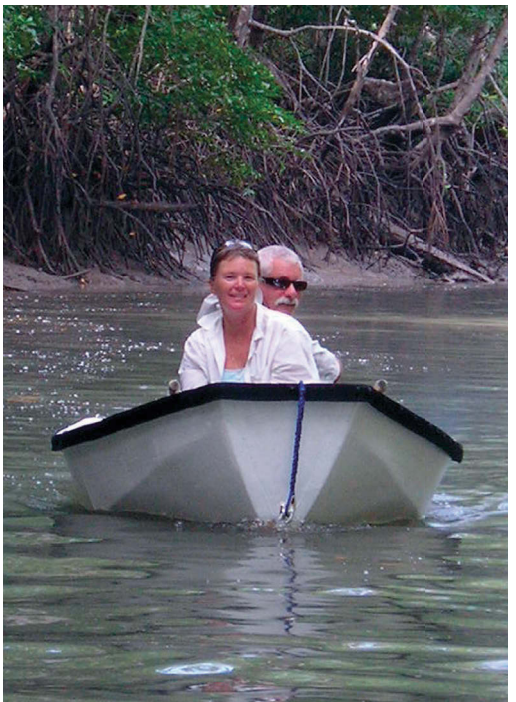
It's designed to be made of marine plywood, fiberglass cloth, and epoxy and has many desirable, and some unique, features: aft buoyancy tanks, a forward storage compartment, removable fore-and-aft oriented seats to allow for adjusting trim under power, and curved mating bulkheads defined by laminated beams. The sections are simply bolted together in three places to form the complete dinghy. Design options include a sliding rowing seat and a sprit-type sailing rig.

To quote the designer: "Over the years, I experimented with . . . {nesting dinghy} dimensions, hull shapes and construction details. I tried boats up to 16 feet in length and with two and three nesting pieces. Some towed beautifully, some sailed very well, some towed well, some were stable, some handled rough weather easily, some were light and compact to stow, and some were very easy to build. None, however, combined these qualities in a way that satisfied me, until Chameleon."

We bought the plans and the optional full-sized patterns for cutting the panels and built our first Chameleon, *Diva*, as a full-sized rowing version. Because it was our first boatbuilding project, and also our first try at stitch-and-glue construction, we worked slowly and methodically for about a year in our unheated garage on nights and weekends. We followed the plans carefully and made no substitutions or changes. We inevitably made mistakes, but soon learned our way with epoxy resins, filleting blends, and fiberglass cloth as *Diva* became a reality.

As promised, she stowed compactly, rowed effortlessly with 7½-foot oars, and towed like a dream. Importantly, when stowed securely behind the mast she did not interfere with sail handling. When assembled and under way, she was solid, and it was impossible to tell that she was joined at the mating bulkheads. In short, we were thrilled with her, except for one problem. When we sold our Hallberg Mistral sloop, *Aria*, and acquired *Carina*, a Mason 33 cutter, we found *Diva*'s nested length was just a trifle too long. It interfered with the use of a reefing winch mounted on the mast beneath the boom.

The full-sized Chameleon was too long to nest behind *Carina*'s mast, so Philip and Leslie modified Danny Greene's plans to make *Bacio*, above, which has the same freeboard and beam but is only 8 feet long. *Bacio* has been used nearly every day for almost eight years and has proved to be a rugged, reliable, and stable tender, below. Plus she's a pretty boat with a graceful sheerline.



Chameleon reduced

To solve that problem, we decided to construct *Bacio*, a shorter version of the Chameleon. (Note: The purchase of Danny Greene's plans allows for construction of *one* dinghy; additional boats require a small royalty payment to the designer.) We did not know it at the time, but others had reduced the size of the Chameleon as we had done . . . with mixed results.

One version we learned about, called the Gecko, was cut down by reducing all Chameleon dimensions proportionally, yielding an 8-foot 6 inch Chameleon. Though seemingly logical and appropriate on paper, the result was a dinghy with unacceptably low freeboard and insufficient clearance for oars when rowing. In the end, after devoting much labor to adding freeboard, the builder was very pleased with the boat.

Our strategy, done solely by instinct, was to maintain the Chameleon's freeboard and beam but to essentially chop it off at both ends to reduce the overall length to an even 8 feet. We hoped this would allow us to retain most of the Chameleon's carrying capacity and stability but make it fit the available space on *Carina* when nested. Concerned about modifiying individual panels, and particularly the size and configuration of the transom, we photocopied Danny's plans so we could make a few small models out of lightweight cardboard and masking tape. Eventually, we became confident enough in our design modifications to cut

plywood. In the end, we preserved the bow dimensions but made the transom slightly bigger than on the original.

Another change we made when constructing *Bacio* was to use 4mm okoume plywood. Okoume plywood is made from the African hardwood *Aucoumea klaineana* and is used in aircraft, kayaks, and acoustic guitars. We used this in place of the specified thicker ¼-inch marine plywood for all the panels with the exception of the bulkheads, bow, and transom. We chose okoume because of its very high strength-to-weight ratio and a desire to reduce weight, though we did so at the expense of rot resistance. Because we used this type of plywood, we sealed every surface of *Bacio* with epoxy and fiberglass, except for the insides of the flotation chambers. Failing to seal the flotation chambers proved to be a bad decision; eventually, water incursion in the chambers allowed fungus to attack the wood.

For inwales and outwales, we chose ash, which is light, knot-free, and strong. We stitched the panels together with monofilament line instead of copper wire to save time. We cut curved knees for aesthetic reasons and through-bolted pad-eyes at all four corners of both halves (eight in total) to facilitate lifting and launch. Also, during construction, we placed a thick piece of corrugated cardboard of the exact dimensions of the mating bulkheads between them before we screwed the bulkheads together. This helped create a "soft" center space to guide our saw and prevent damage to the bulkheads when cutting the boat in two, a problem we had had when building *Diva*.

When building *Bacio*, we eliminated the forward seat, since we rarely used it in *Diva* and often removed it for carrying provisions or jerry cans of water or fuel. We installed Wichard folding pad-eyes on the aft section to which we attach stainless-steel lifeline turnbuckles via large snap hooks. This allows us to lash *Bacio* very tightly onto pads on deck. The forward dinghy section is held captive by the aft section and needs no pad-eyes. We estimate *Bacio*'s weight to be 80 pounds or less.

Practical in practice

To launch *Bacio* from her nested position on deck, we flip over the aft half and, using a lift bridle and our main halyard, lift and hang this section outboard and out of the way. Next, we flip over the forward section and lay it athwartships of *Carina* with its mating bulkhead outboard. We then swing the aft section in and mate the bulkheads with the three ½-inch bolts. We use wingnuts that we tighten onto stainless-steel fender washers and also nitrile rubber washers to help seal out water. Once the dinghy is assembled, we move the forward lines of the lifting bridle to the dinghy's bow and lift the entire dinghy up and over the lifelines and lower it to the water. It takes us about 15 minutes to assemble or disassemble *Bacio*. (With *Diva*, we would put both halves overboard in the water and one of us would climb in the aft half, align the two half boats, and bolt them together.)

To launch *Bacio*, Philip and Leslie first turn her aft half upright and hoist it with a halyard.

With *Bacio*'s stern suspended, they flip her bow half and turn it so the bulkhead faces outboard.

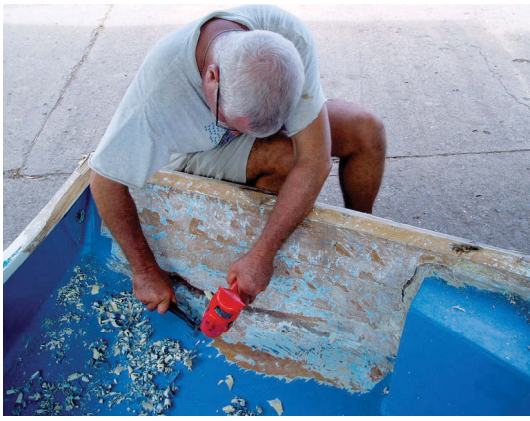
Once the two halves are mated, they switch the forward bridle legs to the bow for launching.

We can also hang *Bacio* from a main halyard (resting against a fender slung parallel to *Carina*'s toerail) for security and to minimize fouling of the bottom and the outboard motor. We use no anti-fouling paint on her bottom.

For propulsion, we outfitted *Bacio* with 7-foot oars and a small 3.3-hp two-stroke outboard, the latter still easily purchased outside the U.S. Though she will not quite get up on plane (most likely due to our amateur design modifications), she still moves along at 5 knots or so under power. By shortening her waterline, we also sacrificed some performance in short choppy seas. We wouldn't recommend it, but we have transported almost 675 pounds, though only for a short, flat-water passage. She'll easily carry 450 pounds.

We have used *Bacio* nearly every day for almost eight years while cruising from our home port in Puget Sound, Washington, through Mexico, Central and South America, and the South Pacific. She has required periodic maintenance but has been a rugged, reliable, and stable tender. Plus she's a pretty boat with a graceful sheerline. One of us still pines for a sailing rig, especially when she sees a Chameleon under sail, but she still does not have it.

Bacio's fine finish has degraded some as we have had to do repairs without fiberglass tape or the best epoxies, but she is as tough as ever and still going strong. She's a working boat, she's held up well to the elements, and her rugged construction probably saved Philip's life when he was hit



***Bacio*'s rugged construction probably saved Philip's life when he was hit broadside by a speeding powerboat in Nuku Hiva, above. The collision stove in the starboard aft hull panel, leaving the forward half of the boat undamaged. When repairing *Bacio*, three photos at right, Philip and Leslie made do with the limited supplies they had on board together with what was available in their remote location. She was afloat again in a week.**

broadside by a speeding powerboat in the Marquesas.

Periodic maintenance

Maintaining our Chameleon has primarily involved keeping her painted, which prevents UV degradation of the epoxy resin. Any spot exposed for even a few months in the tropical sun is subject to delamination. Single-part paints have not proven hard enough for everyday use on the hull, so we've resorted to two-part paints with epoxy seeming to be better than polyurethane for durability. For the inside, rubber roof paint seems to hold up best to standing water while single-part paints quickly peel off where rainwater or dew accumulates. A layer or two of fiberglass cloth tape along the keel did not prove to be substantial enough for frequent landings on sand and rocky shores. To mitigate wear, we added an 8-inch-wide strip of 24-ounce coarse woven roving to the keel to strengthen it for impact and to serve as a chafe guard. The surface is not fair but it's hardly noticeable and does the job.

We have had some problems with rot, though much less than you might expect. The first serious case was due to a crack that developed in the seam of one of the flotation chambers in the aft section. Water quickly accumulated during a long wet Central American summer. While doing routine maintenance, Leslie noticed a softness in the panel, began tapping with a screwdriver, and found a large area of rot. With a borrowed Fein tool, we quickly excised the rotten piece (the inner side had not been coated with epoxy) and constructed a replacement, stripped the adjacent paint, and used a filleting blend to install the replacement. Strips of fiberglass cloth reinforced the fix and *Bacio* was watertight once more.

The other instance of rot involved the forward storage area. Due to ingress around the seal of the commercial hatch we had chosen to install (rather than the hatch suggested by the designer), water accumulated inside. This led to fungus growth that eventually attacked the okoume hull panels of the forward section despite their coatings of epoxy and fiberglass. While in the boatyard for routine maintenance, we stripped the paint from the outside of the hull using a heat gun, dried out the storage area, and re-epoxied and reinforced the fiberglass of the entire forward section. (We also installed a strip of wood forward of the hatch to which we snap a Sunbrella cover that helps minimize leakage.)

Repairable construction

As for major repairs, the collision in the Marquesas crushed in the starboard section of the aft half, shattered one oar, popped the knee, and caused *Bacio* to capsize and nearly sink. The flotation chambers kept her afloat. (Philip was

Resources

References:

Spectre, Peter, *100 Boat Designs Reviewed*, WoodenBoat Publications, 1997

Spurr, Daniel, *Steered by the Falling Stars: A Father's Journey*, Henry Holt & Co, 1995

Spurr, Daniel, *Upgrading the Cruising Sailboat*, International Marine/Ragged Mountain Press; 2nd ed., 1993

Websites:

www.duckworksmagazine.com
www.yachtvalhalla.net/gecko/gecko.html
www.bebi-electronics.com/rtt.html

plucked from the water, unharmed, by the stunned crew of the offending vessel.)

Even though we had limited supplies, we stripped all the paint from the crushed section and gently re-assembled the remaining bits, like a jigsaw puzzle, against a piece of sacrificial plywood, screwing the brace to the damaged piece. We sealed the ragged edges with a liberal application of the locally available epoxy filler (Epi-Fill by International), then faired the surface and glassed both sides with 2:1 no-name epoxy we had purchased in Panama. The bits of knee and gunwale we still had fit together in another puzzle and we built up and sculpted thickened epoxy to fill the gaps left by lost pieces. After a week of work in a hot parking lot on Nuku Hiva, under the watchful eyes of nearly everyone on the island, she was back afloat. We could see her minor scars but no one else seemed able to see the repair.

Nesting dinghy enthusiasts are a small club but we find many Chameleons (and other designs) as primary or secondary tenders in active use by cruising yachts in far-flung ports. In Fiji, we tied up each day next to a Chameleon, made of aluminum, named *Rin Tin Twin*. This is a well-loved family vehicle for liveaboards who commute to their business ashore.

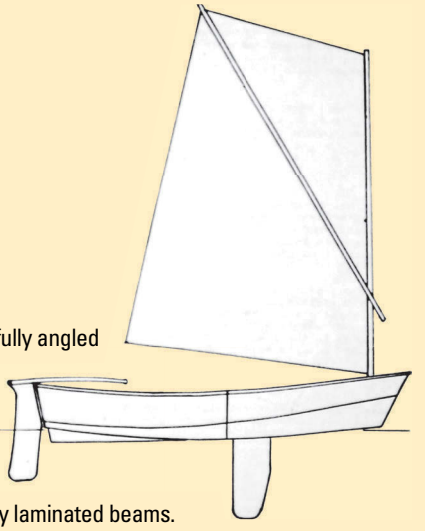
The two Chameleons we have built and used have proved their worth and we encourage any slightly-resourceful sailor looking for an economical solution to the tender dilemma to consider the Chameleon. With a little skill and a small amount of concentrated effort, anyone can build and maintain a Chameleon that will be joy to own (and sail) while providing years of reliable service.

Philip DiNuovo and Leslie Linkkila came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professional jobs and left the Pacific Northwest behind and are now in the South Pacific.

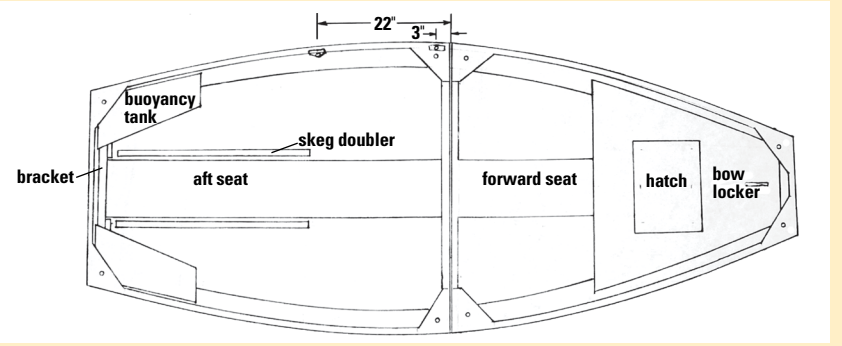
A Chameleon nesting dinghy can be assembled or disassembled with both sections in the water.

Chameleon

LOA: 10' 4"
Beam: 4' 2"
Nested dimensions: 5' 4" x 4' 2" x 1' 8"
Sail area (sprit rig): 50 sq ft
Weight (rowing version): 100 lb approx.
Weight (sailing version): 120 lb approx.
Carrying capacity: 500 lb approx.
Motor size: 2-4 hp



The Chameleon is a nesting pram with a gracefully angled bow transom, hard chines, and a pleasing sheerline. The design includes desirable and unique features including aft buoyancy tanks, a forward storage compartment, removable fore-and-aft seats for adjusting trim under power, and curved mating bulkheads defined by laminated beams.
Danny Greene, Offshore Design Ltd., PO Box GE 213, St George, Bermuda GE BX
dtgreene@ibl.bm



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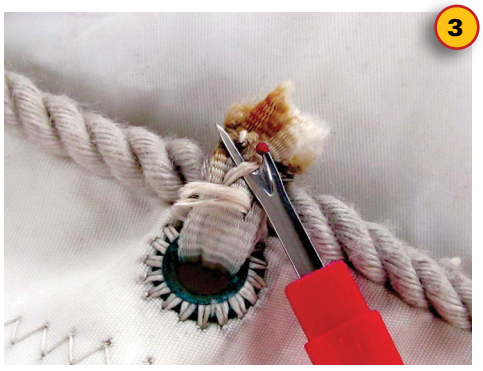
Seizing slides

Keep that mainsail



It is very likely that a sail loft seized the slugs or slides to the luff of your mainsail, mizzen, or trysail. Since that time, those seizings have been slowly chafing and eventually they will fail. If you're cruising when that happens, you will probably be a long way from any sailmaker and will have to make your own repairs.

Fortunately, re-seizing slugs or slides is a straightforward process you can master. There are many variations — we'll show two here but all use the same basic techniques, tools, and supplies. Other sail repair projects require the same hand-sewing skills, so they're well worth acquiring, particularly if you're planning to venture out into the deep blue where self-reliance is imperative.

Rather than wait for a seizing to fail at 0200 on a dark and stormy night, inspect all your sail-slide attachments while you're in a balmy anchorage and preempt the problem. Since you have to take the sail off the mast and boom to check the slides, take the opportunity to inspect the rest of the sail too.

After removing the luff and foot from their tracks, tug on each slug or slide. If any wobble around loosely, it's likely that one or more of the underlying layers of webbing is damaged, leaving the outermost layer as the sole attachment. If you can easily lift the slide or slug away from the boltrope and wiggle it around, renew the seizing immediately (**PHOTOS 1, 2**).

Where you set up to do the work will depend on your circumstances. A long, low, wooden bench that you can straddle and use as a platform for piercing assemblies with a scratch awl is nice to have, but most cruisers make do without.

Read the step-by-step instructions that follow while referring to the accompanying photos. In this case a picture truly is worth a thousand words. Refer to the sidebar on page 44 for the tools and supplies you'll need.

Remove old seizing

Using a seam ripper, gently disassemble the existing seizing, separating old stitches from the webbing (**PHOTO 3**). Cut and pull gently until all the stitches are free. Remove any twine remnants or nits and inspect the grommet and boltrope.

Your sail might have hand-worked eyelet grommets consisting of a sewn ring finished with a brass eyelet (as in **PHOTO 3**) or spur grommets (see **PHOTO 24** on page 43) made of nickel or brass.

Prepare your supplies

Webbing: Lay out the old webbing and use it to estimate the length of new webbing you'll need. Cut your new webbing generously, as the old webbing is likely to be distorted. You need enough to do 2½ wraps through the grommet or ring to end on the opposite side of the sail. Use the butane lighter to melt the ends of the tubular webbing to prevent them from unraveling.

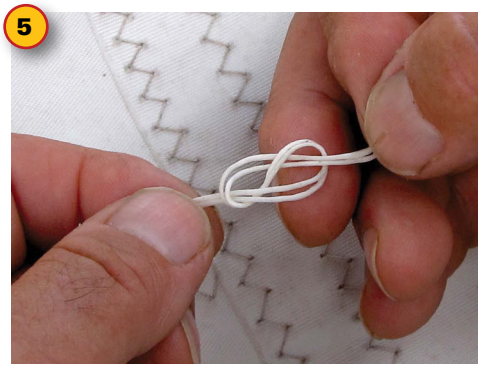
and slugs

attached to the mast

by
Leslie Linkkila
and
Philip DiNuovo

Waxed hand-sewing twine: Measure roughly 5 feet of waxed hand-sewing twine and select a large needle. We like a #14 needle; it's usually the largest in an assortment and measures 2¾-inches long. (Needles get smaller as the number goes up.)

Insert the twine through the needle eye and pull it through until it's doubled. Holding the needle in one hand, pull the waxed twine between finger and thumb on your other hand a few times (**PHOTO 4**), stretching the two strands and warming the wax until the strands lie evenly against each other and any kinks are removed. Tie a figure-eight knot close to the end (**PHOTO 5**) and trim the excess to about 3/16 inch.



Seizing a slide

Secure the webbing to the sail: The first step is to tack down one end of the webbing on one side of the sail, next to the grommet. It doesn't matter which side you begin with as long as you begin all your seizings on the same side. For this description, we begin on the starboard side and call this the front of the seizing.

If you are replacing a seizing, you'll see holes in your sail between the boltrope and the grommet where the twine passed through the sail (**PHOTO 6**). Use the same holes (making more holes will weaken the sail). If you need to expand these holes a little, use the scratch awl, but gently so you don't rip the sailcloth. If there are no holes already in your sail, use the scratch awl to make them. They should be about ⅜ inch apart (for ½-inch webbing) and centered midway between the boltrope and the ring.

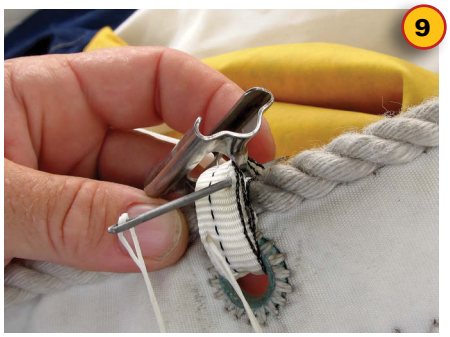
Begin attaching the webbing to the sail by creating a single bar stitch. To do this, first align one end of the webbing with the grommet on the front (starboard) side of the sail. Pierce the webbing with the threaded needle and push it through the right-hand hole and then back through the left-hand hole, creating a single straight or bar stitch parallel to the boltrope on the back side.

Pull the twine tight to press the figure-eight knot into the webbing. Light the 3/16-inch tail of the twine with your butane lighter (see "Tools and supplies," page 44) and, once it burns near to the knot, squash the knot with a sacrificial (insulated) blunt object to douse the flame and "rivet" the knot flat. Flattening the knot minimizes chafe inside the seizing and augments the knot's holding power.

Wrap the webbing over the boltrope and feed the bitter end through the grommet to bring it back to the front side (**PHOTO 7**). This first layer of webbing is there to prevent the slide from chafing against the boltrope.

Wrap the webbing to attach the slide: Wrap the webbing once again up and over the boltrope but this time feed it through the bail of the slide as you hold the slide against the boltrope. Pierce the webbing with the needle from the back to bring the twine to the front of this new layer (**PHOTO 8**).

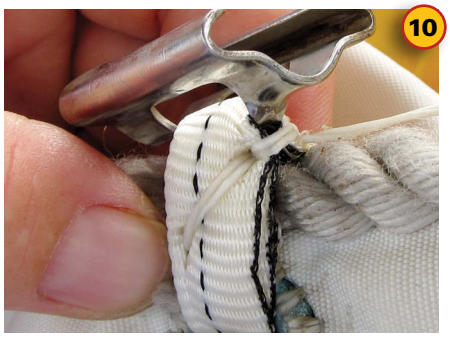
Repeat this step (including the step where you bring the twine to the front) so two wraps of webbing are holding the slide to the boltrope, the edges of these layers of webbing are aligned, and the


9

needle is outside the wraps. Remember, the first wrap of webbing is between the sail slide and the boltrope, while the second two wraps will be threaded through the slide.

Check the webbing length: The bitter end of the third wrap of webbing should be on the back side, aligned with the edge of the grommet, mirroring the termination on the starboard side of the sail (it's visible on **PHOTO 21**).

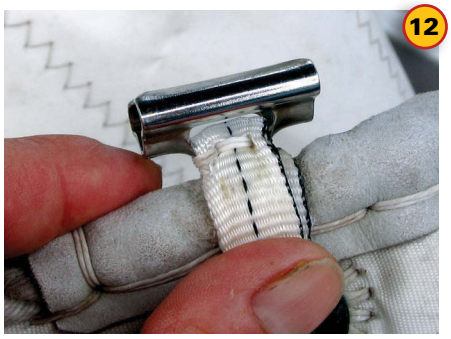
If the webbing is too long, trim it. If it's too short, start over with a longer piece.


10

First crossover: Holding the front side toward you with the twine emerging from the lower left (and through all three layers of webbing), cross the twine over the face of the webbing lying on the boltrope and plunge your needle through the two webbing layers holding the slide to create a stitch that crosses from lower left to upper right (**PHOTO 9**). The needle should not penetrate or even nick the boltrope (consider the consequences of that sort of mistake) but should pierce only the webbing. The needle will emerge on the back side.


11

First seizing: Bring the needle back around the edge of the webbing wraps and insert it once more through the same hole in the same direction (**PHOTO 10**). Pull the waxed twine snugly to secure the slide. If you choose to repeat this stitch (it's not essential but will make the seizing more durable), take care to make it in the same hole as the first and to avoid splitting any of the waxed twine of the first stitch with the needle.


12

Upper bar stitch, back side: Turn the seizing over and view the back side. The twine exits the webbing between the boltrope and the slide bail at the upper left corner of the back of the seizing. Bring the twine across the webbing (parallel to the bail and boltrope) and create a single bar stitch by pushing the needle through from the back to the front of the same two webbing wraps and at the edge (**PHOTO 11**). Once again, avoid nicking the boltrope.


13

Second seizing: The twine now emerges on the front of the seizing. Once again, wrap the twine around the edge of the webbing (front to back) and push the needle through the same hole you made with the bar stitch (back to front) and tug hard to secure it. Repeat this stitch for extra strength if you wish. The slide bail should now be centered above the ring and laying parallel to the boltrope, secured by seizings at both ends (**PHOTO 12**). The needle and twine should be on the front side of the seizing and on the upper left.

Second crossover: Turn your seizing back over to the front side. The waxed twine will have emerged from the upper left. Bring the twine crosswise, going from upper left to lower right (to complete an X across the boltrope) and push the needle through all layers of webbing to the back side. Probe with the scratch awl to find the previously used hole in the sail (**PHOTO 13**). The needle is now on the back side of the seizing, emerging at the lower left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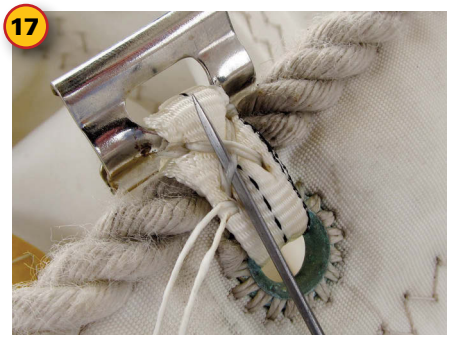

17

(as viewed from the back side). Tug to secure the X stitch against the front side of the webbing (**PHOTO 14**).

Lower bar stitch, back side: Create a bar stitch to secure the end of the webbing by crossing the twine over parallel to the webbing's bitter end and forcing the needle through all the layers of webbing, to emerge at the bottom left end of the X on the front side (**PHOTO 15**).

The crossover stitching will appear only on the front side of the finished seizing (**PHOTO 16**).

Flat knot to finish

A flat knot (used frequently in hand sewing) finishes the seizing. Insert the needle under one of the strands of twine in the adjacent X stitch outside to inside, taking care not to split either strand of twine. This is easier if you roll the needle as you insert it (**PHOTO 17**).

Pull the twine through and pull back toward its standing part (**PHOTO 18**).

Repeat this step, outside to inside, on the opposite strand of twine. Pull back snugly toward the standing part once more (**PHOTO 19**).

Complete the knot by pulling it inside the webbing: re-insert the needle and twine through the hole the two strands had emerged from and pull it out the back side, tugging smartly until the knot disappears into the webbing as viewed from the front side (**PHOTO 20**).

Turn the seizing over to the back side and cut the twine about 3/16 inch long. Using the butane lighter, melt the ends of the waxed twine and squash them to create a rivet (**PHOTO 21**).

Seizing a slug

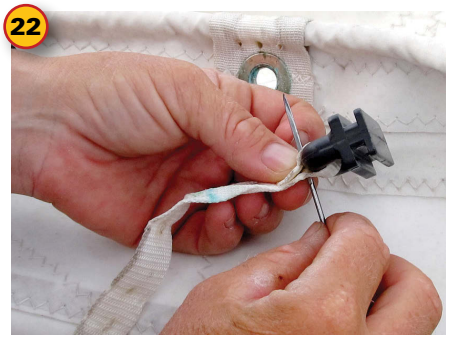
This seizing example is executed with ¾-inch polyester or Spectra webbing and a T-slug. This description will be a bit abbreviated since it is similar to seizing a slide, described above.

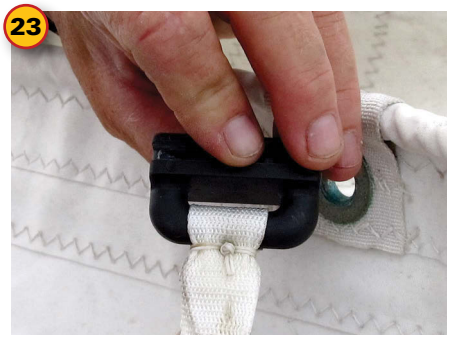
Attach the slug: Thread the sailmaker's needle with sailmaker's twine, as described above. Wrap about 1½ inch of the bitter end of the webbing over the slug bail and secure it by piercing both layers of webbing with the threaded needle in the center (**PHOTO 22**).

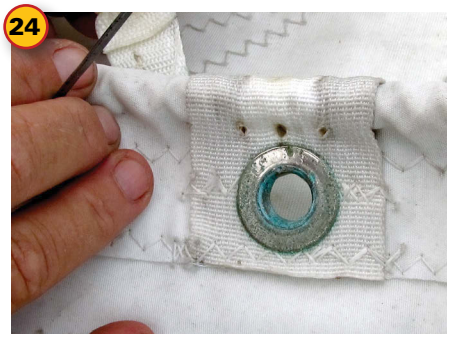
Bring the twine around one edge and back through the center, then around the other edge and back through the center once again. Pull to set the knot snugly against the webbing and rivet the knot (**PHOTO 23**).

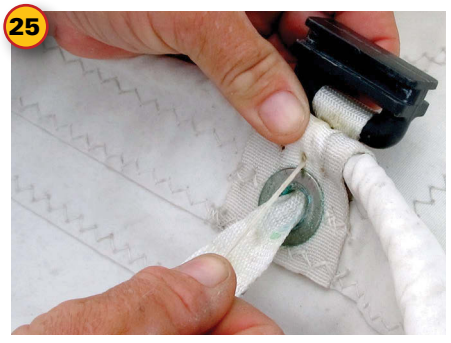
Secure the slug to the sail: For this seizing, three holes are needed in the sail between the grommet and the boltrope. One is centered. The other two are approximately 7/16 inch on either side of the center hole to allow the twine to clear the edge of the webbing when stitching the webbing to the sail (**PHOTO 24**).

Lay the webbing and the attached slug against the "back" side of the sail, thread the needle through the center hole in the sail, from the back, and tug the twine to bring the slug/webbing assembly against the sail. Align the slug bail atop the boltrope and hold it securely while wrapping the webbing down the back side of the sail and through the grommet (**PHOTO 25**).









References

The Sailmaker's Apprentice by Emiliano Marino, International Marine, 2001

The Complete Guide to Sail Care & Repair by Dan Neri, Beowulf Press, 2002

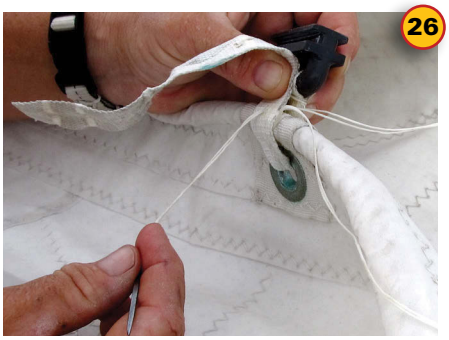
Canvaswork & Sail Repair by Don Casey, International Marine, 1996

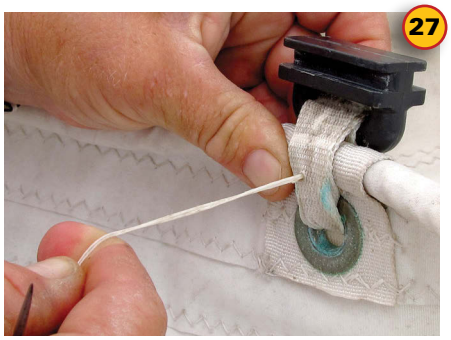
As you bring the webbing up the front side of the sail, pierce it in its center (back to front) to bring the twine to the outside of the wrap (**PHOTO 26**).

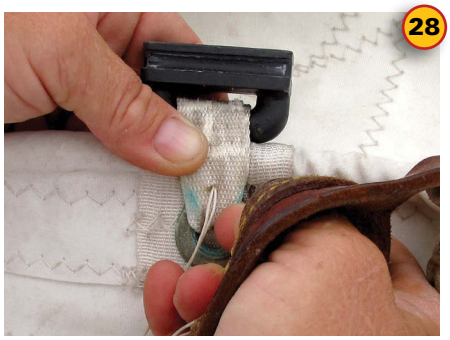
Wrap the webbing through the bail and back around through the grommet (back to front), repeating the step of bringing the twine to the front. A second wrap of webbing through the bail completes the wrapping (**PHOTO 27**).

The bitter end of the webbing should roughly align with the upper edge of the grommet on the back side (visible in **PHOTO 29**).

Secure the webbing to the sail: Holding this assembly snugly, pierce the sail from front to back outside the





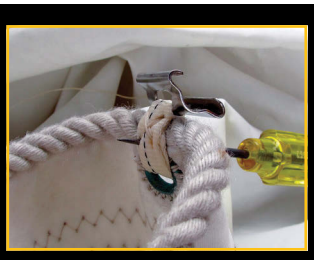


Tools and supplies

When re-seizing slugs or slides, you'll use sail-repair tools for hand-sewing and other supplies you probably already have in your sail repair kit. If you don't have them, this is a good time to get equipped.

Tools you'll need

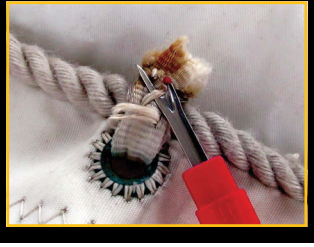
- A right- or left-handed leather sailmaker's palm. This will enable you to safely and effectively thrust the ultra-sharp sailmaker's needle through thick assemblies of webbing and sailcloth. The best is a medium to heavyweight palm. If you mold it to fit your hand comfortably, that will reduce fatigue and cramping when you use it. To mold the palm, soak it in warm water until it's soft. Then shape it so you can easily grasp a sailmaker's needle between your thumb and fingers and brace the needle's eye against the palm's dimpled metal thrusting base. Once the palm dries, it should fit your hand.
- Sailmaker's hand-sewing needles. The best needles are made in the UK and are cast and forged. The tips of these needles are triangular and very sharp. When they're not in use, wrap the needles in a cotton cloth that has been soaked in sewing-machine oil and store them in their plastic cylindrical container to prevent them from rusting.
- A good-quality butane lighter or soldering tip/hot knife. You need this to melt thread to "rivet" knots.
- A heavy-duty seam ripper. Use this to safely disassemble existing seizings.
- A fine-tipped scratch awl. Make or enlarge holes in the materials with an awl to lessen the force required to push the needle through thick dense webbing and sailcloth.



- A fine file, such as a fisherman's file. Use it to keep the needles sharp.
- Sharp scissors. Use them for cutting webbing and twine.

Supplies

- Polyester tubular or Spectra webbing in a ½- or ¾-inch width, depending on the size of your slugs. Polyester webbing is preferable to nylon as nylon stretches significantly when wet.



Spectra webbing may be used but never use polypropylene webbing. Estimate 1 foot per slide, though you may use less. Purchase twice as much as you think you will need so you'll have spare webbing for future projects.

- Hand-sewing twine Polyester UV-resistant, waxed, round, in medium weight, V-462. We use Dasew by Heminway & Bartlett.
- Slugs or slides. You might have to replace lost or damaged ones.

webbing — but very tight to its edge — using the hole previously made in the sail (**PHOTO 28**).

Next, pierce all the layers of webbing back to front in the center, bringing the twine and needle once again to the front side of the sail (**PHOTO 29**).

Repeat this stitch on the opposite edge of the webbing: front to back, tight to the edge of the webbing, and then back to front up through the center (**PHOTOS 30, 31**).

Seize the slug: At this juncture, the needle and twine emerge from the center hole in the sail and webbing and are on the front side of the sail. Bring the needle up the center of the webbing (parallel to its length) and pierce, in the center and front to back, the two layers of webbing holding the slug bail — without nicking the boltrope (**PHOTO 32**).

The twine now emerges under the slug's bail on the back side of the sail.

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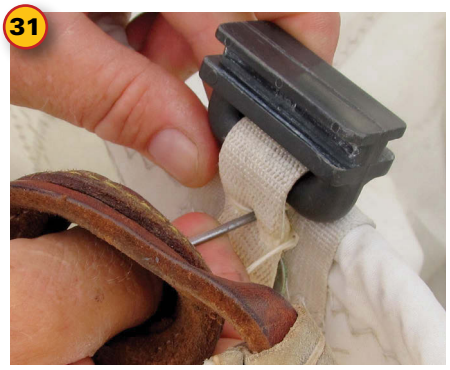
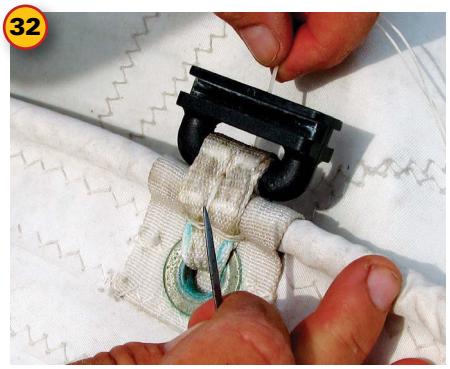
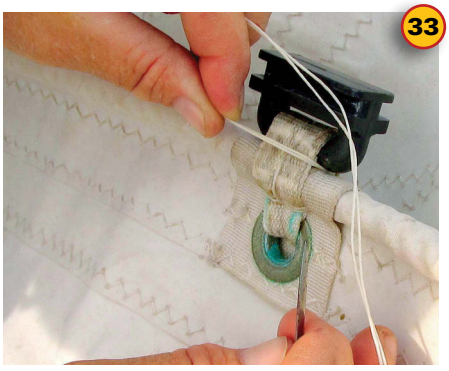




continued from page 45

Wrap the twine around one edge of the webbing to bring it to the front (**PHOTO 33**).

Pierce the webbing once again in the center hole to move the twine to the back side of the seizing (**PHOTO 34**).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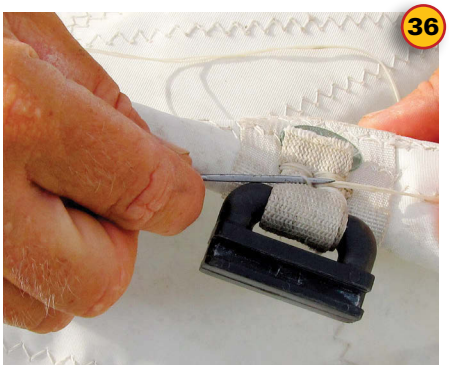
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Pull firmly to tighten the twine against the edge of the webbing. Repeat the wrapping around the opposite webbing edge and again pierce the seizing in the center, pulling firmly once again (**PHOTO 35**).

Repeat both of these seizing stitches so there are two sets of stitches (four strands of twine) along each edge, tightening each stitch firmly to snug the webbing to the slug bail (**PHOTO 36**).

Secure the seizing: At this point, the twine and needle emerge from the back side of the sail. Select one stitch or the other (two strands) and tie a flat knot.

Bury the knot in the webbing by putting the needle back through the center hole (back to front). The twine will emerge on the front side just under the slug (**PHOTO 37**).

Bring the needle and twine down the face of the webbing along its centerline and plunge the needle into the bottom center hole (**PHOTO 38**).

The twine and needle are now on the back side of the sail. Once again, secure the webbing to the sail by creating a stitch around both edges and through the sail.That is, push the needle through the sail at the edge of the webbing (back to front) and then back through the center of the webbing (front to back), tugging smartly. Repeat this stitch around the opposite edge of the webbing (**PHOTO 39**).

Flat knot to finish: The twine and needle are now on the back side of the sail in the center of the lower seizing. Using two strands of the adjacent stitch, create a flat knot (see page 43) and pull the knot into the webbing through the center hole by pushing the needle and twine from back to front and pulling until the knot disappears into the webbing. Snip the end of the twine as it emerges on the front side to 3/16 inch, melt it, and make a rivet (**PHOTO 40**).

A stitch in time

Renewing seizings to ensure an aging mainsail stays firmly attached to your mast is not a complex process and provides valuable practice in using simple hand-sewing techniques. This sort of expertise has been invaluable to us in keeping our boat's sails ready for the challenging conditions of open ocean sailing.

Philip DiNuovo and Leslie Linkkila came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professional jobs and left the Pacific Northwest behind and are now in the South Pacific. Follow them in their travels at <http://sv-carina.org>.


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Salvaging a dream

When super-human effort isn't enough, humanity succeeds

by Philip DiNuovo and Leslie Linkkila

This is a story of disaster, struggle, despair, and dreams lost . . . but also one of friendship, creativity, redemption, and triumph through sheer stubbornness. It begins with a cyclone.

It was late in the season for tropical storms in the south Pacific when a deep low formed between Fiji and Samoa. It developed quickly and swept onto the north coast of Fiji's northern island of Vanua Levu on the ides of March 2010 as Category 4 Cyclone Tomas. It then slowed dramatically, its 145-knot winds and pounding rain leveling villages, stripping coconut palms bare, and flooding cropland.

In a remote corner of the island at Viani Bay, a late-model Hunter 41 was catapulted onto the reef like a toy boat. Those aboard were rescued through the heroic efforts of the crew of a nearby motorsailer. In the storm's aftermath, local boys undertook a salvage operation — mostly with bush knives — and the damaged vessel was left abandoned.

A seafaring nomad

Brian Taylor is a Kiwi and a voyaging nomad who sails mostly by himself. By definition, singlehanders sail on a slightly different tack than the rest of us and Brian is no exception. Buzz-cut and bespectacled with a perpetual cloud of smoke hanging about his gaunt frame, Brian is cheerful, kind, and softly erudite even when just passing along great jokes . . . an all-around good mate.

We met Brian at a well-known watering hole in Tonga's Vava'u group during the 2009 cyclone season. Although he occupied "his own bar stool" at the Mermaid, he wasn't as entrenched as Jack Wagoner, a sprightly, seemingly ageless WWII veteran who not only had a bar stool dedicated to him but also had his picture as "Commodore" above the bar. While Jack stayed near his bar stool, Brian set sail downwind for Fiji in his slow but reliable, rust-streaked, much-patched, one-off steel cutter, *Kyogle*.

When you cruise distant ports for any appreciable amount of time, characters like Brian drift in and out of your life, so we were pleased and not too surprised to see him again in Savusavu, Fiji, a funky, sleepy town of friendly Fijians living peacefully among wacky expats. We felt right at home.

We learned that Brian had purchased the wrecked Hunter 41, still ashore in Viani Bay and now renamed *Viani*. Brian was in the throes of a seemingly impossible salvage operation. Viani Bay is fringed with reef, yet incredibly deep and inconveniently located 200 miles from the nearest yacht haulout facility, in Lautoka. No roads reach Viani Bay. Two small villages perch on its shores, most of the homes occupied by the extended clan bearing the name of Fisher. Transportation in or out is by tortuous footpath across the mountains or by local boat, 15 miles to Buca Bay to catch the once-daily, rickety former school bus that travels down the pothole-strewn Hibiscus Highway for a kidney-busting 6-hour ride to Savusavu.

The remote location didn't diminish Brian's enthusiasm for saving this previously well-found modern yacht. He dreamed *Viani* would someday become his comfy floating RV (or caravan as they say Down Under). Armed with enthusiasm and aided by friends who often questioned his sanity, he began the salvage operation.

The first major challenge was to recover *Viani's* looted instruments and equipment. This was eventually

Cyclone Tomas threw a Hunter 41 onto a reef-bound shore in Fiji, at top of facing page, where she was abandoned by her owners. The local villagers, who had no access to heavy equipment, righted her by digging a hole beneath her keel with shovels. This gave them access to patch the holes in the starboard side, at bottom of facing page. Brian Taylor, at right in the photo on this page, purchased the wreck and engaged his friend, Tuki Langdon (and, by extension, many of the local populace) to help him salvage it.

accomplished with the intervention of the village chief (this is Fiji, remember). The loot, or most of it anyway, was eventually returned in a pile of dirty cardboard boxes. Spaghetti-like bundles of cables and connectors protruded from the equipment as wires had been snipped or hacked hastily and without regard to future use.

At this juncture, *Viani* was afloat, thanks to the extraordinary efforts of Brian's friend Tuki Langdon and a team of Viani Bay locals. (Without Tuki there would be no story to tell.) Cyclone Tomas had deposited *Viani* on her port side, leaning landward and with a large hole at her waterline. Lacking heavy equipment, Tuki and the boys ingeniously righted her for patching by excavating the ground beneath her with shovels. The hole quickly filled with water, but *Viani* stood tall and was soon patched, tilted to seaward, and floated.

Viani may have been patched and floating but she was essentially sinking, and sinking fast. Her keel and the stump of her rudder wobbled alarmingly with each passing wake. Wires that had previously connected bilge pumps dangled in the sloshing water. All hands concentrated on keeping Viani afloat long enough to allow her to sail, motor, or be towed to a site where repairs could be made.

Quest for a safer haven

Brian's first step was to move *Kyogle*, the mother ship for the salvage, to Fawn Harbor, a safe haven 15 miles downwind. Meanwhile, back in Viani Bay, Tuki was diligently manning the hastily wired bilge pumps and keeping batteries alive by hot-wiring the auxiliary engine (the engine panel had been looted).

After setting sail for Fawn Harbor, *Viani*'s crew battled capricious winds and an inoperable engine well into the night as they floated toward Vanua Levu's barrier reef, roaring with surf. Unable to confirm a safe course into the narrow, dog-legged entrance to Fawn Harbor, Brian decided to leave Tuki on board *Viani* while he took his inflatable in search of the break in the reef. Tuki — who is not a sailor — drifted through the night dangerously close to disaster.

The moon had set and Brian was unable to find the unlit tree trunk that marks the entrance to Fawn Harbor. Exhausted, he fell asleep while his dinghy drifted. When Brian did not return, Tuki picked up his cell phone, saw a faint signal, and called for help from the Pickering family in Fawn Harbor. Tony Pickering jumped in his skiff and drove through heavy seas to reach *Viani*, took her in tow, and guided both boats through the pass and into the calm waters of Fawn Harbor. They immediately filed a missing persons report for Brian.

Spirits were low up and down the coast, but the dawn brought Brian into Fawn Harbor, groggy but very much alive. His good friends, though relieved he was safe, joked that they wanted to kill him for undertaking such a crazy escapade. Meanwhile, *Viani's* bilges continued to fill at an alarming rate and she couldn't be left unattended in case the hastily assembled connections to her temporary bilge pumps failed.

A reunion

Into this adventure we sailed a day later, almost, but not quite, oblivious to it.

Our first order of business was to organize some sustenance for the team. Brian seemingly exists on tea and cigarettes, but Tuki and the Fawn Harbor boys (led by chief Maya) needed food. The boys were important for the planned careening that all hoped would reveal the cracks and allow for effective patching. While Brian traveled to Savusavu in the hope of negotiating with customs authorities, we assisted Tuki as he applied gallons of automobile filler to *Viani's* hull while free diving. His efforts seemed to have little effect on the leak.

The day of the careening, chosen for its tides, started with a squall followed by a magnificent rainbow that made everyone optimistic. Armed with anchors, miles of line, and trunks of wetland trees, the team eased *Viani* onto a shallow patch near the reef and propped her up. They watched the water recede and then rise again but could not locate the secret to her damage. *Viani* continued to take on water.

Into this scene stepped the unflappable Rita Nesdale. Rita travels from Perth each year to spend a month or two accompanying Brian on his sailing adventures. There was going to be no cruising this year for Rita and, to her surprise, she didn't have to make just *Kyogle* livable, she had to face *Viani's* wrecked interior too.

A week or so later, a rare break in the trade winds that make Vanua Levu a dangerous lee shore allowed Tuki, Rita, and Brian to make the 35-mile dash for Savusavu, where ferries and small planes call and limited hardware is available. Brian and Tuki built a cradle and hauled *Viani* ashore.

After freeing the boat from the reef in Viani Bay, Brian moved her to Fawn Harbor to careen her and patch persistent leaks.

Fiji may not be a third-world country, but things don't happen here in ways we are accustomed to. Instead of ordering lumber from a lumberyard, Tuki hiked his ancestral lands, selected the finest vesi wood trees, felled them, shaped them into beams with a chainsaw, and had them hauled across the coastal mountain range to where *Viani* waited at Nakama Creek.

A jungle haulout

When we sailed back into Nakama Creek four months later, we found Brian and Tuki bustling about *Viani*, sitting high and dry in a cradle that looked strong enough to hold the *QE II*. We had missed the action but were regaled with stories of how the cradle was dragged by brute force up the gravel boat ramp to sit just high enough to have king tides lapping up under her shattered rudder — a haulout coordinated and executed in typical jungle style and with typical jungle success.

Things were looking up and spirits were high. *Viani's* keel had been straightened and patched, her rudder prosthesis was nearly complete, and the wiring and plumbing puzzles were being solved. Dealing with the askew propeller shaft would have to wait until *Viani* rested once again in the briny blue and the hull resumed its proper shape.

The question was how to get *Viani* wet again. How, exactly, could they push 13 tons of boat and cradle down a stony incline? They had not used rollers during the haulout and it would be impossible to install them now without lifting *Viani* with a crane. So Tuki visited his church (no, not to pray) while Brian puttered off to Hussein's Hardware to buy a whole fleet of mini hydraulic jacks.

Then began the slow process of jacking up sections of the cradle and inserting under it the borrowed 2-inch Schedule 40 steel pipes that normally support the ceiling of Tuki's church. As the weeks went by, the cradle snuggled

deeper into the ground made soft by the summer rains. Even with rollers, *Viani* stubbornly refused to move. Brian, amazingly, seemed unfazed and sat puffing on a cigarette and contemplating the failure *du jour* before ambling off to make tea so he and Tuki could engineer a new plan.

One day, after a crowd of men failed to move *Viani* even an inch using jacks and levers, Tuki got an idea. He gathered up all the coconut-palm trunks lying around the site and laid them end to end in a row from the upland end of *Viani's* cradle to a hardwood post the team had cemented into the ground roughly 70 feet inland. A hydraulic jack inserted into the row of palm trunks was able to push the cradle, and *Viani* began to move downhill, albeit glacially, toward the sea — another great example of jungle engineering that, though wobbly, actually worked.

On April Fool's Day, Brian sent this email message:

Hi All . . . Well we are there at long last; floating alongside the wharf and still in the cradle which is lashed to the yacht . . . We eventually called on the services of the 13-ton powerboat with twin engines. No, the pulling power was not enough, so he took a running jump with about 20 feet of slack. No, that did not work either but we did break some ropes. He increased speed before taking up the slack (and then the rope stretch) to 7 knots and we did move a foot or two. Interesting watching the powerboat doing 7 knots forward, being stopped by the non-moving load, and then being pulled quite quickly backward by the rope stretch taking up. After this initial movement it was easy . . . just a couple more running jumps and we were free.

I pushed the cradle containing the yacht to the wharf with the dinghy and we started looking around

In Savusavu, Tuki and his team built a cradle for *Viani* and hauled her ashore so Brian could set about making her seaworthy again.

for a cup of tea until we noticed the bilge pump was working. Yuck. Turned out that one hose was leaking (would you believe the big washing machine/dryer outlet?) and the seacock, although turned off, was not operating . . . Tuki smacked a bung in fast from the outside of the hull, so we are now a dry boat again . . . Then we had a cup of tea!

. . . That, I hope, completes the end of the 9-month salvage attempt which started after Cyclone Tomas (16 March 2010) took Viani *ashore at Viani Bay.*

Viani **and her cradle settled into the rain-softened ground and resisted all efforts to budge her toward the sea, above. When a new scheme eventually prompted** ***Viani*** **to move, the crew (that included the authors — Leslie in the white and Philip in the floral blue), took a celebratory break, below.**

A false start

Alas, *Viani*'s salvage was not complete. While fixing what now seemed to be minor issues, Brian optimistically set sail two weeks later inside Savusavu Bay. All went well until the rudder fell off and disappeared into the deep. A rescue operation was launched to tow *Viani* back to Nakama Creek. Two months went by while Brian organized the purchase of a replacement rudder that, when all the costs were added up, doubled his investment in *Viani*. Inexplicably, U.S. officials held up the shipment due to security concerns. Typically, although it had been consigned to Savusavu as air freight, the rudder eventually arrived by sea.

Extracting the stub of the old shattered rudder stock and installing the very buoyant replacement rudder while *Viani* was afloat (and still slowly sinking) stretched the creativity of the team. At last, she was afloat and mobile once again. During the interim period, there had been plenty of other projects to keep Team Viani busy. Ever cheerful, Brian wrote:

GPS — it was actually inset into the deck . . . wires cut, of course, and broken inside the unit — however Michael of Bebi Electronics *here managed to do some micro-soldering for me and it is all go; connected up to the chart plotter/autopilot/radar. All of this stuff now talks to itself (including wind speed and direction, depth, and boat speed) so I can have the radar image on the chart plotter screen and vice versa. Maybe I do not have to leave the chart table to go sailing (???) . . . Interface Google Earth and maybe I don't even have to leave the wharf to see the world!!!*

A real boatyard

Things seemed to be looking up when the 150-mile passage to Vuda Point Marina in Lautoka went smoothly and *Viani* was lifted and set gently into a proper boatyard for what Brian hoped would be final repairs. Of particular concern was the area where the keel joined the hull. He needed to eliminate persistent leaks. As expected with a boatyard vacation, a thousand additional things occupied the team that once again included the affable and tolerant Rita.

Launch day in the boatyard was tense. As soon as the travel lift set *Viani* in the water, she began to leak, so she was hauled ashore once more. Diagnosis: insufficient reinforcement where the keel stub joins the hull. During the re-launching, the previous repairs had opened up and, when she was set down again, the keel depressed an inch up into the bottom of the hull. A lesser man might have thrown in the towel at this point but, instead, a now grim Brian emailed Hunter Marine for engineering advice. Hunter suggested surgery from the outside of the hull to allow access to the inner supports where structural repairs might be made.

Tuki and Brian completed the repairs as recommended, applying reinforcements to the inside and outside of the hull. Once Brian pronounced the surgery successful, they closed the wound, sealed it with epoxy, applied antifouling paint, and *Viani* was launched once more. A quick 18-mile test sail downwind to Musket Cove confirmed a dry bilge and allowed for a small celebration. Rejuvenated and unfazed by a growing list of additional issues, Brian and crew brought *Viani* back to Vanua Levu, even stopping in a few choice

anchorages to allow for a bit of relaxation after 17 months of struggle

Back in Savusavu, Brian began to prepare *Viani* for her first long passage from Fiji to Tonga. While there, he sold his trusty old *Kyogle*.

A fateful passage

Viani's departure was delayed by late-winter blustery weather and friends' concerns, but finally Brian pointed *Viani* east toward Niuatoputapu, rolled out sail, and disappeared over the horizon, elated to be at sea. Even under normal trade-wind conditions, this is a hard passage into large ocean swells, but conditions deteriorated even further and *Viani* took a beating. Quite suddenly, Brian heard the bilge pumps working and investigated. Water was pouring into *Viani* and the pumps were overwhelmed. Extra pumps he activated could not keep up with the flooding. Still 125 miles from Niuatoputapu, Brian altered course for Niua Fo'ou, about 40 miles downwind.

Niua Fo'ou has no protected anchorage but it was the nearest land and would have to do. After anchoring on the narrow shelf on the lee side of the island just off the supply-ship wharf, Brian snorkeled to survey the damage. He could not believe what he saw: extensive cracking around *Viani's* keel and the same keel wobble that had plagued them from the onset of the salvage.

Knowing the damage was permanent and irreparable, Brian considered his options. He could not safely go to sea again in *Viani* and there was no harbor, crane, or even a remote chance of repair at Niua Fo'ou. He could either let her sink where she was or drive her ashore. He put *Viani* on the beach and donated her and all her gear to the local population.

Instantly, Brian became the guest of the Tongan government. Many of his possessions, such as his camera, were held pending an "official" investigation. The Tongans were good hosts though, housing him, homeless as he was, in an apartment normally reserved for the king when he visits.

Word of *Viani's* demise leaked out, though details were few. The cyberwaves were abuzz with worried emails begging information. His good mate Curley Carswell, at anchor in Vava'u 200 miles away, prepared to rescue him by sea. Before Curley and crew could depart, however, the kindly Tongans decided to leave the copilot of the weekly flight to Niua Fo'ou behind so Brian could take his place and be flown out to Neiafu in the Vava'u group.

In Vava'u, Brian was quickly enveloped by the warm welcome of friends. Larry and Sheri at the Ark Gallery gave him a clean berth aboard a borrowed yacht, good cheer, and space to recover from the shock of being marooned and boatless. Through this turmoil, Brian was remarkably cheerful and writing reassuring emails, despite the painful loss of his home, most of his possessions, and his dream.

It was now time for Jack, "commodore" of the local yacht club that was now defunct due to a fire that leveled the Mermaid Café, to step in. His boat, *Antares*, a Pearson Vanguard, had been his refuge and vacation home for more than 20 years but now sat deteriorating at her mooring in Vava'u. He was home in California when he heard of Brian's disaster and kindly offered to sell *Antares* at a price Brian could afford.

Before leaving Fiji on her fateful voyage to Tonga, *Viani* displayed the grace she once possessed as a sailing boat.

Some might say that Brian just bought himself another nightmare, but *Antares*, though old and in need of care, is a strong, cyclone-tested boat.

So here the story ends . . . or begins, depending upon your point of view. Brian is once again afloat, the ever-present mug of tea and cigarette in hand, knees crossed and deep in thought as he plans his next escapade with Rita and Tuki, one dream lost but another just found.

Philip DiNuovo and Leslie Linkkila came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professional jobs and left the Pacific Northwest behind and are now in the South Pacific. Follow them in their ongoing travels at <http://sv-carina.org>.

Why sails fail

We had just crossed the equator northbound on passage from the Solomon Islands to Micronesia when we saw a squall approaching from the east. We studied the squall's profile on radar and decided it was typical of what we had already endured a dozen times over the last few days and also that it would likely pass behind us. Our mainsail was already deeply reefed, so we rolled in about half of the genoa, closed the companionway, and waited.

In an instant, the wind direction shifted dramatically and the squall was upon us, bringing deafening wind, blinding rain, and sea spray. *Carina* heeled over, came up, and rocketed into the darkness with her port side deck immersed to the portlights as waves rushed aboard. When Leslie released the sheets, the mainsail and boom fell violently against the leeward running backstay. *Carina* still heeled dangerously while Leslie cranked furiously on the furling line as sails and lines flogged violently in the gale. By the time things were under control, the squall had moved on and we were flopping around in steep square waves, soaked and exhausted. Trade winds filled in behind the squall as if in slow motion and, as we prepared to get under way once again, we noticed *Carina*'s mainsail had lost a batten and its aging leech was rapidly unraveling. Suddenly we were facing a journey of hundreds of ocean miles sailing to windward without a mainsail.

This was just one more lesson for us in how the very nature of sailing is hard on boats and their gear, and especially on sails.

The materials used to make modern cruising sails are all plastics, and plastics are polymers, meaning they are composed of small organic molecules (monomers) chemically bonded together to form very large, very strong molecules. If the bonds are broken, the polymers break down and the materials fall apart. (The monomers, and hence their polymers, are called organic chemicals because they contain carbon.)

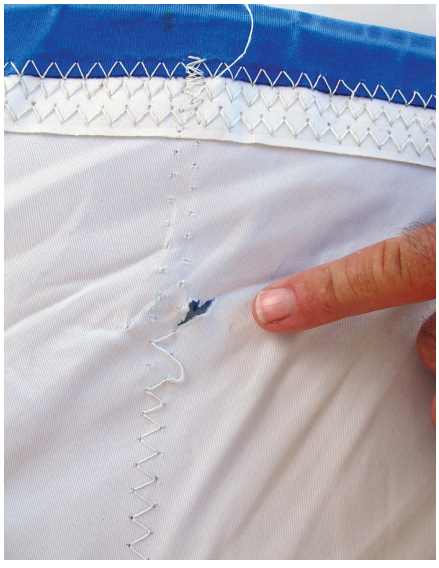
Dacron, used to make sailcloth, thread, and webbing is a polyester. Nylon, used for webbing and light-air sails, is a polyamide. Spectra is an ultra-high-molecular-weight polyethylene. Sunbrella, a solution-dyed acrylic fabric, is a polyacrylate. Damage to these organic polymers can occur from physical, chemical, radiation, and biological sources.

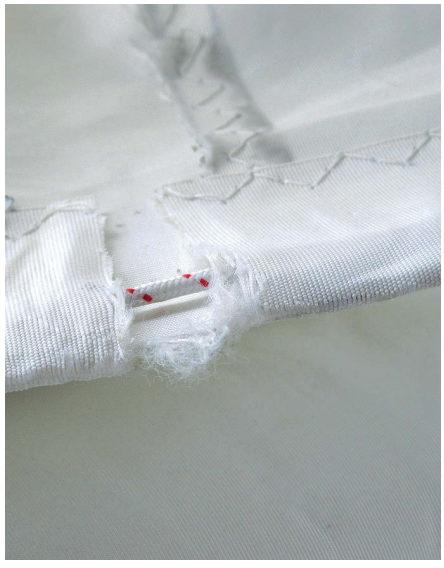
Physical damage

Physical damage occurs when sails slat against wire rope rigging in light wind or are tacked across standing rigging. They can chafe against lifelines and bow pulpits. They can collapse and then suddenly fill with a gust of wind. Sails may be allowed to flog or flutter along their edges.

In heavy winds, leech flutter, however minor, will rapidly turn a sail's edge into confetti. Once a leech tape is compromised, the leech line is exposed and can become snagged on rigging. When this happens, the leech tape will rip open end-to-end.

Chafe or the abrading of the sailcloth, stitching, or webbing can occur wherever a headsail contacts a part of the boat such as spreaders, pulpit, or





Sailcovers are intended to protect sails from the ultraviolet light in sunshine. This one, top of page, is not being allowed to do its job. Sails suffer physical damage from many causes, above left, center, and upper right. If not repaired promptly it only gets worse, above right.

Nature and lack of nurture take their toll

BY LESLIE LINKKILA AND PHILIP DINUOVO

shrouds. Lazy-jacks, with or without a stackpack-type sailcover, cause mainsail chafe. A better alternative are lazy-jacks that stow away alongside the mast and boom, such as EZ-Jax. Chafe also occurs where a sail is attached to the vessel — at the hoist and tack shackles — and at the clew where constant movement of sheets can chafe the sailcloth and unprotected webbing.

Chemical damage

Chemical damage can occur when degrading hardware leaves a residue that stains and attacks fabric by breaking down the polymer molecules. Hanks and pressed-in rings are common culprits.

Despite the aesthetics, we prefer to not attempt to remove stains if the method necessary to do so is harsh and might further damage the cloth. We prefer to remove the contaminating element, wash the area with warm soapy water, rinse it thoroughly, and let it dry. If the sailcloth has actually been breached by the chemicals in the stain, we repair it by applying a patch.

One of the more visible causes of chemical damage to sails is rust, which might arise from stowing a wet sail, upper image, or from corrosion of sail hardware, above.

Radiation damage

Exposure to ultraviolet radiation is the cause of the greatest damage we have seen while repairing cruising sails. Sails are exposed to UV while in use, but many headsails also are vulnerable to UV damage when furled. The same is true for mainsails. Stackpack covers have become popular and it's common to see a mainsail sitting for days in a sailcover of this type that has not been properly closed and secured. In short, if you want your sail to last, no key load-bearing webbing, stitching, or any amount of Dacron sailcloth of a sail should see the light of day when the sail is not in use.

Most sails are protected from UV radiation using shade cloth. Sunbrella is the most widely used, though there are others, such as Solacryl. Darker colors provide better UV protection than light colors because the dyes used to make them absorb light. Darker-colored shade cloth lasts longer too.

Sunbrella has two disadvantages as a shade material: weight and poor abrasion resistance. For working jibs and genoas on a cruising sailboat, the weight is generally not a problem, though many opt for UV-coated Dacron which, in our experience, does not last as long or protect the sail as well as dark shade cloth. The bottom line: dark-colored shade cloth such as Sunbrella provides the best protection from UV for cruising sails.

Along the exposed foot and leech edges of a furling genoa or staysail, light can sneak in while a sail is furled, so whatever UV-protective material is used should wrap around the inside of the foot and leech to the full width of the sail tape (approximately 1½ to 2 inches for sails on the average cruising yacht).

At headsail corners, there are two issues: light leakage (as with edges) and webbing damage. Light leakage can be mitigated by incorporating a patch of UV-protective material in the inside of a roller-furling sail at all three corners.

Protecting webbing attachment points is even more important. Webbing connections on all corners of a headsail should be protected from exposure to UV radiation. Better sailmakers use tubular polyester webbing inside of tubular Spectra webbing for head and tack corners and then go on to sew a leather cover over this webbing assembly. The clew-corner webbing should also be protected from UV (and chafe) by leather. Thus, all sail corner connections are both UV- and chafe-protected on these better-made sails. This type of protection lasts a long

UV light from the sun is an unrelenting cause of sail damage, degrading everything from stitching, upper image, to the webbing seizings on sail slides, above.

Resources

Canvaswork & Sail Repair
by Don Casey, International Marine, 1996

The Sailmaker's Apprentice
by Emiliano Marino,
International Marine, 2001

The Complete Guide to Sail Care and Repair
by Dan Neri, Beowulf Press, 2002

The Art & Science of Sails: A Guide to Modern Materials, Construction, Aerodynamics, Upkeep, and Use
by Tom Whidden, St. Martin's Press, 1990

Mildew, which often appears as black specks, degrades sailcloth biologically.

time, years in fact, before the leather degrades and must be replaced. In the interim, the load-bearing webbing is protected, retains its strength, and lasts indefinitely.

Biological damage

Creatures such as birds, bats, geckos, cockroaches, mud wasps, and the more insidious microbes can leave biochemical residue that damages sails. Salt crystals and mildew abrade sails, but the growth of mildew also rots sailcloth by breaking down the fabric's polymeric organic molecules. This is, after all, the role of fungus in nature.

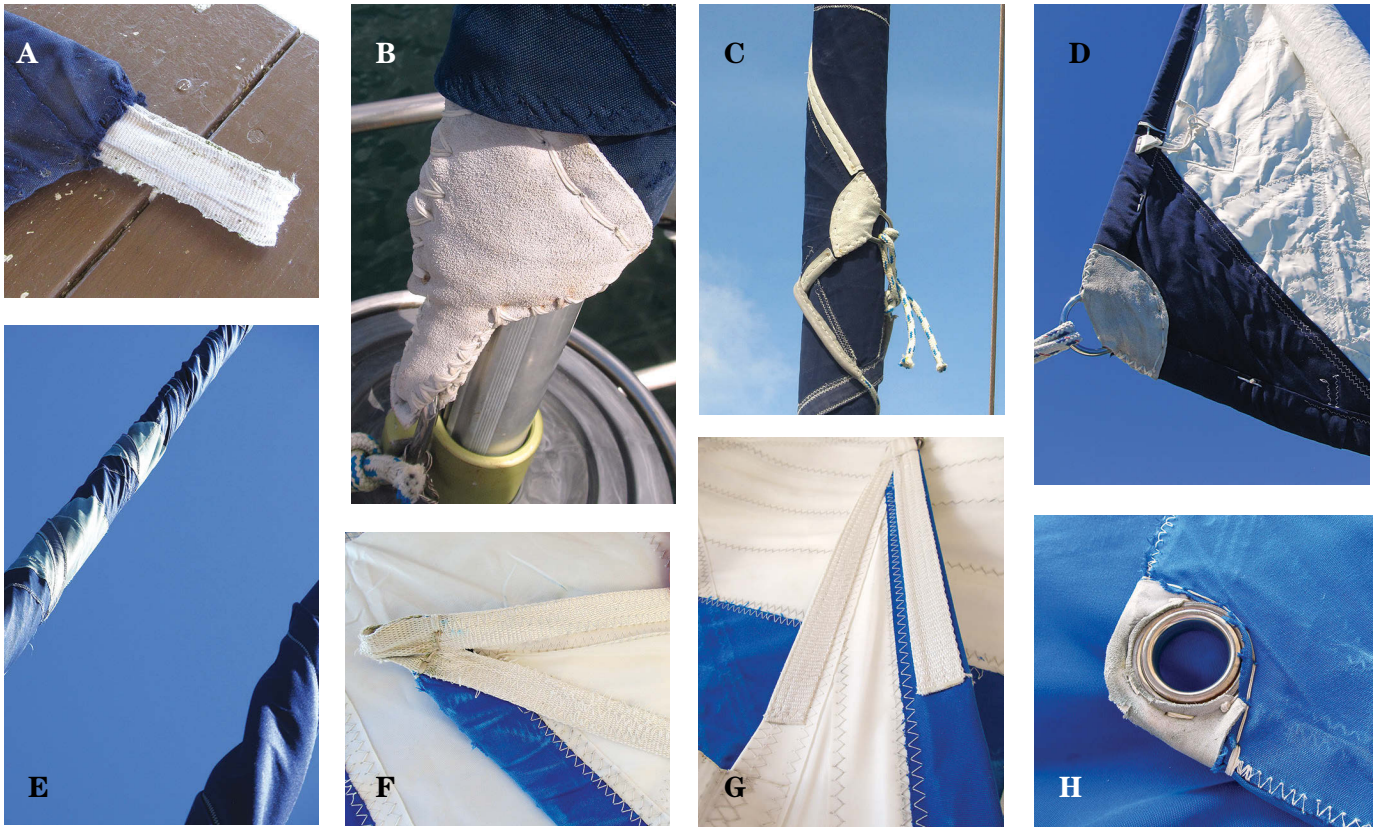
Clean, dry sails will not mildew, whereas sails that are wet or salty (and therefore continuously wet) provide a comfy place for fungus to reproduce. Mildewed sails plague sailors in temperate and tropical climates alike.

New Sunbrella shade cloth sheds water, but this property decreases with age and UV exposure. As Sunbrella ages, it begins to absorb moisture and stay wet longer, promoting the growth of mildew on the sail it is meant to protect. In rainy climates, stack-pack-type mainsail covers left open can trap water and promote the growth of fungus on the wet mainsail.

For killing established mildew, there are many recommended cocktails of water, bleach, vinegar, or baking soda followed by sunlight. Proceed with caution when applying any harsh chemical agents to your sailcloth.

Modern sails are made of high-performance plastic materials that are damaged by physical, chemical, radiation, or biological sources. By specifying sail design features when purchasing and by learning how to care for your sails, you can mitigate such damage and keep your sails pulling longer. This is especially important if you plan to cruise to distant shores where there is no sailmaker.

Leslie Linkkila and Philip DiNuovo came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professional jobs and left the Pacific Northwest behind to cruise the South Pacific in their Mason 33, Carina. *In April of this year,* Carina *was in the midst of a refit in the Philippines. Catch up with them at http://sv-carina.org.*



A. Layered webbing protects primary load-bearing webbing from UV exposure. B. Covering layered webbing with leather can further protect it from chafe and UV exposure. C. Jib clews take a beating, but leather over the clew webbing and along the adjacent tack and foot offer protection from UV and sheet chafe. D. Shade cloth on the inside of a sail corner further protects the webbing against damaging radiation "leaking" around the edges. E. Patches of extra fabric protect a Sunbrella sun cover from chafe against the spreader and the radome. F. Chafe and UV radiation weaken sail corners. G. In the absence of a protective cover of shade cloth, UV radiation will damage Dacron sailcloth on the inside of the hoist of a roller-furling sail. H. An unreinforced pressed-in clew ring shows deterioration from chafe.

To sew, or not to sew

A stitch in time can extend the life of a sail

BY LESLIE LINKKILA AND PHILIP DINUOVO

The monsoon season was upon us. Each day we spoke by high-frequency radio to friends clawing their way toward Palau aboard a 50-foot sloop. Plagued by multiple failures, including their autopilot, radar, and throttle cable, they remained remarkably cheerful despite making only 20 nautical miles to the good after two days at sea. Dead calm and steamy heat was interrupted by violent squalls that sometimes brought 50-knot winds and boarding waves. They were often over-canvassed and caught unaware by squalls that arrived at night.

When they made landfall, their stay-sail was in tatters, their furling line was broken, one genoa sheet was broken, and the other was badly chafed. Hours after arriving, they were absorbed into the fleet of cruisers who commiserated with them and toasted heartily to their safe arrival. They would assess the damage in the morning.

Makeshift sail loft

To assess sails and plan for repairs, you need plenty of room, preferably in a shoreside location protected from the weather, clean, and big enough to spread out a sail. In some places, finding such a spot is a challenge. Avoid dragging the sail across concrete or gravel as this will abrade the cloth. Grass can leave stains on the sail, but that's better than spreading it out on tarmac or gravel. Use a large table only if the ground or floor is dirt or dirty.

Once a sail is laid out, you can figure out whether it can or should be repaired. We're talking about repairing failures — rips, tears, chafe, and broken or lost hardware — rather than correcting flaws of draft or a wrinkle or two.

Condition survey

Of primary importance in such an evaluation is the overall condition of the sail, including the stitching and, in particular, the sailcloth. Does the sailcloth have sufficient service life left to justify the repair? If it does, it makes sense to proceed. Of lesser importance is the hardware: grommets, slugs, slides, rings, hanks, and the webbing used to attach them. These parts can be replaced as long as the foundation remains serviceable.

Once the overall condition is known, it's a question of economics. How does the estimated cost of repair compare to the cost of replacement? This is assuming that replacing it is possible at your location and within your time-frame constraints.

Sometimes, even if the sail is in poor shape, if it is critical for moving the yacht, then trying to repair it may be worth the effort. In that case, you'll need to make a more thorough evaluation and a plan for doing the repairs.

Cloth and panels

If there are no obvious tears or holes, remove your shoes and inspect the entire sail for chafe and small holes by crawling over it on your hands and knees. Mark places where the fabric has failed with colored masking tape.

Repair small holes by applying two identically sized layers of adhesive Dacron, one to each side of the sail. Use a seam rubber to make sure the patches are well adhered, then stitch the patches down using zigzag stitching.

Large patches will likely require that new material be applied with an adhesive to keep it solidly in place while sewing. Adhesives can darken over time, promote the growth of mildew, and tend to collect dirt. When we must use adhesive (rather than staples, which we use for some jobs), we prefer two thin layers of contact cement. We were once asked to repair a cruising sail where the captain had used 3M 5200 to repair a tear. Perhaps a judicious amount of this adhesive might have been appropriate, but the sail had such a thick layer of 5200 that it was impossible to repair.

When designing a patch, try to match the fabric weight and orientation (warp/weft and bias) to the sail in its present state. Make the patch as big as necessary to ensure that it extends to good solid cloth. If you plan on cutting away the damaged fabric and you're using adhesive, apply the adhesive to

For inspecting and repairing sails, a clean, dry work area and a sewing machine (or a friend with one) make all the difference.

a seam allowance along the edge only. Once you've applied the patch and sewn around its perimeter with zigzag stitching, flip the sail and cut away the damaged cloth, leaving a seam allowance. Sew one or two additional rows of zigzag stitching to ensure the patch is firmly sewn to the sail.

From the top: first assess whether the sail is even worth repairing. Small holes can be covered with adhesive patches applied front and back, then stitched through. Larger areas of damaged cloth can be cut out once the area has been patched.

Check all panel seams for chafe or rotting stitching. Remove any failed panel stitching and restitch. Long panel seams that have failed completely will require basting with double-sided Seamstick Basting Tape (or a similar adhesive) to keep the panels aligned while you're sewing. Restitching panel seams generally involves rolling up the sail so it can be fed through the arm of the machine.

Corner patches

Check for damage at corner reinforcement patches. Layered reinforcement patches at the clews of headsails are frequently abraded. Remove any damaged thread and mark areas to be restitched with small pieces of colored masking tape.

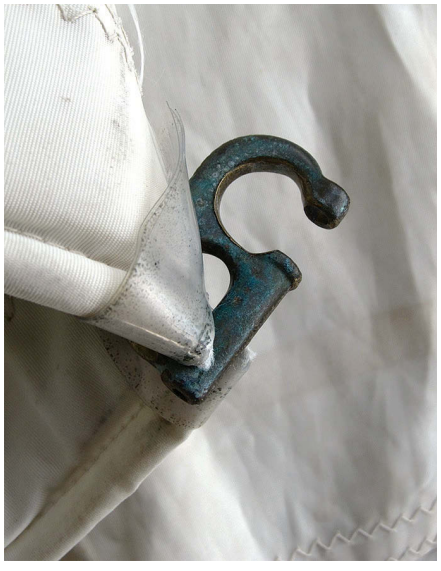
Chafe patches

Replace torn or abraded chafe patches. For heavy chafe areas, you may wish to use alternative materials to protect the sail such as Top Gun, a tough woven-polyester material. Patches that have come away from the sail should be reattached with staples or adhesive prior to sewing or their positions will inevitably shift during re-stitching. Don't forget to remove the staples when you have finished sewing.

Luff

Inspect the continuous support tape of roller-furling headsails and in-mast mainsails for damage. Chafe or damage that exposes the small boltrope can generally be patched with a thin strip of adhesive Dacron and sewn down. Do likewise for damage at the head or tack ends where lightweight adhesive Dacron is folded over the cut end of the luff tape and sewn down. If the boltrope of the luff tape is broken, a sticky material patch is only a stop-gap measure and the continuous support tape should eventually be replaced.

Inspect mainsail slides or slugs for structural integrity, as well as the webbing and twine used to seize them. Webbing at the headboard is



From the top: support tape on the luff of a roller-furling sail can be patched but not the boltrope inside it. Webbing on sail slides can decay and fail. Sail hanks can cause damage at the luff, especially if they are loose or are missing their pistons.

particularly subject to chafe due to the sharp edges of the headboard. Replace rings or grommets that have become separated or torn away from the sail.

Check the headsail hanks for excessive wear from the wire rope rigging and to make sure the pistons are functioning. Seized pistons can generally be freed with such products as PB Blaster or LockEase. If the hanks are the pressed-on type, examine the boltrope. If wear is evident, you may wish to insert and sew on a small piece of leather, since attempting to remove the hank is likely to break it. For sewn-on hanks, tug hard to determine whether the hanks remain securely seized to the sail's boltrope. They should not move independently.

Leech

Carefully examine the whole length of the leech for chafe or tears to the leech tape and leech line. Areas of wear on the sail should be overlaid with folded Dacron tape of the appropriate weight and width. If the leech line itself appears abraded enough to make breakage likely, replace it. You can use the existing leech line as a messenger or remove the stitching along the entire leech to remove and replace it.

On a roller-furling headsail, also check the fabric and seams of its sun cover, particularly along the edge where it is exposed to UV when furled. Wear in the sun cover can be patched with matching Sunbrella or a more durable material in a similar color. We have used Top Gun and Sur Last for areas where abrasion is severe and chronic and where it is impossible to keep Sunbrella intact.

On mainsails, pay careful attention to the batten pockets, especially the stitching and the integrity of features designed to retain the battens. Address any abrasion caused by contact with standing and running rigging.

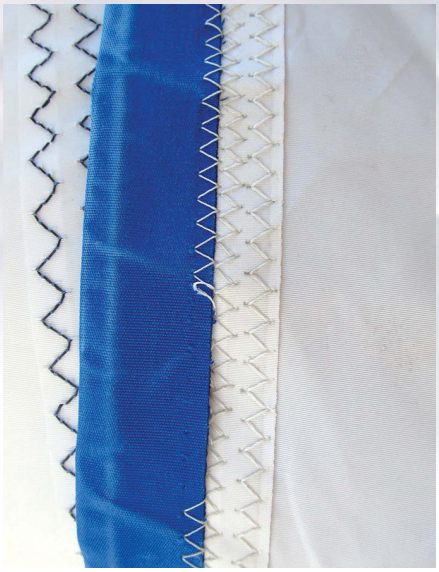
Foot

On headsails, examine the area near the tack where it chafes on the bow pulpit and lifelines. The other problem area is closer to the clew where the foot drags across the wire rope shrouds during tacks. The Sunbrella sun covers of roller-furling sails commonly suffer damage in this area.

On mainsails, inspect for damage from hardware such as reefing hooks or outhauls. Also inspect and repair as needed the seizing, webbing, and hardware of the slugs or slides as you already did on the luff.

Sun cover

Since it is continuously exposed to UV, the stitching securing a sail's sun cover is likely to be weakened. This applies to roller-furling headsails as well as mainsails. Inspect the entire sun cover (leech, foot, and clew patch) for areas where the stitching has failed and remove any loose thread before re-stitching with zigzag stitches.



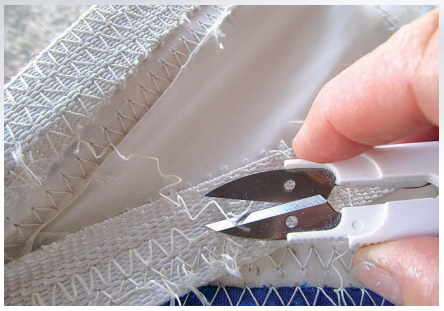
The stitching on a roller-furling headsail's sun cover is vulnerable to damage.

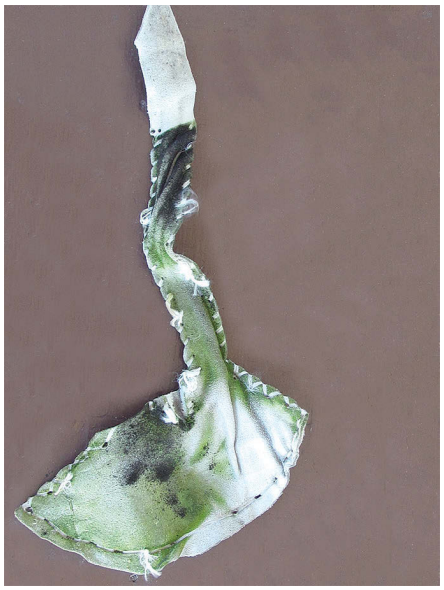
If long panels in the sun cover were not originally tacked down with diagonal seams, you may wish to add these if it appears the sun cover and sail are not rolling together synchronously. Also inspect the cover for torn areas that require patching.

Corners, hardware, and webbing

Check the stitching of all reinforcing patches, particularly for abraded thread. Appraise the condition of protective leather. Brittle, cracked, or torn pieces should be carefully disassembled so you can use them as patterns for replacements. You may want to remove the leather anyway so you can make a thorough inspection of the condition of the webbing that secures the corner rings.

Look for damage along the leech, where chafe on rigging can expose the leech line.





Carefully inspect corner rings, particularly if they have welds. Replace any ring that is distorted or cracked. Replacement involves removing the old webbing and sewing in new webbing. If your sewing machine is not capable of sewing through webbing and the clew reinforcement patch, hand sewing is the alternative. Once the webbing is sewn down, seize the "throat" of the webbing to the ring using hand-sewing thread so the ring cannot move and then design a cover, to be made with sailmaker's leather, to protect the webbing against UV and chafe.

Check the integrity of the small cleats (or hook-and-loop fasteners) that are often used to secure the leech and foot cords. Cleats are often sewn down with hand-sewing thread that will eventually break down in the sun. Hook-and-loop fasteners for leech and foot cords tend to fail with age.

Most roller-furling headsails we've repaired were originally delivered with corner webbing attachment points that had no protection from UV radiation. In some cases, the entire length of webbing, plus the stitching that secured

Look for damaged stitching, at top, and cut it off with a thread snipper. If leather protection, at left, is brittle, remove it, center above, but use it as a pattern for a replacement. Webbing on a clew ring can fail for many reasons, above, and the ring should be replaced if the welds show signs of cracks. Unprotected webbing at the tack or head, top right, needs to be replaced before it can fail.

it, was not covered. The critical attachment points of sails made this way are degrading from UV exposure every day the sail is on the furler. Such corners can be reinforced by adding one or two pieces of additional webbing, sewing it down to the corner reinforcement patch, and seizing it to the original webbing. However, if the webbing is no longer serviceable, it is better to pull it all off, clean up the thread nits, and re-web the corners. After re-webbing, protect the replacement webbing from UV exposure by covering it with shade cloth and leather.

With age and use, your sails will eventually fail. By periodically inspecting them critically and comprehensively and performing necessary maintenance, you can prevent profound failure while in use and avoid a failure that could endanger yacht and crew. Even if you have no desire to make your sail repairs yourself, it's always good to know how they should be done so you can talk effectively to the sailmaker who will perform the work.

Leslie Linkkila and Philip DiNuovo came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professional jobs and left the Pacific Northwest behind to cruise the South Pacific in their Mason 33, Carina*. They recently gave* Carina *a well-earned refit in the Philippines. Catch up with them at http://sv-carina.org.*

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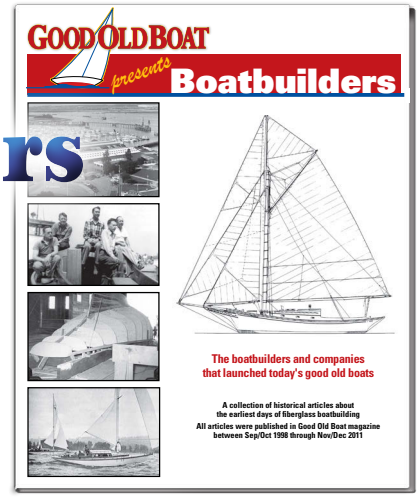

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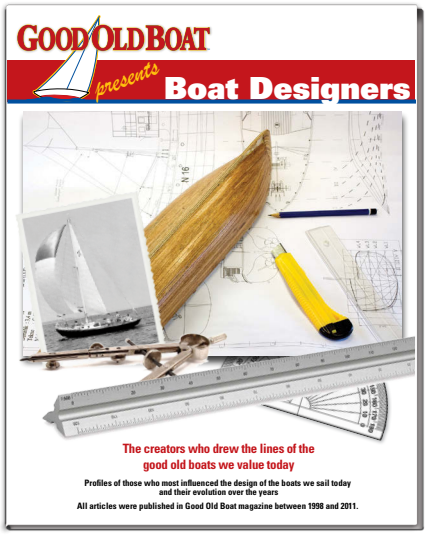

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Sail-repair

Don't let wear and tear stymie your cruising plans

While we were anchored in Micronesia, a large well-found yacht arrived in port on a tight schedule. She was bound for the Marianas and then mainland Japan via Okinawa, a passage of about 3,000 nautical miles. The season between winter storms and typhoons when it is safe to cross this expanse of ocean is short and the crew was understandably anxious to push on. Unfortunately, on the last passage, the tack webbing had failed on the only genoa they had aboard and the crew had no way to repair it.

When we laid the sail out to inspect the damage, it was clear to us, and to the crew, that this failure presaged others to come and the sail would require extensive work before the yacht could put to sea. There was no time in their schedule to buy a new sail or to send this one to the nearest sail loft in the Philippines, so the repair had to be done in the marina parking lot with materials on hand.

Gearing up

Every sail-repair project is unique, but most require the same techniques, which are fairly easy to master, and employ the same tools. You can get a head start on acquiring the necessary skills if you can attend a workshop or work under a sailmaker willing to mentor you. We were lucky enough to do both before we set sail.

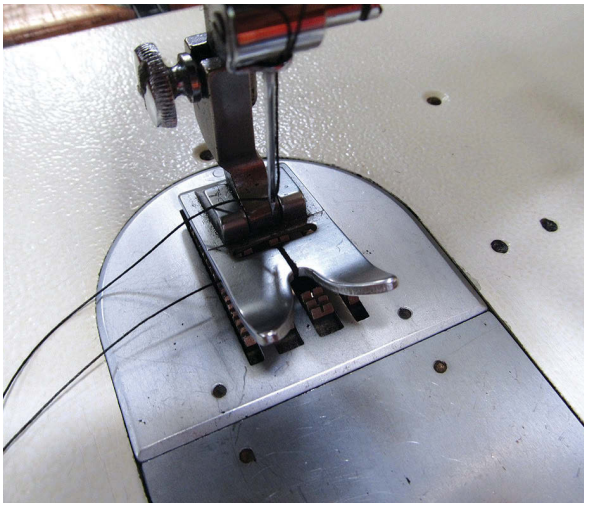
Most sail repair work is done using a heavy-duty industrial sewing machine that can take heavy-gauge round needles and V92 or V138 bonded polyester UV thread. Light-air sails like spinnakers are an exception. You can use smaller needles and thinner thread when repairing them. Home sewing machines are generally not robust enough to handle the heavy fabric and thread used on working sails. Most, though not all, machines used to sew sails are of rotary-hook design. They are usually very heavy and made with a body and gears of steel with few, if any, plastic parts. A monster wheel with a hand crank increases the punching power of the needle. The hand crank is also good for sewing thick assemblies and sewing small areas at slow speed.

Sails are sewn with zigzag stitches except in a few places, such as roller-furling luff tape, so your sewing machine should be capable of sewing straight and zigzag stitches at 6 mm or greater width. A two-point (or one-step) zigzag, which is the usual type, works for most sails. Machines are also classified by how they move the fabric sandwich: a walking foot or presser foot. Either will work, though a presser-foot machine allows you to choose from a greater selection of specialized feet for different materials and projects. Searching the Internet for a machine will yield thousands of potential candidates, though few are set up as portables in cases for carrying aboard. Popular brands include Adler, Bernina, Pfaff, Reed, Sailrite, and Singer.

Industrial sewing machines are made of metal and have few, if any, plastic parts, top of page. Leslie's machine is fitted with a portable motor, cogged monster wheel and hand crank, and a strong wooden case. For sail work, it must be able to sew straight and zigzag stitches, above left. Different materials and fabric assemblies are best accommodated by a variety of presser feet, above right.

essentials

BY
LESLIE LINKKILA
AND
PHILIP DINUOVO



Sail repairs require a number of tools, some of them specialized, at left, but the entire collection (see page 21 for Leslie and Philip's recommended list) takes up very little space on board and they come in handy for all manner of canvaswork. The 12-mm-wide presser foot and feed dog of the Sailrite Sailmaker are suitably rugged for sail work, at right. A stitch is formed when the sewing machine needle drives the upper thread through the throat plate, where the hook takes the thread and loops it around the bobbin thread.

Our Sailmaker model was Sailrite's top-of-the-line zigzag, rotary-hook, presser-foot machine when we purchased it new in the mid 1990s. It is a Brother TZ1-B652 made in Japan and fitted with a small AC motor, cogged monster wheel, and hand crank, all in a rugged wooden case. A later modification involved removing the clutch that would sometimes slip when we pushed the machine to the edge of its capabilities. Parts are readily available, though we have needed to replace few.

One reference says the Sailmaker will sew through 12 layers of 9-ounce Dacron sailcloth. We have sewn at least that much, sometimes a bit more, when sewing the corners of large cruising sails. It will also sew a whopping 12-mm-wide zigzag stitch. Its limitation seems to be the presser-foot lift height when set up as a portable machine. If it were set up on a sewing machine table and fitted with a knee lift, the presser-foot lift height would be greater. Whatever machine you choose, you will find its limitations. This is why sail lofts operate a variety of sewing machines.

In addition to machine sewing, hand sewing is often required when repairing sails. With the proper tools, hand sewing is relatively simple. The most important thing to learn is to handle the needles safely when sewing through thick materials. These very sharp, very thick needles can cause serious injury.

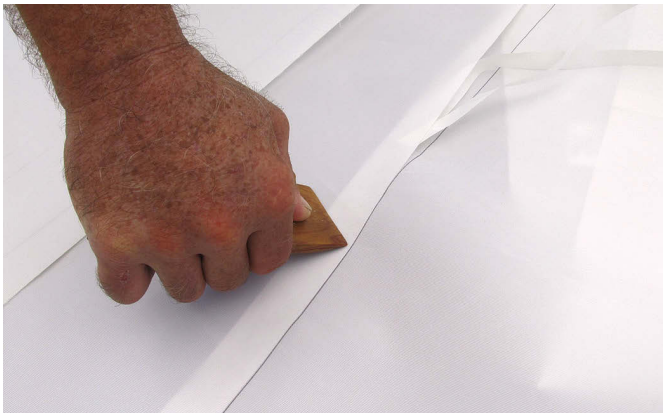
Machine sewing

Sewing heavy sails takes practice. Sewing machines are relatively simple mechanically, but the precise interaction of the parts is critical. Keep your machine well oiled and timed, especially if you keep it on board. Be prepared to stop working and service the machine whenever things go awry. With patience, you'll solve the problem and be back at work again.

A sewing machine has two thread streams, the upper thread and the lower (or underside) bobbin thread, that cross and lock inside the fabric sandwich. The two threads cinch the fabric layers together, so if the stitch is to be uniform, their tension must be identical. The upper thread is continuously fed into the machine off the top of the thread spool. The underside thread on most sewing machine models must be wound onto a bobbin and is of limited length. When the bobbin thread has been used up, sewing must stop and a new bobbin substituted. If your sewing machine can wind a new bobbin from a separate spool of thread as you sew, that will save you some time. Our Sailmaker allows us to do this.

Before beginning to sew, baste your fabric pieces securely using an adhesive or staples. This prevents misalignment of the slippery fabric. Adhesives may

Sewing while simultaneously winding a bobbin saves time but requires two spools of thread.



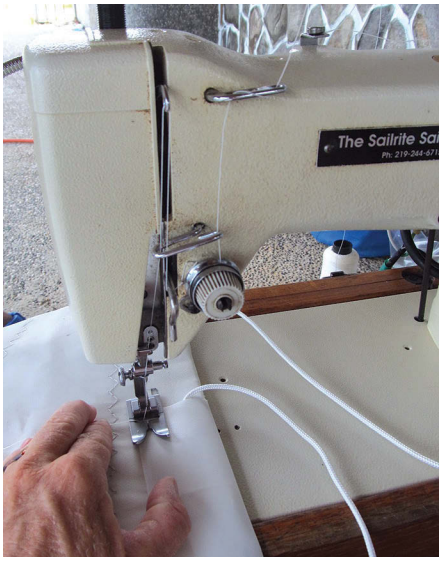
When repairing sails, basting the materials prevents them from slipping out of position. Seamstick tape is a convenient way to apply adhesive, at left, and contact cement is also commonly used. Staples work very well for basting materials together, at right.

be applied in the convenient form of double-sided sticky tape, called seamstick, or as a liquid, such as contact cement. Staples are an efficient way to baste fabric layers because dozens can be applied (and removed quickly afterward) and they leave no residue to attract dirt or mildew, a problem with adhesive-basted seams.

Before starting to sew, test and adjust your machine's settings by sewing a stack of material similar in composition and thickness to your sail-repair project. This allows you to confirm the tension settings and adjust stitch size. Your sewing machine owner's manual should provide instructions for adjusting thread tension.

The size of straight stitches is adjusted strictly by stitch length, but for zigzag sewing you need to adjust the length *and* width of the stitches to closely match those already on the sail you're repairing. You may also wish to adjust the presser-foot tension to facilitate movement of your fabric assembly through the sewing machine.

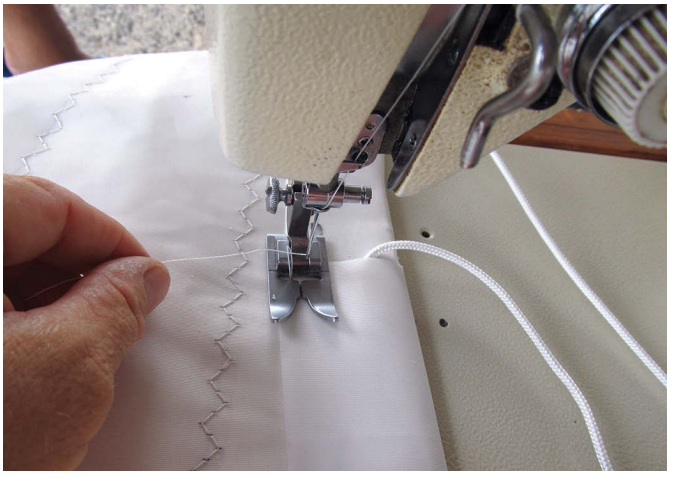
To start a seam, bring the bobbin thread to the top of the fabric. To do this, operate the machine by hand,

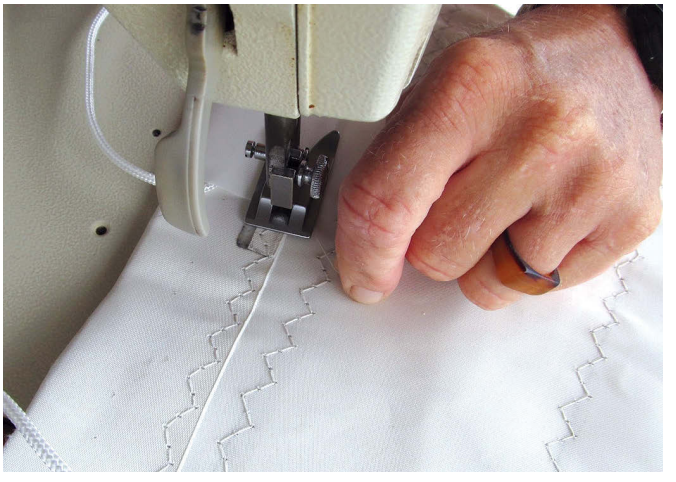


rotating the pulley (or monster wheel) toward you to bury the threaded needle into the fabric sandwich and continue rotating the pulley until the thread take-up lever is at its highest point. Grab the top thread and give it a slight tug. The bobbin thread should pop up through the hole. Carefully guide both threads around the needle and under the presser foot, hold them taut, and begin to sew. Release the threads after a few stitches.

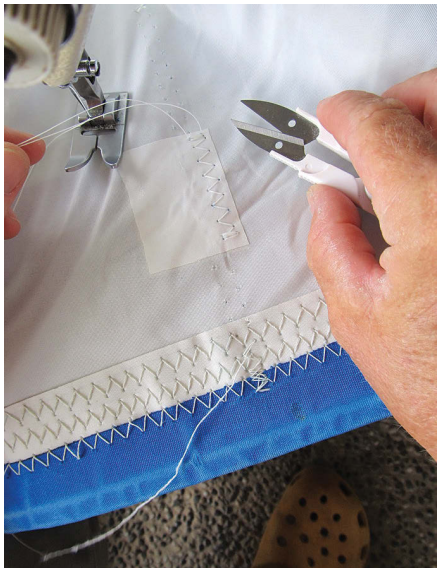
On straight seams, lock the end of the row by making a few stitches backward to the starting point of the seam before proceeding forward once again. Do the same thing at the end of the seam: back up over the last stitches a few stitches, then proceed again to the end of the row.

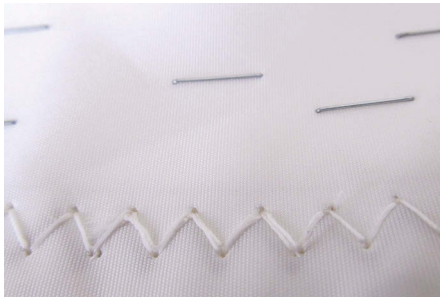
For single-point zigzag, lock the end of the row by making a bar stitch at the beginning and end of the seam. We do this by setting the stitch length to its minimum and then sewing while





To start, bury the needle and rotate the machine until the thread take-up is at its highest point, above center. Tug on the top thread to pull the bobbin thread to the top of the fabric, at left. Bring both threads under the presser foot and back, hold them taut, and begin sewing, at right.





A bar stitch (just to the left of the point of the shears) is used to lock the ends of zigzag seams, far left. To make a bar stitch while hemming a sun-cover patch, Leslie uses the reverse lever, upper left. Interruptions in a zigzag seam are ideally resumed by locking and aligning new stitches with the old ones, lower left. Hand sewing is used to finish, reinforce, or apply protective elements to a sail, below.

holding down the lever for sewing in reverse. If the bobbin needs to be changed in the middle of a seam on long sail runs, lock the new zigzag stitches into the last few stitches made prior to the interruption. A hand crank helps you go slowly enough to make the new stitches in precisely the same holes.

Hand sewing

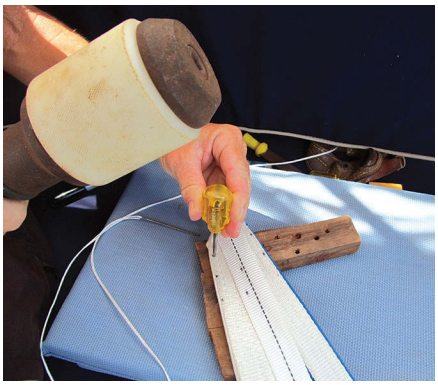
Hand sewing is used to finish, reinforce, or apply protective elements to a sail. The techniques are labor-intensive but simple to master. When at sea, hand sewing replaces machine sewing for emergency repairs, so learning to hand sew sails is valuable for offshore sailors.

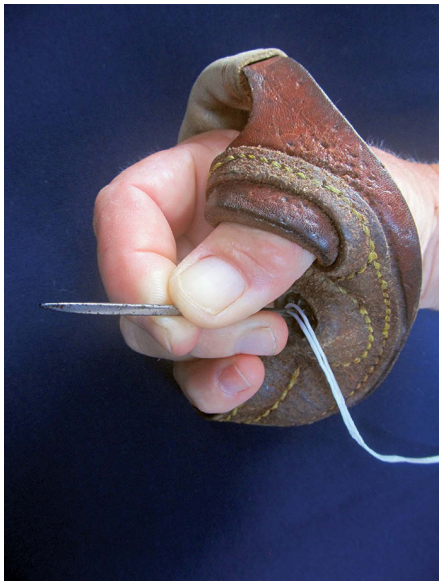
For hand sewing, you'll need thread called twine, large triangular forged-steel needles, and a sailmaker's palm. We use three stitching patterns most of the time: straight stitches for tacking down cloth or leather and for seizing rings and webbing, an X-pattern of straight stitches for securing webbing straps, and baseball stitches to join two pieces of leather or cloth along an edge or to secure a boltrope.

For thick assemblies, we first punch holes with a scratch awl and mallet

Tools and equipment

	Source	Notes
Industrial or semi-industrial sewing machine	Adler, Bernina, Pfaff, Reed, Sailrite, Singer	Zigzag + straight stitches, portable
AC power	Honda EU1000i	
Sewing machine needles	Sailrite or any industrial sewing machine shop	Reinforced-tip needles, such as Serv 7 by Schmetz, #18 to #21
Stapler	Bostitch, Rapesco	Long arm
Staple remover	Bostitch	Single piece, scoop-type
Sailmaker's seam rubber	Port Townsend Sails	A custom item. Many antiques exist.
Thread snippers	Gingher	Rounded blades
Scissors	Gingher, Mundial	
Butane lighter		High-quality refillable pipe lighter
Hot knife	Engel, Sailrite, Weller Portasol,	AC or butane
Sailmaker's palm	Wm Smith & Son	Buy the highest quality available
Needle-nose pliers	Stanley	
Hand-sewing needles	Wm Smith & Son (Sailrite)	Variety pack, #14 to #18
Scratch awl	Bainbridge	Sharp!
Fishhook file	Luhr Jensen (Bass Pro Shops)	
Maul or mallet	Wrising or Tandy Leather, Al Stohlman	~ 3 lb, polyhead
Rubber pad and sacrificial wood	Sailrite	
Colored pencils, waterproof markers, and flexible stainless-steel ruler	Any store that sells office supplies	





Punching holes in a thick assembly using a scratch awl and maul against a sacrificial wooden block, at top, makes hand sewing easier and reduces fatigue. When repairing sails outdoors, waxed hand-sewing thread can easily pick up dirt and debris, middle. A sailmaker's palm, above, should be molded to an individual user's hand so the fingers can grip the end of the needle firmly while bracing it against the metal thimble in the center.

against a sacrificial wooden block to minimize the pressure necessary to push the needle and thread through the material. This makes sewing safer and reduces fatigue. Some sailmakers recommend using a drill to make holes, but the drill bit can bind and rip the sailcloth fibers.

For Dacron sails, reinforcement webbing, and 4- to 5-ounce leather, we use UV-resistant waxed polyester hand-sewing twine, round, in medium weight (V-462 made by Heminway & Bartlett). Wax holds the strands or plies of the twine together and makes sewing easier. Once the stitch is made, the wax helps retain stitch tension. The quality of waxed hand-sewing twine varies, even between lots by the same manufacturer. You can apply wax manually to improve performance if twine plies don't hold together well. The only drawback with wax is that it can collect dirt, an aesthetic rather than a functional problem.

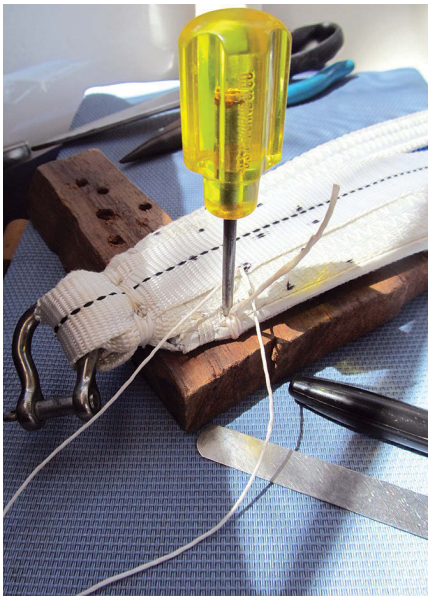
The best sailmaker's hand-sewing needles are made in the UK and are cast and forged. The shanks are triangular and smooth but the tips are very sharp. If you accidentally stick yourself, it will cause a painful puncture wound, so never pull or push a needle toward any body part. Use a fine file, such as a fisherman's hook file, to keep tips sharp. For storage, wrap the needles in a cotton cloth that has been soaked in sewing machine oil and keep them in a plastic cylindrical container to prevent them from rusting.

A sailmaker's palm is not a quaint relic of the past — it's a critical tool for repairing sails because it allows you to safely and effectively thrust an ultra-sharp sailmaker's needle through a thick assembly of webbing and sailcloth. In the middle of the sailmaker's palm is a metal base called a thimble, iron, or eye. This metal base has small indents and is secured to a leather strap that wraps around your hand so the eye rests in your palm.

You need a high-quality right- or left-handed leather palm that fits your hand. Don't scrimp here. The best is a medium to heavy sailmaker's roping palm molded to fit your hand. To mold the palm, soak it in warm water until it is soft. Once it has softened, put it on your hand and shape it so you can easily grasp a sailmakers needle between your thumb and fingers and brace the needle eye against the palm's dimpled metal eye. After the palm dries, oil the leather to keep it pliable.

Recommended sail-repair supplies

- Two spools of V92 or V138 UVR bonded polyester thread, white
- Medium weight, V462, waxed polyester hand-sewing twine, right-hand twist
- Dacron sailcloth tape, 5- or 8-ounce in 3- or 4-inch width depending on the weight of the sail
- Adhesive (sticky back) Dacron, 3- or 4-ounce
- Ripstop nylon repair tape
- Dacron sailcloth, 54 inches wide, 5- or 8-ounce cruising grade
- Polyester webbing, tubular, 1-, ¾-, and ½-inch
- 5-ply seatbelt webbing, 2-inch
- Spectra webbing, 1¾- to 2-inch
- Leech line, ⅛-inch
- Sailmaker's leather, 5-ounce
- Continuous-support luff tape (a length and size to fit your roller-furling units)
- Seamstick tape
- Contact cement (or 3M 5200 Fast Cure)



Straight stitches are used to secure leather chafe guard to a mainsail tack, top left. After making a hole, the scratch awl holds down a corner assembly, middle left. Dividing the two strands of twine before piercing the hole helps them lie parallel, bottom left.

Straight stitch

To begin stitching, measure out roughly 8 feet of twine, thread the needle, and double the thread back. Close your hand around the two thread strands at the needle and pull the thread between your thumb and forefinger from the needle to the end a few times to lay the two strands parallel to each other. Measure and mark for stitches. A short ruler and fine-tipped waterproof Sharpie marker work well.

Using a scratch awl and mallet, pierce the assembly against a wooden block. It's easiest to leave the assembly tacked to the block while you fit your palm. Remove the awl, place the eye end of the threaded needle in the center of the palm's eye and, while holding the shaft of the needle with your thumb and all of your fingers so it's perpendicular to the vector of thrust, pierce the hole and push the needle into the assembly with the palm.

Once the needle is securely seated, you can pull against the assembly with one hand as you push using the palm. Take care not to push at an angle to cause the needle eye to slip from the palm's dimple or you could end up piercing the palm of your hand. Once you have pushed the needle as far into the hole as the sailmaker's palm allows, pull the needle the rest of the way through from the other side. If you have a lot of resistance, use needle-nose pliers to pull, but don't pull the point of the needle toward any part of your body.

Once the needle is through, pull the thread through until approximately 1 inch remains on the top side. Don't knot the thread. Make your second hole in the assembly and, using the palm, pierce this hole with the threaded needle from the underside, as you did before.

It's helpful to divide the two strands of twine and put the point of the needle between them as you pierce the hole. This keeps the two strands of twine parallel to each other when the stitch is formed. Now put the thread back through the first and second holes as you did before, creating a loop of waxed twine between the first two holes. Pull hard to firm down this first stitch and then continue on, piercing the assembly and setting stitches snugly in the same way according to the stitch pattern. When you have completed your stitching, go back and cut the 1-inch tail of waxed twine down to roughly ¼ inch. Melt and crush (or rivet) this to flatten it and secure the twine where you began sewing.

Seizing uses the same techniques and knots. However, when seizing a ring to webbing, at the clew for example, use many straight stitches through the same holes, pulling snugly with each pass, to ensure the seizing is strong enough to prevent the ring from moving against its reinforcement webbing.

Resources

Books

Canvaswork & Sail Repair
by Don Casey, International Marine, 1996

The Sailmaker's Apprentice
by Emiliano Marino, International Marine, 2001

The Complete Guide to Sail Care and Repair
by Dan Neri, Beowulf Press, 2002

The Art and Science of Sails: A Guide to Modern Materials, Construction, Aerodynamics, Upkeep, and Use
by Tom Whidden, St. Martin's Press, 1990

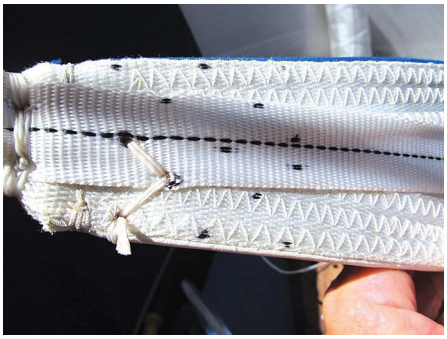
Sail-repair workshops

Center for Wooden Boats:
http://cwb.org/classes

Port Townsend Sails:
www.porttownsendsails.com/seminars.htm

NW School of Wooden Boat Building:
http://nwswb.edu/workshops

To finish the seizing, at left, the waxed sail twine has been melted and flattened, or "riveted." Hand-sewing twine reinforces webbing on a repair to a staysail hoist, middle left. Marks made with waterproof ink are helpful as a guide when securing webbing with X stitching, bottom left.



If there is play between the ring and the webbing, the webbing will eventually fail from chafe. Straight stitches are useful for tacking down materials used to protect the edge of a sail, such as leather chafe guard along the clew.

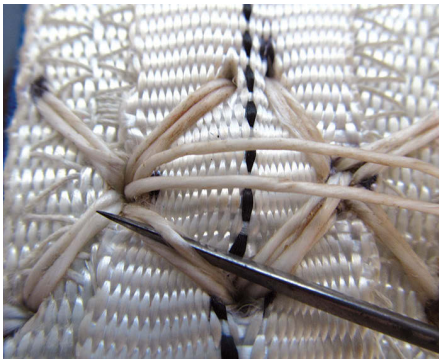
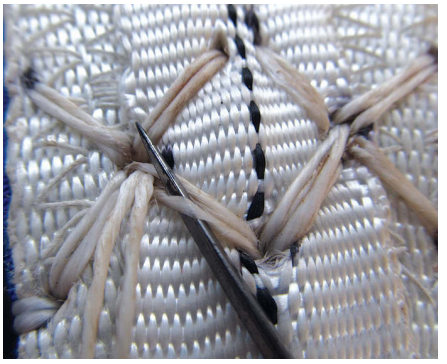
X stitch

An X pattern of straight stitches is used for sewing webbing to sails, particularly for 1-inch tubular polyester webbing. Some sailmakers also make a box pattern around the outside for additional strength. Measure and mark the stitch pattern by putting a dot at all four corners of small squares. Tubular polyester webbing usually has a dark center line; if your webbing doesn't have this guide, make an additional mark in the center of the square.

If the webbing strap to be sewn is near the edge, we generally begin at the corner of the X nearest the edge and wrap one or two tight stitches around the edge of the sail. However, the optimal place to begin an X-stitch pattern is in the center of the first X, closest to the edge of the sail (or the ring). Pierce the center and push the thread through to the other side. Next, make a hole in one corner of the X away from the direction you will be sewing (or back toward the beginning), thread the twine back through to the top side and then back down through the center hole, up through the corner of the X opposite your first stitch and then back down through the center once again. At this point, you have created half of your X-stitch pattern. Pull on the thread firmly to ensure the stitches are tight.

Repeat with the remaining two corners of the X, completing the pattern by pushing the needle down through the hole to the opposite side. At this point, you have the tail of twine on the top side of the sail and the remaining thread and needle on the bottom side of the sail. You may choose to knot your thread and begin the next X in the same way or thread back to the top side of the sail through a hole in the corner of the next X down the seam.

Whether you proceed down the webbing to the next X or make a knot here, the proper knot to use is a flat knot. Begin by inserting the needle under one of the strands of twine in the adjacent X stitch; outside to inside, taking care not to split either strand of twine. Rolling the needle as you insert it helps. Pull the twine through and back toward its standing part. Next, repeat this step, outside to inside, on the opposite strand of twine. Again pull back snugly toward the standing part. Complete the knot by inserting the needle and pushing the twine back through the hole the two strands emerged from, exiting on the top side. Pull the twine smartly until the knot disappears into the webbing. At this point, the tail left at the beginning of your stitching and the remaining thread and needle will emerge from the same hole. Trim the twine ends to ¼ inch, smooth the ends together, then burn and flatten the twine to create a rivet knot. (See also "Seizing Slides


A flat knot is begun, at left, by inserting the needle from the outside to the inside of one strand of the stitch (without splitting the strands of twine). The needle is then inserted from the outside to the inside of the adjacent strand of twine, center. The head of a staysail, at right, has been reinforced with new webbing hand-sewn to the older webbing with an X pattern of stitches.

and Slugs," by Leslie and Philip, in the November 2012 issue.)

Baseball stitch

For a baseball stitch, make the first stitch perpendicular to the edge and one additional stitch through the same hole before bringing the thread over the edge and down the next hole on the opposite side. Continue the length of the seam with this cross-over stitch. Make one or two stitches through the last hole, bring the thread across the seam again, and work your way back up the seam, creating an X stitch between the holes and across the edge. Finish by overlaying one perpendicular stitch in the first hole. At this point, both ends of the thread — start and finish — should exit the same hole. Cut them both to ¼ inch, smooth the ends together, and burn and flatten them to create a rivet knot. Alternatively, make a flat knot (described above) to improve the security of the stitching.

A hand-sewn baseball stitch is used to join two pieces along an edge or secure a boltrope, at left. Leslie, at right, seems to enjoy the challenges posed by sail repairs.

Conclusion

Although some professional sailmakers don't believe sailors can competently repair sails, with a few skills, tools, and supplies and a wee bit of pluck, you can maintain your own valuable sails, especially where there is no sailmaker. The cost, time lost, and sometimes-impossible logistics of sending out for a repair will no longer dampen the dream or soak the pocketbook. Coastal or seasonal cruisers who learn to repair their sails benefit by learning how sails are constructed and also how to differentiate between construction techniques that last and those that do not. This knowledge makes these sailors better equipped to choose quality sails in the first place.

Many years ago in the Sea of Cortez, we helped a family on a 60-foot sloop repair seven panels of their mainsail that were blown out in a chubasco. As they were 400 miles from the nearest sailmaker and it was during the height of cyclone season, there really was no other choice. Their repaired sail looked like "frankensail," but it was a functioning sail rather than a rag. About a week later, they hailed us on an HF radio net to report simply that they had "sailed to weather."

Leslie Linkkila and Philip DiNuovo came to cruising and boat ownership as adults and quickly developed a passion for small-boat travel. In 2003, they quit their professional jobs and left the Pacific Northwest behind to cruise the South Pacific in their Mason 33, Carina*. After giving* Carina *a refit in the Philippines, they sailed to Indonesia in September. Catch up with them at http://sv-carina.org.*