Deck Layout

Laying out a deck arrangement is a function of how a vessel is to be used. With three or four sets of hands to do the work the main issues will be keeping crewmembers out of each other's way as they handle lines. But for shorthanded sailing the opposite is the case. We want as much sail-control gear close by the one or two crewmembers as is practical.

Then there's the issue of dinghy storage. It's always nice to be able to carry a hard dink on deck or a partially deflated rubber dinghy. This usually takes some careful forethought in the design procedure.

COCKPITS

Aft cockpits are generally more comfortable since they're lower in the boat and not subject to as much motion as those centered in the deck plan. The aft cockpit is also substantially drier. Often, the spray pattern from the bow will keep a center cockpit almost continually wet when beating or reaching in boisterous conditions, where one would be nice and dry a few feet farther aft.

On the other hand, visibility is better from farther forward. It's usually easier to lay out the sheets and halyards with a center cockpit, and it helps divide the interior into separate sections, if such a layout appeals to you.

The center cockpit makes installing steering more difficult unless hydraulics are used. The long distance and numerous changes in direction usually end up with a sloppy-feeling cable system.

On balance, our preference is for an aft cockpit, mainly because of the comfort issues and the fact that it leaves the interior unobstructed.

Bridgedecks

A lot of modern yachts built in Europe have the entry to the main saloon amidships, with an aft cockpit for sailing. This leads to a bridgedeck between the saloon hatch and cockpit area.

The basic problem is traversing the bridgedeck in heavy weather. Generally, there's a lack of handholds, and you're totally exposed until the safety of the hatch or cockpit is reached.

On the Deerfoot 2-62s we solved this problem by extending the coamings from the forward saloon hatch (which had its own cockpit well) all the way aft, adding

Intermezzo II had a cockpit that was ideal for singlehanding. The seats were long enough to sleep on; there was a single primary winch aft of the helm, with secondaries on top of the coamings for staysail, runners, and jibing the spinnaker. Mainsheet, main halyard, and reef lines were all led through the front end of the dodger.

Look at the port upper corner of the transom and you will notice a socket for the man-overboard pole. If there's room to bring this into the interior without messing up an aft cabin, it makes an ideal out-of-the-way yet quickly deployable location.

The cockpit on the Sundeer 56 is my favorite of all the aft cockpits we've done. There's plenty of room for a group of people to work the boat, yet she can be singlehanded with ease. Reef lines, main halyard, traveler controls, and vang all lead back to the end of the coamings, where they are easily dealt with by the person at the helm. Most boats were fitted with an electric winch on the starboard coaming. This handles the main halyard, reef clew lines, and mainsheet. When docking in tight situations a breast line is led here that allows the helmsman to pull the boat into the dock with the winch. Engine room access is via the opening hatch under the starboard seat.

A traditional aft cockpit on a split rig. The problem here is that there is no simple way to rig a dodger.

Note the primary winches on the coamings back by the helm, allowing one person to drive and trim at the same time.

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stainless handrails all the way along the top. With this system the crew could work its way aft within the confines of the coamings, with the security of a stainless handrail to hang onto.

If you end up with a bridgedeck, think about adding sturdy, high handrails to help the crew make its way aft.

Cockpit Design

Cockpit design is an art in itself. Drainage must be substantial. If the cockpit is well aft, see if drains through the transom or counter will work. They can be huge, and this eliminates two through-hull fittings. Next, be absolutely certain that the water will drain fully when you're heeled and when sailing downwind in heavy going, *with the vessel fully loaded*. There's nothing more annoying than having your feet continuously in seawater, even if it's only a small puddle.

The same goes for cockpit seats. They should be angled outboard as they run to the stern. If they're not, then inboard drains must be provided at the forward end, or else water will puddle up to leeward with nowhere to drain when you're heeled. The width of the cockpit well must be such that you can sit to weather and brace your feet on the leeward seat edge.

A detail of the steering station of the cockpit shown on the preceding page. The rounded corners are lovely to look at, but difficult to brace against when sailing at high heel angles.

The steering station on one of our large cutters (above). Note the relationship between the back of the footwell and the helm. There is just 17 inches (431mm) clearance. This is an ideal amount, as it allows you to brace the back of your legs and lock your body between wheel and footwell. It works even better with a mizzen mast behind you.

Two views (left) of the aft cockpit on *Locura*, a Deerfoot 72. All sail controls are lead aft to where the helm is located so one person can drive and pull strings if he is so inclined. The dodger is a semi-permanent affair that just clears the hydraulic vang on the mizzen book. The third athwartships rail, at the front of the dodger, is to control headroom when dropping down the companionway, since the vang restricts what you can do with the dodger shape.

The two handrails alongside the companionway serve two purposes. One is to help going up or down. The second is to keep you in place when you are sleeping on the weather side of the cockpit, with your torso forward.

Note how the forward ports (into the aft cabins) are protected by the dodger. This allows them to be opened in all sea and spray conditions.

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Remember that this dimension will vary with the length of your torso and legs. And factoring in the use or lack of cockpit seat–back cushions will be necessary.

Cockpit seats should be long enough to sleep on. The backrest must be 12 to 14 inches (300 to 350mm) high and angled outboard 15 degrees. If the coamings are somewhat short, the discomfort can be overcome with seat back cushions stiffened with plywood.

When you're mounting winches, try to position them so they can be worked without interference from people sitting in the cockpit area. Cockpit lockers should be eliminated if at all possible. If you can't avoid them, a large up stand with good angles, a positive rubber or foam seal, and a positive latch *must* be used. In heavy going, despite all your precautions, a substantial quantity of water will find its way below through these openings.

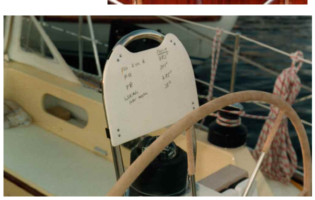
The companionway hatch and slides obviously have to be heavily built. You must be able to

Center-cockpit designs (top/bottom photos) offer much better sight lines forward as you are closer to the bow and higher up. They also provide a means of separating the fore and aft living quarters (most center-cockpit designs have the galley down one side and the engine room taking up the rest of the space). This interior approach makes a lot of sense if you are cruising with other people and want privacy between the sleeping cabins. On the other hand, the forward location of the center cockpit is much wetter. The increased height above the pitch center of the boat (compared to an aft cockpit) means side to side motion will be aggravated. Finally, there are visual penalties to be paid in the interior since galley saloon area is broken up by the bulk of the engine room.

The bridgedeck between the pilothouse and cockpit on this Deerfoot 74 (top two photos) is broken up with a large cockpit table. The norm at sea is to have the wings folded down and locked. In port, if it is in use, folding chairs are used for sitting. With a bridge deck it is best to have some form of guard rail (which purpose the table performs) or handrails as on the Sundeer 64 to break up the space and give you something on which to hang when offshore.

A great contrast in approaches to cruising. The grease pencil "blackboard" in the bottom photo is a wonderful invention by Corky Aucremen. Bearings, courses, etc., can all be noted with ease.

The helm station at right looks great, and certainly has a lot of data for the helmsman. However, with instruments so close he has to take his eyes off the sea ahead. I'd rather have the sailing instruments mounted forward where they could be glanced at without loosing the view forward. The radar and switches will last a lot longer if they are installed in a protected area.



A shot of the bridgedeck on a single-stick Sundeer 64. The mainsheet traveler divides the bridgedeck and cockpit area. I would have preferred to not have the sheet in this area, but it was the only structurally plausible possibility (the Deerfoot 74s above have the mainsheet attached to the top of the pilot house). Note the handrails on each side of the bridge deck to help the crew as they move forward or aft.

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lock them from inside and outside. If they aren't locked, and you suffer a severe knockdown or rollover, the odds are they'll drop out or slide open and allow thousands of gallons of water below.

The compass binnacle support will need to reinforced to take the load of a crew-member being thrown against it. Of course, the compass will have a large stainless guard/handhold over its dome.

Cockpit tables are a mixed blessing. Linda and I have always disagreed, however, on the size. I prefer a small table, hinged off the binnacle, sufficient for drinks and snacks. She likes a full table for eating. The problem I have with this latter approach is that it blocks the cockpit totally.

Where the engine controls are mounted is a subject of some debate. I used to like to have them right on the binnacle, but with larger steering wheels it becomes impractical to reach around, and reaching through it is too slow when maneuvering in tight quarters. The alternative is to mount the control an the cockpit side. If a single-lever control is used, and it's positioned so the skipper's foot can actuate it, the hands are left free for spinning the wheel — an optimal compromise.

The steering well should allow the helmsman to brace himself while sitting to windward or leeward. If you expect to spend much time standing at the wheel, then some form of foot brace to leeward becomes a necessity. Another approach to this is angling the edge of the steering well sole at 20 degrees or so. This provides a comfortable spot for your leeward foot, while it's braced against the edge of the cockpit well. A wedge like this can be easily fabricated from timber and moved from side to side as required.

Some deck layouts isolate the steering well from the regular cockpit. This usually means that you have to climb over a short piece of deck to gain entrance to the steering cockpit. For racing boats this may make sense, but it becomes a hassle when cruising.

We've already discussed wheel size, but when thinking about this, consider what a large wheel does to the cockpit access. Sometimes dropping just a few inches in diameter makes a world of difference in the ability to move around comfortably. Many of our friends go so far as to remove their steering wheels in port.

Four views of the aft cockpit on the Sundeer 64, with a happy owner, Chuck Matthews, demonstrating steering ergonomics.

The use of twin wheels dominated the design of this cockpit area. They offer several advantages. First, you can get to windward or leeward for a really good view of the sails and seas. Second, under power, you are a lot closer to the dock, regardless of which side you are bring alongside. This makes judging distances easier.

On the downside you have extra complexity, additional cost, and extra steering friction. We spent a ton of money and effort on trying to get the steering effortless, but in spite of everything I was never totally happy with the way the helm felt (compared to a single-wheel installation).

The primary winches are within reach of the helmsman, as is the main and mizzen sheet winches.

The one big negative in this cockpit layout is the bridgedeck, which must be crossed coming aft from the pilothouse. If you look carefully you will see the 32-inch (812mm) handrails on top of the coamings to protect you (along with the mizzen mast) when moving aft.

The Deerfoot 2-62, of which we built four in the early '80s, had a mid-cockpit over the centralized engine room. The steering position and sail controls were all the way aft. This is a great daysailing layout as it separates guests from crew work. However, I have mixed feelings about the large bridgedeck, which has to be crossed going aft to the helm position.

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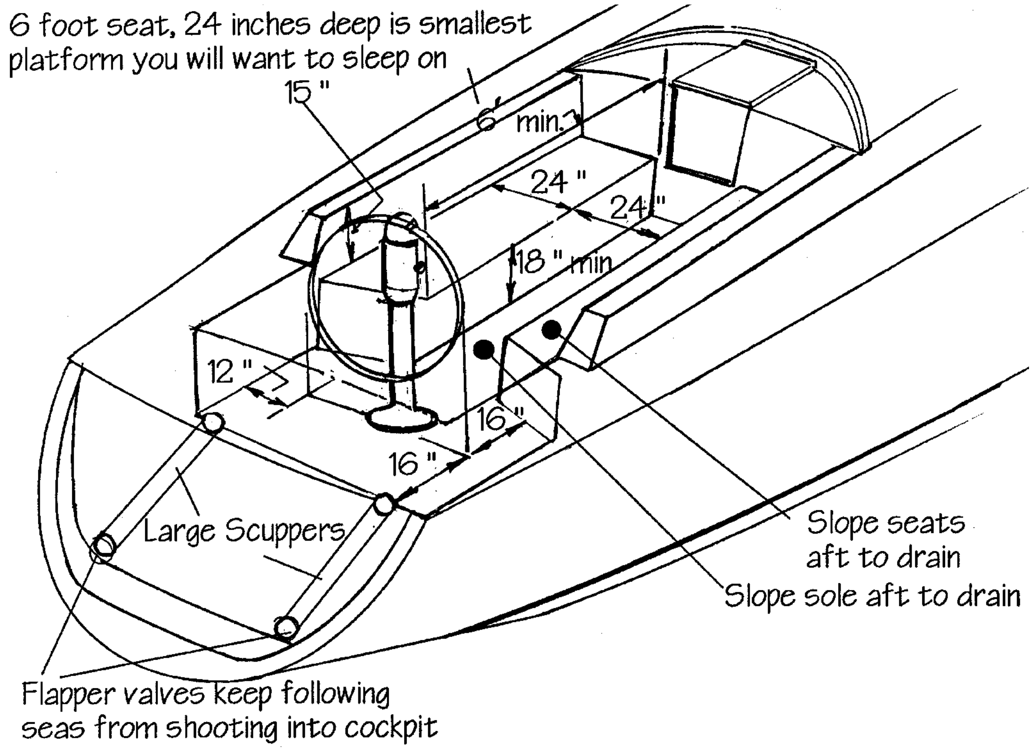
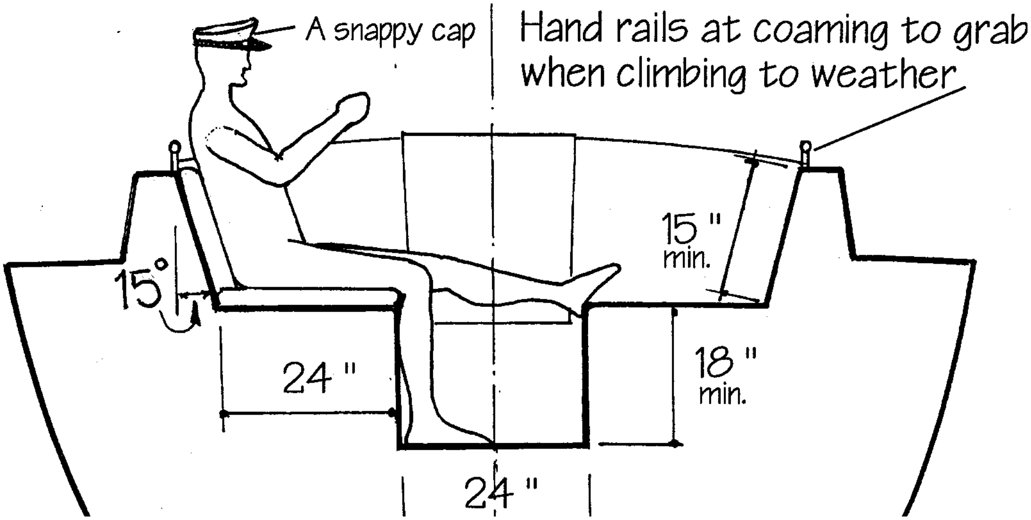


Cockpit ergonomics stay pretty much the same regardless of yacht size (unless the size of the sailors changes). You need a 24-inch-wide (610 mm) seat for sleeping. If you toss a thin cushion, a couple of inches thick (50 mm) behind your back, you will need a 24-to 26-inch (610 to 660 mm) footwell width to brace your feet against.

A big variable is the depth of the footwell. Deeper provides better leg support when the boat is heeled and you are standing with your leeward leg braced against the footwell side. I like to see 18 inches (457 mm) of depth—more is better. However, if you are sitting on a cushion this will make the seat too high to comfortably put your feet on the sole. So, you either sit fore and aft, with your feet up, or brace them across the boat.

A key factor in this is the drainage system for the cockpit. The best system, shown above, is to take drains out the aft end right through the transom. These can be quite large, there are no seacocks involved, and you will be sure of good drainage if pooped by a wave. The sole should slope aft to prevent water from accumulating forward (even under bow-down trim). We typically specify an inch (25 mm) of fall for every 3 feet (0.9 m) of cockpit length.

The last issue is space around the helm. The ideal is16 inches (400 mm) between the aft end of the wheel and mizzen mast or cockpit well. This enables you to snug yourself in-between fore and aft. Twelve inches (305 mm) from the edge of the wheel to the side of the cockpit is pretty much a minimum.



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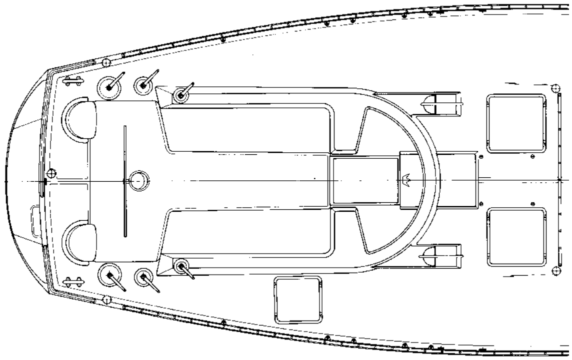
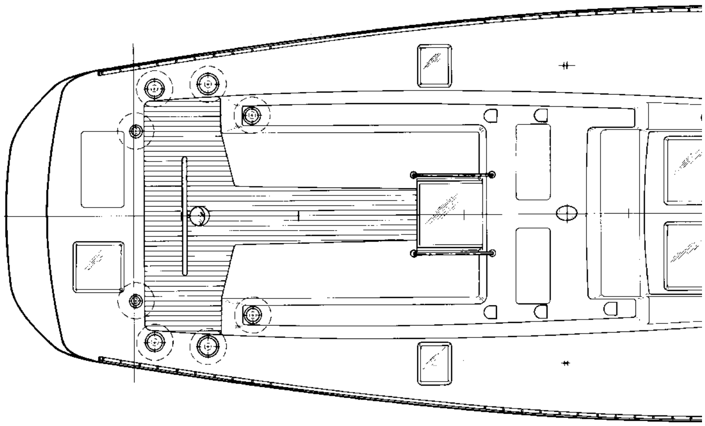




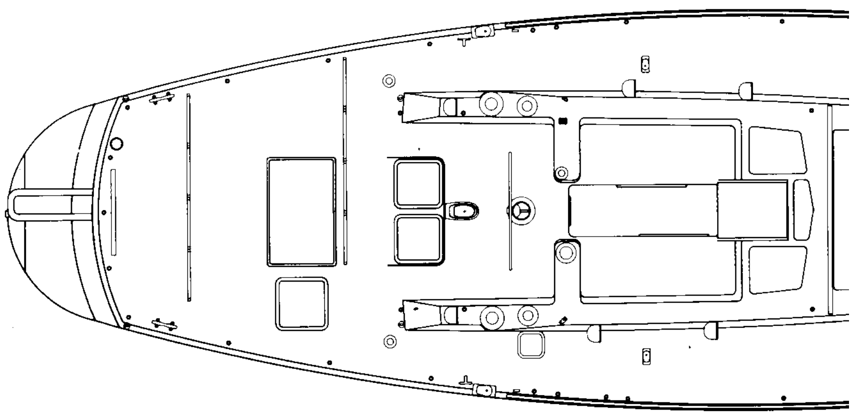
Four different approaches to cockpit layout (all to the same scale). The top drawing is a Deerfoot 58. This cockpit and the one below (a Deerfoot 72) have what I would call classic single-wheel designs. In the case of the 58, the seats are just long enough (6.5 feet/2 m) to sleep on. Notice how the dimensions around the helm are almost the same, despite the difference in the overall size of the vessels shown.

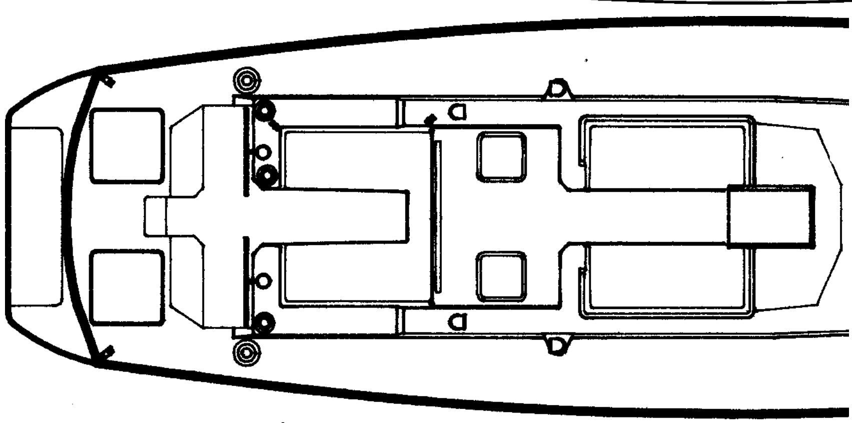
The front end of the 58's coaming is rounded and there are two dorade boxes worked into the forward corners. The round shape looks attractive and make it easier to fit a dodger without making the back end of the boat too ugly.

The 72, having a mizzen to contend with and an owner desiring large deck lockers, extends her coamings forward in a rectangular fashion.

The two bottom illustrations show a contrast in approach. The bottom drawing is the Sundeer 64 with an aft sailing cockpit and a forward watch-standing area with a pilot house. There are twin wheels (a necessity for seeing past the pilot house) and all sailing controls are located around the helm area all the way aft.

The other boat (third down from the top) is the original *Sundeer* (67). Here the helm is just aft of the pilot house,





leaving the aft deck clear for dingy storage.

Sailing controls are all clustered at the back end of the pilot house, where they can be reached from the helm or from inside the pilot house.

The 64 layout is better for daysailing and having a group aboard. The twin wheels are a definite plus. Having designed and sailed both I'd have to say I prefer the original (67) layout for our own usage. I like being able to reach sail controls without getting wet and the dink storage aft is a major factor with us. Another issue is aft engine-room space. By virtue of the flush aft deck the 67 has a lot more headroom below the deck.

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Helm Chairs

Years ago, my dad bought a couple of fishing chairs and put them just aft and on either side of his steering wheel. When I first heard about this, I thought, "What a dumb idea.." But after sitting in one of those chairs and steering for the first time, I went right out and ordered two for ourselves.

If you have space on your afterdeck, they do make for a very comfortable place from which to keep watch and to steer.

Helm chairs are marvelous for watchstanding and for steering in moderate conditions. And while they do take some thought to work into the layout, most yachts over 40 feet or so can usually fit them in. They should be placed as far outboard as possible to improve visibility down the side of the boat and so you can see the headsail luff. While most chairs come with padded seats, we find that these become a real maintenance headache after a while and prefer just plain plastic moldings.

We picked these cheap plastic helm chairs up for $20, and they lasted two years. Plus they were more compact than the fancy ones usually available in marine stores!

We eventually covered over *Intermezzo's* large cockpit with a bridgedeck between the cockpit coamings, making an aft cabin for the kids out the space. From an interior standpoint this worked well. But we then had to cross a bridgedeck to get back to the cockpit under the mizzen boom.

So we spent most of our time on watch sitting in the companionway, looking forward.

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For steering you'll want to place the chairs where you can comfortably grab the steering wheel rim. Since most chairs have 4 to 6 inches (100 to 150 mm) of horizontal adjustment this is usually easy to accomplish.

Another consideration is bracing yourself when the boat is well heeled. I like to have the chair and lifeline or pushpit positioned so I can rest my arm (bracing it at the same time) against the top rail.

Cockpit Volume

The actual amount of deck space devoted to the cockpit has been shortened on cruising boats in recent years, and this is a good trend. *Intermezzo* was an example of the old-style weekend cruiser/racer. She had a very long cockpit, set ahead of a lazarette, and as a result lost almost a third of her potential interior volume to the cockpit area. Before correcting this in New Zealand, Linda and I frequently looked longingly at that space, dreaming about what a nice additional cabin it would make. The cockpit needs only to be big enough to hold you and a few occasional guests. The smaller it is, within those parameters, the safer it is at sea for the vessel and her crew.

COMPANIONWAYS

The ergonomics of companionway design is a complex subject. On one hand, you want a small opening to minimizing structural loading when a wave breaks against the washboards or when you are inverted. On the other hand, you need enough space to work your way comfortably below.

Finally, the space should not be too large, as it very nice to be able to brace yourself in the companionway in heavy going to keep watch.

How wide should you go? Over the years we've found between 21 and 24 inches (533 and 607 mm) to be about right (and this applies to our largest boats as well as to smaller designs).

Offset Companionway Hatches

Offsetting a companionway hatch to the saloon can really free up the interior design layout. But for offshore work this can be very dangerous, since the outside of the hatch will now lie below the waterline when a knockdown occurs. And *when* (not if) this occurs, even if the hatch is closed and locked, substantial leakage and/or flooding below will occur. So, for offshore work, I think a centerline location is by far the best.

Washboards

There are all sorts of ways of making washboards. The most common is from slats of teak. My preference is to use Lexan polycarbonate plastic. It is tough and gives you a chance to look out while allowing a bit of light below.

We typically use 1/2-inch (12.6mm) Lexan for the average hatch.

Regardless of the material used, you will want to be sure that the tracks into which the hatches slide are strongly made, as there could be several tons of pressure on the structure.

Slides should be rebated, i.e., notched so they have an overlapping joint to reduce leakage. I like to have the fit of slides in their tracks a bit loose to allow for warping (and, for plastics, expansion in hot weather).

There should be some form of barrel bolt lock to hold the slides in place during a knockdown or rollover.

Companionway Threshold

While your washboards are going to keep large quantities of water out of the interior, modest amounts that fill the cockpit will seep around the edges of the washboards. Since the cockpit is going to be filled from time to time the answer is to have a threshold high enough so that small amounts of water will drain before they attack the washboard joints.

We've found that between 6 and 8 inches (150 and 200 mm) of height works for most boats (with good-sized cockpit drains).

Sliding Hatches

There are a series of issues to consider with your sliding hatch. The first is the watertight integrity when the hatch is closed.

Imagine the crest of a wave breaking against the edge of the closed hatch. What keeps the water at bay? It is the interface between the hatch itself and the track on which it runs. This is typically a pretty loose fit, so it is not going to be very watertight in a direct hit.

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Here's a clever system for dealing with companionway hatches and/or washboards. In this case the hatch slides in tracks on the inside of the companionway area, and drops down below the cockpit level when open. In this position the washboard is stored, ready for instant use. You will accumulate leakage when the cockpit is filled. However, this can be mitigated with gaskets.The bottom of the frame is then connected to the keel sump so that whatever seawater does find its way below is quickly conducted to where it can accumulate without getting anything else damp.

Illuminating headsails is always a problem at night. You want to be able to see the luff shape, but not ruin your night vision. We normally use our steaming light for this purpose. But on one of our boats we installed a small halogen spotlight into a dorade box.

What we've found works well is to have an outside breakwater to deflect the impact of spray so that it cannot directly hit the hatch or the track on which it slides. Then, realizing that water is still going to make its way past the track, we have a coaming that runs all the way around the perimeter of the hatch opening, standing up perhaps an inch (25mm). This catches any drips (or worse) and directs them back outside.

The next issue is the slide-rail system. Sliding hatches tend to be large, heavy, and occasionally warped. There are many ways of making slides, and the good ones have several features in common.

First, they need to have some sort of over/under configuration which limits the squirting effect of wave hits so that it dribbles down and is contained by the inside coaming edge. Next, you need something that is slippery, with a low coefficient of friction. We like to use UHMW plastic for this. Next, there needs to be enough tolerance for the hatch to warp a bit and still slide easily.

The hatch itself can be made from timber, a weldment, or plastic. I like plastic best because it lets in the most light. The hatch should be fitted with a barrel bolt or other locking mechanism (operable from the inside) so you can keep it in place in heavy going.

Finally, you will want a secure stop so that the hatch doesn't run all the way to the end, catching your fingers in the process.

WORKING ON DECK

Being able to work your way around the decks at night, without deck lights, barefoot, and having to worry about broken toes, is another criterion. This means that obstructions such as padeyes, cleats, and blocks should be minimized where they're directly in the walkway.

Then there's the issue of handholds as you work forward or aft on a pitching deck. Handrails on cabintops, over dorade vents, around the mast, and especially on the foredeck are necessary. It should be possible to go from one handhold to another without letting go.

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Stanchion Bases

The stanchion base needs to be heavily made in order to take both the normal working load of the stanchion and the occasional extra load from misuse. A heavy base also needs lots of backup under the deck. If done correctly, leaks will not be an issue. Otherwise, there will be more water coming below through the stanchion base mounting holes than you can imagine.

One way of helping out the base is by taking a tab or strap to the top of the toe rail. This increases the stiffness of the total base substantially.

Three approaches to stanchion bases (below and right). Below, you have a flush-mounted base with a piece of rod stock inserted into the stanchion itself. This is not a good detail, as all of the bending load on the base comes in at the weld point of bar stock to base. Eventually it will fail.

The upper right-hand photo shows a brace to the top of the cap rail. This is a good idea as a start. However, because there is no direct connection between the stanchion itself and the brace, the angled brace only reinforces the stanchion when it is pulled outboard (a good idea). It would have been better to extend the socket up from the deck to the height of the cap rail, and to weld the brace to the socket.

The lower right photo shows a socket we used on the Sundeer series. The base is bolted to both the deck and toerail. The rod between the socket and the base helps resist bending loads on the stanchion socket/base connection welds.

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These two base details (left) are extremely strong. The left-hand double stanchion forms a "couple" between the deck and top of toerail. It is going to be bulletproof, almost to the point of being too strong (in a collision the damage is going to be difficult to repair). The right-hand photo is a fairly common detail on race boats and makes for a very strong, lightweight stanchion. You do have to watch your toes at night, however, on those inboard legs!

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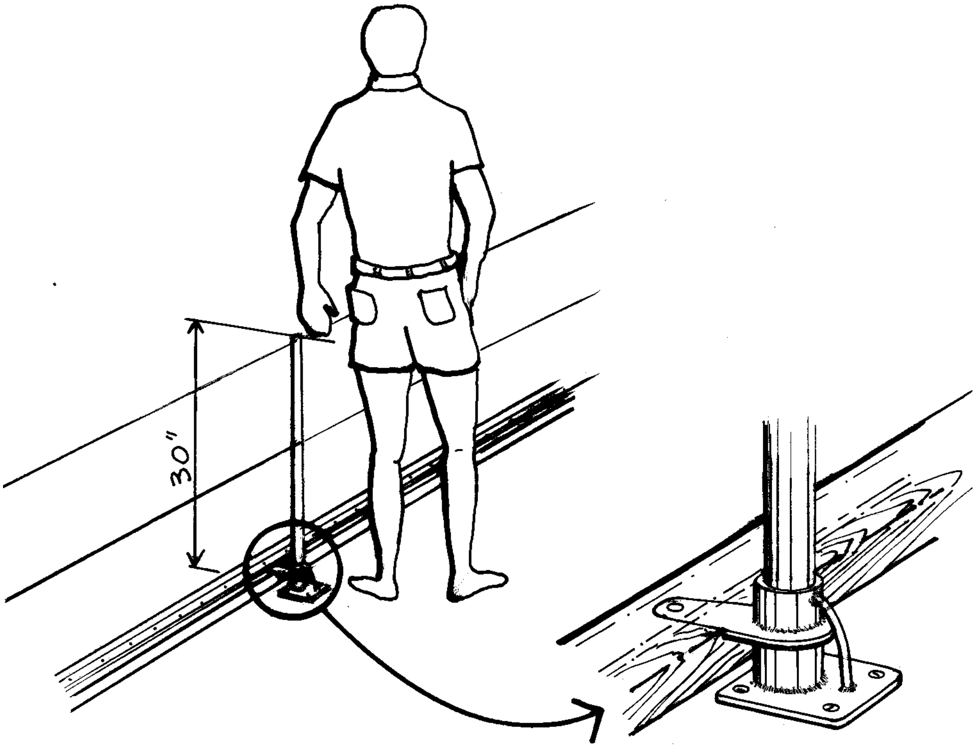


Lifelines should be a minimum of 30 inches (762 mm) off the deck. Another couple of inches (50 mm) is even better. Anything lower than this is almost worse than useless as it tends to trip you and toss you overboard if you are thrown against the lower height.

The ideal height is very much a function of your body's center of gravity. If you are over 74 inches (1.9 m), even higher lifelines are in order. On the other hand, if you are short, you may be able to get away with something lower than the heights specified.

Gates and Openings

All openings in the lifelines are going to need diagonal braces to support the end stanchions. These braces can be one size smaller in diameter, typically about 1 inch (24 mm). They should go *right to the top* of the stanchion to be most efficient. Otherwise, you're likely to have a bent top at some point in the future.

Gate Location

Gates should be located close to mizzen shrouds or running backstays so these can be used to help pull yourself aboard. If there are windows in the hull, and they have a lip, one should be located near the gate so the lip can be used as a step.

Pulpits

The pulpit needs to be large enough to allow the crew to work with some degree of efficiency around the headstay and anchor roller. It also needs to be, as much as possible, out of the way of the foot of the jib.

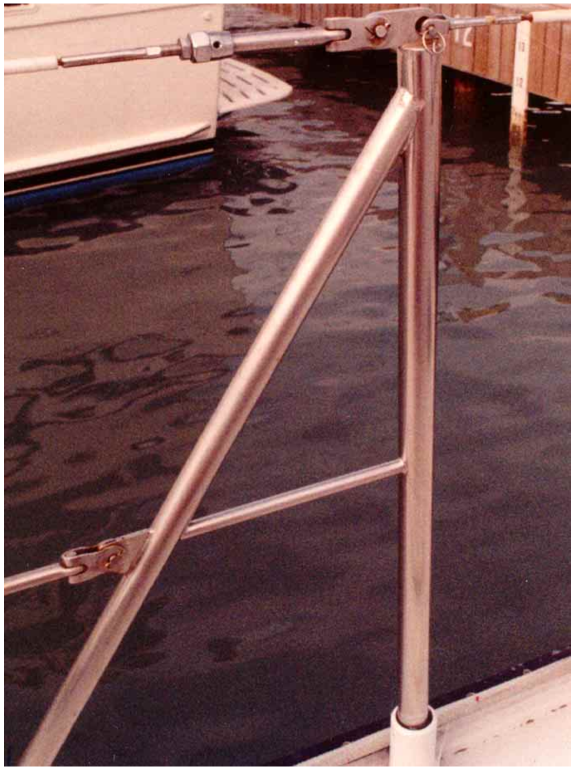
In some cases this means a split pulpit will work best, with a slot between forward and aft halves for the jib foot to slip through. On *Sundeer* we had a single port and starboard pulpit open at the forward end to facilitate getting ashore when moored bow-on, and to make working on the anchor easier. We use a removable wire between the two sides for security when at sea.

If the pulpit has a couple of bales for halyard attachment and a means of capturing the spinnaker pole, it will help your sailhandling.

Pushpits

The pushpit surrounding the cockpit area usually ends up hosting man-overboard gear, outboards, boarding ladders, stern anchors, and other paraphernalia. Having brackets welded on for each job is usually not that expensive.

Consider taking the top rail and extending it forward the length of the cockpit, in place of the top wire. A solid bar is much easier to hang onto when first getting out of the cockpit, and it makes an ideal spot onto which you can mount solar panels.



Lifeline boarding gates should always have their angle supports run right to the top (above). This provides plenty of bending resistance when someone leans on the lifelines and the gate is opened. Otherwise, as you can see to the left, when a load is placed on the lifeline, perhaps even a fender snubbing the dock for a moment, that unsupported stanchion top is going to bend easily.

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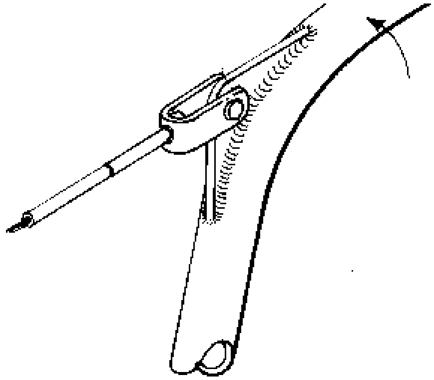

A series of wire-attachment details, all done with flat-plate bails. Look at the amount of weld surface and then compare this to the more typical wire bails. There is probably 50 times more weld bead here. And these types of tangs do not fail with age.

The middle photo shows one way of dealing with gate openings. In this case a bail has been welded turned to the inside, instead of facing forward or aft as is the norm. This has the advantage of not catching on your clothes when you are climbing through the gate.

The lower photo shows chafing gear to protect the jib and the effects of an oversized pin (the chafe spot). If this is not dealt with eventually, it will wear a hole in the bottom of the jib.

Wire Attachment

It's common to use stainless wire, bent into a U-shape, and welded to the stanchions for attachment of the lifeline wires. Because the wire tends to be flexed back and forth, the welds on these connectors are subject to early failure, often when you least expect it.

It's far better to take a flat piece of stainless with lots of welding surface for attachment tabs. A hole is drilled in the tab for the lifeline shackles.

Wire

The top lifeline is better off being a little oversized, primarily because of the abuse the end terminals take. About 3/16-inch (5mm) is the right size.

Most boats use plastic–coated wire. It provides a good grip and looks nice (when clean). But you have to be careful with what's going on under the wire. If you start to see rust stains it's probably a good idea to replace the wire.

We use a middle lifeline wire of about 1/8-inch (2 mm). From the shrouds forward there's a bottom line as well. The three lines then provide a base for our foredeck lacing.

End Fittings

End fittings are usually swaged on. Unfortunately, the turnbuckles available are stainless on stainless. To prevent galling in later life, use waterproof grease or anhydrous lanolin.

At the gates a pelican hook will usually be employed. When you go to sea, seize these shut with a bit of light line as they have a habit of opening at inopportune times.

A Word of Caution

Even with brand-new, heavy gear, *don't trust your lifeline system*. Always assume it's going to fail at an awkward moment. Use other handholds as much as possible when working on deck.

To maintain maximum strength, don't tie fenders or dinghies to the lines. Their flexing up and down will shorten the life of wire and fittings. Rather, secure these loads to the bases of the stanchions.

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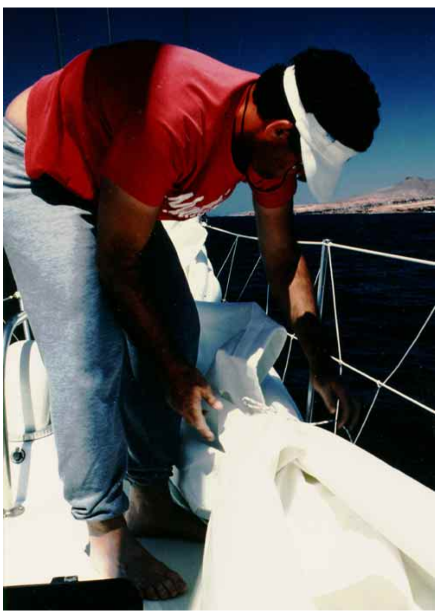
Running lights are typically integrated into the bow pulpit. When this is done, caution must be exercised so that the running light (or its mounting plate) does not become a catchment for spinnakers and sheets.

In this unit (above) there is a horizontal bar across the bottom to support the base and keep the corner protected. Note the bail on the lower forward corner. A piece of line is tied between this and the deck to protect the forward portion of the base.

Two different approaches to gates. Above is the opposite of the bail on the preceding page, while the lower photo shows a "hard" gate (i.e., one made from tubing and locked in place with a fast pin). A hard gate provides a nice secure handhold, and feels better to leaning against than a semi-loose wire gate.



Lacing the lifelines (above) helps contain foredeck headsails in high wind and seas.

Mast bars not only help when you're working at the mast (when heeled), but they also provide a place to store rope tails. In addition, you can stand on them when putting on the mainsail cover, removing the cover, and attaching the halyard.

They generally work best if mounted alongside the mast rather than in front.

Note how both sets of mast bars in these photos have three vertical legs, the middle of which is out of plane with the outer legs. This helps to stabilize the bars and prevent their bending when you are leaning against the mast and pushing outward with your feet.

Another consideration is the use of the mast-bar bases for tying down awnings and dinghies.

Mast bars are generally made from 1.25-inch (32mm) stainless pipe.

Mast Bars

Mast bars, if properly executed, contribute in a number of ways to your foredeck work.

To begin with, they offer a margin of security when you are working on the leeward side of the mast.

They can provide a place on which to attach halyards. Frequently mast bars can be used to gain the altitude required for attaching the main halyard and for dealing with the top of the sailcover.

As long as there is an offset bracing leg, mast bars can be constructed from 1-inch (24mm) tubing.

Height needs to be carefully evaluated and varies somewhat with your own body height. A minimum would be 32 inches (787 mm). Better yet is a 36-inch height (0.9m). Before making the final decision however, look at the height in conjunction with handling the main halyard and cover. Sometimes just a hair more will make it possible to get to the very top of the sail or to brace your foot on a convenient mast winch.

You will want to consider headsail sheets and if they can catch on your mast bars. This problem can be eliminated by tying a line from the forward upper corner to the mast (or a halyard). This requires a bail on the front. When checking headsail sheets, be sure to look at your storm jib or storm staysail, which may be flying on a cutter stay. This will tend to catch more than your outer jib.

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HANDLING DOCK LINES

With a timber cap rail you will need some form of chock through or on top of the rail to prevent chafing. This can be elaborate or as simple as some oval-shaped stainless rub strips. As vessels get larger it is sometimes nice to have vertical roller at each end of the chock to reduce the friction between large-diameter lines and the chock edge. In any event, the chock working surface must be very smooth. Even small knocks, over time, will chafe the lines.

Aluminum Toerails

With an aluminum toerail the issues change a bit. If the toerail is smooth, you don’t really need a chock. On our unpainted metal boats we don’t bother with chocks or rub rails. The line and toerail coexist very nicely.

Catching Rain

One thing to consider with chocks is catching rain. If this is in your plans, the chocks will have to be plugged with rags to contain the run off down your deck.

Positioning

The position of chocks needs to be looked at in light of a variety of different docking situations. For example, with bow chocks, the bow line may be run out at right angles to the centerline of the boat, forward at a flat angle, or aft to be used as a bow spring. In each case you will want the chock to be positioned so that the lines run clear down the deck to the closest cleat or winch.

For spring lines you will want a chock at the point of maximum beam. This can then be used effectively for bow and stern spring lines.

Cleats

Most people have what others consider idiosyncrasies. I suppose I have more than my share (I don’t like fat boats, abhor overhangs, and like big roached mainsails). One of my main pet peeves is docking cleats. Many boats have them strewn all over the deck, adding lots of places where you can break your toe, when there are other places where a dock line could be secured.

The dock cleats you do have aboard need to be substantial, both to provide a surface to create friction to control the dock line when easing it under load, and to have a large enough base to be securely bolted to the deck. The bolts typically should have a backing plate.

You will need two cleats at the bow. Using a single cleat can lead to all sorts of complications if you have two bow lines or a bow line and spring line.

Most folks will want a pair of cleats amidships (port and starboard) for spring lines, although I prefer to lead them to a winch aft so that I don’t have to worry about snubbing my toes.

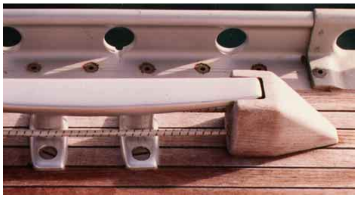
Stern cleats are rarely required, as the primary or secondary sheet winches can do the job aft.

This top toe-rail chock has edges that are a bit sharp. Over time, the dock line will break down where it goes around this very tight radius at the chocks edge.

Here’s a very simple way of dealing with dock lines and offering some variety for leads at the same time. The base is 3/16-inch (4.5mm) with 3/8-inch (9.6mm) bails.

Look how nicely rounded the rubbing surfaces are on this chock, compared to that at the top of the page. This will not only minimize wear, but make the lines much easier to pull.

An interesting cleat attachment detail on an aluminum bulwark. By keeping the cleat off the deck, the risk to your feet is reduced.



A simple way to reduce toe damage. A couple of teak chocks, held together with a bit of bungee cord keeps your foot from slipping under the horn of the cleat.

A welded chock let into the toerail. Notice the sections of pipe inside the chock to keep the dock lines from chafing on the edges. This type of chock is relatively easy to fabricate.

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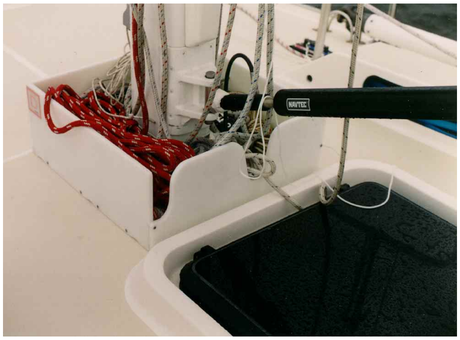
ON-DECK STORAGE

For a vessel heading offshore you need to look at on-deck storage in a heavy-weather context. Any weight on deck reduces your ability to carry sail and limits your range of stability. If a breaking sea sweeps the boat will it take your deck gear with it? If so, what secondary damage will be done to the boat or crew by wave and loose gear in combination?

Of course, there are some items that simply cannot be avoided. Hard dinks, life rafts, and running rigging come to mind. Where you do have gear secured on deck, make sure the lashings and the hardware to which the lashings are well secured.

One of the problems all sailboats face is what to do with the myriad of lines that collect around the mast and in the cockpit. There are all sorts of ways of dealing with these, some of which are shown here. The main thing to remember is that you need a system that allows you to react fast, as the boat is being buffeted by wind and sea.



Three different approaches to running-rigging storage. In each case the sheets and/or halyards will be free to run at a moments notice.

The middle left photo shows a simple way of using coaming lockers to stow running rigging.

Here's a simple way to tie off a windsurfer mast (middle right). The Velcro strap is quick to operate and has substantial holding power. This is a good set up for coastal work, where the convenience of the Velcro is a benefit. But for offshore you would want to have a proper lashing with light line.

We'd rather not see any jerry jugs lashed on deck, but if you are going to carry them they do need to be well secured. The middle left two photos show a clever stainless containment edge to keep the containers from shifting when they are secured to the handrail. However, in a serious knockdown the odds are the handrail would fail from the tie-down loads. It would be better to have dedicated padeyes which have been through bolted.

The bottom left photo shows another interesting approach to securing jerry jugs, this time on deck, between two boards, which are then tied to stanchion bases.

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COCKPIT LOCKERS

Cockpit lockers which lead to the interior require very large upstands and good seals to try and retain some watertight integrity. However, with most of these situations in heavy going, some water is going to find its way below.

The ideal solution is to have no lockers from the deck, except for a lazzarette hatch that can be dogged against a good gasket.

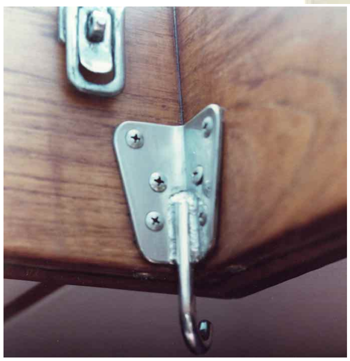
If you do have cockpit lockers, make sure the gaskets are in good shape all the way around and have some way of easily locking them when they are not being used. Often a small jib hank will get the job done (so that the contents stay put in a knockdown!).

RUNNING LIGHTS

We've yet to find any running lights which when mounted forward will stand up to the rigors of heavy weather. They usually become a wet, corroded mess inside, regardless of make. We've only found two ways around this: One is to solder the wire leads directly to the bulbs (which provides some shock-absorbing capability and ensures a good connection). The other is to move the lights aft to around amidships, where they are away from the motion and water of the bow area.

Running lights mounted forward have to contend with spray, motion, sheets, and sails. It is a tough combination of foes!

Here are a couple of nice installations in the pulpit (left and right), where a stainless protector has been fashioned in which the running light itself fits.



There may be times when you want to bag a headsail but are short of hands to hold the bag open. If you have a series of four hooks mounted in the corners of your foredeck hatch (left), these can be used to hold the sail bags open.

Mounting your sailing insturments where they can be seen from the helm and crew (without adding lots of extra readouts) is sometimes difficult. In this case (left), we created a handrail onto which the B&G readouts were hung.

Attaching the halyard and sail cover is always a problem, and here's a simple solution for a lot of boats.The Carmines created this step (above) so that they could reach up that extra foot.

SAILING SHELTER

There's probably no element more crucial to comfortable cruising than good shelter on deck. We've covered dodgers and awnings in the first section of the book. Now let's look at more permanent forms of shelter.

HARD TOPS

Hard tops offer some advantages, such as a nice place to stand on when looking for coral or working on the mainsail. Hard tops, however, are heavy, expensive, raise the center of gravity, and can't be folded down.

Linda and I have debated this subject back and forth for years. We've looked at hard-top designs on other boats, but always came back to the dodger until we did *Sundeer*. And from there on it has always been some fixed form of shelter for us.

Still, our decision has been influenced by our cruising grounds — the tropics. As the temperature drops and latitude increases, hard tops begin to make more sense.

If a hard top is in your future, here are a few things we've observed to make them pay their way. First, the sides and back of the top make ideal handrail locations. These can be invaluable when getting into or out of the cockpit, or when going forward. Next, some form of ventilation, either with opening windows in front or hatches in the roof, is essential, even in temperate climates. Dodger-style windows are very difficult to keep watertight, especially if there's a steep slope to the front of the structure. There should be provision for getting up on top, usually by walking up the mullions between the front windows. Some form of catches for your feet will be very helpful here. The top should be painted with nonskid material or taped off with nonskid tape. Since the top does make a good intermediate-level viewing platform when sailing in coral, having something to hold onto when standing there is a great help. If there's a mizzen mast behind the roof, you may be able to work out a bar between its headstays to lean on.

For additional protection, a removable back window to close off the cockpit area can come in handy. These are easiest to store if done in flexible vinyl, as with dodgers. You may want to use the same approach with the sides as well.

FIXED WINDSHIELDS

Quite a number of European cruisers are fitted with a fixed windshield around the forward part of the cockpit. Under inclement conditions a top is then put into place. On some designs the top is actually a removable hard top (similar to the removable tops on the original late '50s Ford Thunderbird). But more often this is done with fabric. The windshields are usually broken up into small rectangular sections, separated by and contained within an aluminum framework. As such, they lend themselves to opening hardware and a reasonable degree of watertightness when dogged down. This approach makes sense in a European weather context, but for the tropics, where you want airflow and protection from the sun, you're probably better off with a good dodger.

A short hard top like this is quite popular on European boats. It does provide good protection for the companionway hatch, but the crew is pretty much left out in the rain and spray unless the hard top is extended in some form of top and side curtains.

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If you want full standing headroom, aesthetics will need to be compromised. Of course, from inside the boat, with all that lovely space in which to lounge, you can't see how ugly your structure looks.

In the right-hand photo, note how the aft vertical support has been opened up with handrail slots.

The more freeboard and coaming structure you have onto which you can set your roof structure, the less obtrusive it will be. We took these photos in Cabo San Lucas. It's pretty warm (note shorts and no shirt on the foredeck) yet the cockpit area is still enclosed. That's an indicator of a pretty good ventilating system for the cockpit.

The front end of this structure looks like the typical, short European windshields, except that a long fixed roof has been added over the cockpit.

The edges of the roof provide an attachment point for the curtains on the sides and back.

The fixed roof is a great place to stand when furling and covering the mainsail. Imagine doing that job without the roof!

THE PILOTHOUSE

Properly executed, a pilothouse can add to the aesthetics, seaworthiness, and usefulness of a cruising yacht. But a good pilothouse is probably the single most difficult thing to design aboard a seagoing vessel.

The first step in this equation is to decide the function(s) of this structure. In a basic pilothouse you would want shelter from the elements in a design that works well at sea with the boat rolling around, as well as a nice outlook on life when anchored.

In the next step you might then desire a little more floor space to increase the apparent roominess: Nice for entertaining, although it does complicate things below decks and at sea.

The last approach is a full-on raised saloon, where your living room and piloting area are, in effect, combined.

Ergonomics

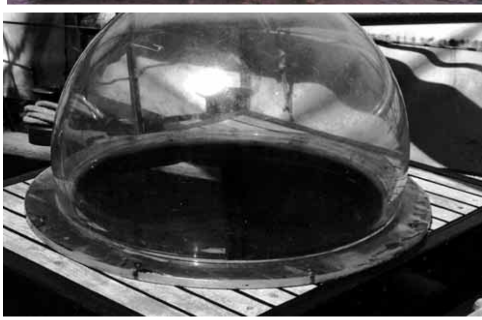
The difficulty in designing the house comes in several areas. From an exterior aesthetic standpoint the house structure should be as low as possible. Yet a low house will intrude into the interior of the boat, causing problems below. You need have 39 inches (1m) of clearance between the seat bottom, without cushion and the roof. This allows room for an adult of over 6 feet (1.8 m) to sit straight up on a 3- or 4-inch (75 to 100mm) cushion.

Next is headroom when standing. If you go for full headroom, the sole area will have to be depressed so that the sole is perhaps 36 inches (0.9 m) below the seat. This means your legs won't have direct support, but you can have a support bar (hinged, preferably) built in, or you can brace your legs across to the other seat front or a divider bar if the spacing is worked out correctly.

This design approach keeps the roof reasonably low without having to drop the seats below deck level. Seats can be dropped down so that the distance from seat to sole is more conventional, but then the seat bottoms intrude into interior space, which means losing headroom in the interior or raising the entire freeboard of the vessel, which is an enormous hit on performance.

This trade-off with the rest of the interior design must be considered carefully. You need to make sure than the pilothouse requirements in and of themselves do not force compromises

There are all sorts of ways of executing pilothouses. The bigger the boat and/or the higher the topsides, the better the house structure will look in relation to the rest of the boat. Sometimes, however, it is not possible to make the house unobtrusive. When this is the case, it is sometimes better to make the house a design feature, as in these photos (above and left).



pilothouses are wonderful structures at sea. However, they are also heavy, expensive, and visually cumbersome (unless you've got a really big boat). You could buy a very nice boat for what a proper pilothouse will cost, all by itself! A well-done dodger will provide all the same functions. It will keep you warm and dry, allow you to sleep under its shelter, for a fraction of the weight and cost of a pilothouse.

And, if you really want to keep it simple, a plastic observation dome will allow you a good view of the surrounding area with little cost, next to no weight, and insignificant windage.

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on the rest of the boat that you may later come to regret.

In our own struggles with pilothouses, on a number of designs, we have always ended up keeping the pilothouses as compact as practical, designed so that they were optimized for watch standing (which means keeping space tight so they are easy to move in at sea). In so doing, the rest of the interior areas have paid little penalty.

We've found in port that the somewhat smaller pilothouse still works wonderfully for entertaining or just enjoying the surrounding views.

External Sight Lines

Another consideration is sight lines from the cockpit when conning from the outside steering station. Standing on the centerline, you need to be able to see either over (preferably) or through the pilothouse. You also need to be able to see along the side when sitting to leeward and steering by the headsail. Remember that in this analysis there will be more than one person's height to consider.

If the pilothouse leads to a cockpit area that is at deck level, seeing over or around it will not be a problem. But if there is a sunken cockpit, then the sight lines from aft are going to be problematical.

One way to mitigate these issues is to use twin steering wheels, in conjunction with a heavily cambered pilothouse roof. The outboard-mounted steering wheel allows you to move to the edge of the boat, at which point when you look over the house, the camber has reduced its height.

This vessel started out as a traditional 1950s raised saloon motorsailer to which an ambitious owner added an enclosed pilothouse. If the height were brought down a bit, and the face were pulled forward a modest distance, it would not look quite so boxy.

Both of these yachts spend time in the high latitudes so the house first and foremost must be functional. I like the straight, businesslike and unpretentious lines of both. These vertical windshields will shed water more rapidly than the one that is angled, and to improve visibility in difficult conditions.

A small yacht like this is usually better served with a dodger rather than a pilothouse. However, this one does a reasonable job from an aesthetic standpoint.

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The higher latitude a yacht is designed to sail in, the bigger you'll find the pilothouse. This rule certainly applies to the top two photos (of the same boat). There is full standing headroom under this house, with large side openings that are closable with dodger-style curtains.

This Kiwi design (left) has a large house on it for the size of boat. However, by dropping the sole well into the interior and tying the house to a long trunk cabin, the appearance problems are mitigated.

The edge of the pilothouse is the perfect place for a nice long handrail. If the handrail doglegs toward the center at the aft end, you can walk all the way down the side deck and step into the cockpit or bridgedeck area without ever letting go.

Internal Sight Lines

Visibility from inside the pilothouse is typically a question of how close to the bow you can see the water. Offshore, this will not be an issue. But if you are conning from inside the boat in congested areas, or where debris could be a problem, you will want to be able to see the water no farther than two or three boat lengths from the bow.

Sometimes this is not possible without significantly raising the height of the house, unless you have a hatch in a strategic location through which you can poke your head to gain some altitude. These needs to be done in conjunction with a step or seat strategically placed to give you some support.

Sole Width

Pilothouse floor width must be considered as well. The floor width and seating can be laid out cockpit-style, with just 2 feet (610 mm) of sole. This means you can be braced to leeward when sitting on the weather side. It also means an easy-to-traverse area in bad weather. The pilothouse sides may still be quite far out, giving lots of visual interior space with this approach. An advantage of the narrow sole is less intrusion into the interior.

Or, you may want a wider sole, which definitely enhances the openness of the house but is a negative in the interior. A wider sole (say, 48 inches/1.2 m, or so) necessitates a removable middle bar for a foot brace and handhold at sea.

Structure

Having decided on size, the next step is structure. If the pilothouse has unsecured openings into the interior, then it must be considered *primary structure*. This means it must stay intact in a rollover or when the vessel is dropped off a large wave. That's tough to execute: A *heavy* problem. On a metal boat, things are simplest, as you can pick up the deck frames with the house structure, welding everything together. But if this is a bolt-on situation in a timber or glass boat, it's probably better to be sure the openings to the interior can be made watertight, just as you would with a dodger.

When you are engineering toward primary structure, the house needs to be able to take high impact loads on the side and support hydrostatic pressure when the boat is inverted.

Glazing

Glazing is another question. Plastics are best, either a polycarbonate with a hard finish, such as GE's Lexan or Rohm and Hass' Tuff Act, or a good-quality acrylic. If you're aiming for primary structure, then the windows should be bolted into place with ring frames. Thickness varies with

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span. With a 24-inch (607mm) span we usually go with 1/2-inch (12.6mm) Lexan.

Window Shading

Shading of the plastics is a function of how you intend to use the house. The more glazing you have, and the lower the latitude, the darker it should be. Yes, you'll lose some visibility at night. The darkest plastics will show well-lit targets a mile or so off, but may block the light of a small boat on a stormy night. However, the heat load from the sun is so high with clear that I prefer to use dark plastic, and stand outside for watchstanding when conditions are really bad, where I can hear, smell, and see better.

Visibility Issues

Visibility through the forward windows will be affected by your distance from it and its angle. Ideally, you would stand right in front of the window and it would be tilted forward (as they frequently are in fishing boats). But this geometry looks like hell and rarely fits in a sailing pilothouse. Usually, just the opposite is the case. A well-swept windshield is necessary for aesthetics and windage reduction, and you may be 3 or 4 feet (0.9 to 1.2 m) from the surface. This in turn affects what, if anything, you do to keep the windshield clear. With a nearly vertical surface, where the eye-to-window distance is within a foor (0.3m) or so, a high-speed "clear view" will keep a portion of the window always clear, even with continuous salt spray about. Another way to go is with large windshield wipers. However, if you have plastic windows these must be carefully installed to avoid scratching the plastic, and they must only be used when the window is wet. A very practical approach is plain fresh-water spray, which minimizes salt buildup, doesn't scratch, and is easy to install.

However, I don't really see the need for any of the above, as our experience has been that the visibility isn't that bad even with a lot

As the boat gets longer it is becomes easier to fit a pilothouse in terms of the overall proportions. The heights are typically the same as on smaller boats, but there is more hull and coaming to balance out the structure. This is *Interlude*, one of our Deerfoot 74s. If you look carefully you can see the centerline sole brace that breaks up the floor space to keep you tucked in at sea, and provides a place to brace your feet when you are sitting.

There are opening panels on the port side to allow communication and airflow into the galley area.

One way to install pilothouse electronics is to build everything in. The advantage is that everything looks very finished. However, you must be careful to allow for good airflow to the backside of your electronics.

The negative with this approach is that when the time comes to change a piece of gear, the carpentry work to match up the new face plates will cost far more than the electronics. Also, the furniture housing the electronics reduces your sense of space.

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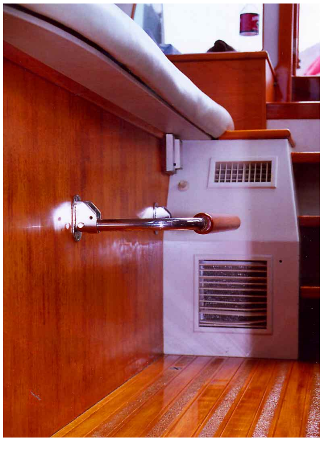
Maya, a Deerfoot 75, has a pilothouse that provides an interesting contrast to the two 74s on the preceding page. The length and width of this house is almost the same as the other two boats. However, the sole space has been reduced to a more roomy cockpit-like dimension. When you are sitting on one of these seats, you have the same visual feeling of space as the wider sole boats, and indeed the square footage at eye level is almost the same. However, because the sole is narrower, there is a lot more space in the galley with which you can work. This results in a very nice counter running down the inboard side of the galley (as well as the larger outboard counter, a very practical trade-off for a narrower sole.



We find that often the best pilothouse layout has the seat level higher than normal sitting height. This means your feet cannot touch the floor in the normal seated position. Some form of support is required for comfort. A hinged brace (middle photos) will do the job. A center divider bar, helpful in breaking up sole area at sea, also works well.

of salt water around; and when conditions are really tough we're going to be outside anyway.

Heat load in the sun can be a major problem, even with very dark plastic. If much time in sunny weather is planned, give some thought to outside, easily deployed window covers. A number of fabrics let in some light, leave a little visibility, but cut down most of the heat. Having tracks or snaps built in around each window with some easy form of rolling the screens/shades up when not in use will do wonders for the internal temperature gauge.

Pilothouse Ventilation

Several opening hatches should be strategically placed in the roof. Hopefully these will be clear of the mainsheet. Ideally, one will be over each side at the aft end of the seat, with the aft edge of the hatch even with where the middle of your head falls. This gives you the best airflow from the hatch when incoming breezes are light. If the pilothouse is built on a coaming, dorade boxes can be incorporated into the coamings with air vents from the tops of the coamings angled into the pilothouse.

Navigating from Inside

Being able to run the boat from the pilothouse is one of the major reasons for going through this exercise. This means provisions should be made for steering via the autopilot manual control and for controlling the engine. It's also nice to work in the basic navigational electronics used on a minute-by-minute basis: radar, GPS, VHF, depthfinder, and sailing instruments. Hopefully, the radar will be visible from the outside helm station as well.

The radar should be visible from both sides of the pilothouse. Ideally, you'll be able to sit with your back against the aft side of the house, facing forward, keeping an eye on instruments and horizon, while in a nice dry, temperate environment.

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Aft Overhangs

The last thing to consider is an aft overhang on the pilothouse roof. If you have room in the cockpit, extending the roof aft a couple of feet (600mm) will make a cozy nook in which to get out of direct wind and spray, while remaining outside in the fresh air. The sides of the house should be pulled aft as well, providing shelter from side spray well and lengthening the house visually.

Night Lighting

If pilothouse lighting is handled properly, you will have enough light while under way to eat a meal without losing your night vision. We have found that the best way to handle this is with a low-power string of tube light (some folks call them Tivoli lights) run behind the valances, stopping even with where the pilothouse desks begin. This keeps the lighting behind you and off the windows (so no glare is produced).

We typically specify half-watt bulbs spaced at 4 inches (100 mm) on center for this application. This will not be enough light for entertaining in port, and for that purpose a few spots can be inserted into the headliner if required.

Chart lights are typically required at the forward and aft ends of the pilothouse, forward for the usual nav work, aft for reading on watch or at anchor.

Seat Design

We tend to make our pilothouse seats quite wide, with thick back cushions so they are not awkward to sit on. Seats usually run about 28 inches (688 mm), with back cushions that are about 5 inches (125 mm) wide at the base. This gives you a comfortable seat to sleep on at sea (with the back cushion in place since you will be sleeping to leeward, and it makes a nice soft bunk edge) or in port with the cushion removed.

The Hybrid Approach

When the time came to decide what to do on *Sundeer,* Linda and I were in a quandary. We went through all of the arguments for and against a pilothouse, and we decided that a well-designed, fully enclosable dodger really made the best sense; it cost less, weighed less, and was easy to execute. But just in case, *Sundeer*'s cockpit coaming was designed so that a pilothouse or hard top could be worked in and look good at a later date.

Well, that later date came sooner than we thought: about midway through the hull construction process. I'd been working with Ulf Rogeberg on an 86-foot design concept and asked him if he had any ideas for *Sundeer.* He came up with a sleek-looking structure, of the same height as our dodger. This gave us normal headroom for the seats, and something less than full headroom when we were standing — the same as we'd always had with dodgers in the past. Since the windows into the cockpit were watertight, and we'd already made provision for washboards and a sliding hatch, we calculated the house structure could be built for under 400 pounds (181 kg). While this was a big hit — 8 feet (2.4 m) above our center of gravity — it wasn't the same magnitude as some of the 1,000-pound (453kg)-plus structures we'd been involved with in the past.

We decided to leave the back of the house open, so as to have maximum ventilation and communication with the rest of the cockpit area. This would be enclosed with a removable back curtain if required. Two 24-inch (610mm) hatches were let into the roof for additional ventilation.

The net result of this compromise was a hybrid cross between dodger and pilothouse, with the best of each concept.

Engine and sailing performance instruments and radar and autopilot control were all mounted at the forward end, with the radar and pilot heads being easily removable for storage down below when in port.

The forward windows were angled steeply aft to reduce windage. They also looked nice that way. Since the cockpit area was watertight, with proper cockpit drains, the 1/4-inch (96.3mm) acrylic-plastic windows are glued in place without the use of bolted compression rings.

How has it worked out? Visibility offshore at night was fine for watchstanding. Closer to shore, with lots of small-boat traffic, we take a look outside every 10 or 15 minutes, the same as we would with a dodger. When entering a port I want to be outside anyway, so the somewhat restricted visibility doesn't have a negative impact on the way we cruise. The ambience was very nice. Surrounded by teak trim, with lovely cushions and soft lighting at night, the house was one of our favorite places on board to sit at anchor as well as offshore. Was it functionally better than a dodger? Not really. But there's a certain emotional benefit from the solid structure that you don't get from fabric and stainless.

Sundeer's pilothouse was the first of our "hybrid" designs. We treated it structurally as a dodger and had a self-bailing cockpit and washboards in case of severe flooding due to a structural failure. The aft end was open but could be closed off with removable curtains. There were large ports through the footwell that did a marvelous job of helping airflow into the interior. Since these ports were covered by the house roof, they could be left open in all weather conditions.

We mounted our radar, autopilot-control head, and VHF radio in the pilothouse area. The rest of the gear was kept below in the nav station. When we were in port, the electronics in the pilothouse would be removed and stowed below (to remove temptation). With the back end open, we had excellent airflow, even in the tropics.

Winch Location

Now we get to a tricky question, where do you locate the sail controls? On the original *Sundeer* we had these within reach of the pilothouse. Main- and mizzensheets were both by the steps leading down into the pilothouse area. Primary winches were just aft of the end of the house.

On the 64s, with the aft cockpit, we made provisions for the winches to be mounted either all the way aft in the cockpit area, or behind the house. When we mocked everything up, the consensus seemed to be for having winches close to the steering areas all the way aft. This means that you would have to go all the way aft from the pilothouse to make adjustments, whereas before you could poke your head out behind the house to trim or ease. Of course, when you were working the boat from the aft cockpit everything was very handy.

Which is the best approach. I think it hinges on where the steering station goes. Now that we've done both I really like each approach. However, my preference is to be able to trim in inclement conditions without getting wet! So, on *Beowulf*, we brought the cockpit back contiguous with the pilothouse, so the wheel was close by, and then arranged the winches in the same fashion as we had done them on the original *Sundeer*.

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The pilothouse for the Sundeer 64s borrowed heavily from our experience with the original (67-foot) *Sundeer.* We adopted a more aggressive styling with hard edges, doing away with the conical corner windows in the process. This improved visibility through the corner windows, as the curved windows would distort images quite substantially. For this pilothouse we installed four small Bomar hatches, two per side, for good ventilation when sitting forward or aft in light wind conditions.

The aft end of the 64 pilothouse is enclosed with dodger-like windows. These can be rolled up to allow better wind flow or visibility, or removed and stowed below when you want full air-flow all of the time.

Several of the owners decided to have their electronics installed in custom-made cabinets. It does add a finished look to things but reduces the visual space you have to work with.

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VENTILATION

Suppose you're anchored in American Samoa's unpleasant harbor of Pango Pango, and the weather pattern is in its usual "swamp the dinghy" rainmaking mode (that's on an hourly basis!). You're trapped in the unventilated main saloon by the deluge on deck, soaked with perspiration, watching the mildew grow. Or perhaps it's the Virgin Islands toward the end of the season; it's warm, with rain squalls about, forcing you to keep the deck hatches closed. Ventilation then becomes the key to continuing to enjoy your cruise.

At sea, ventilation problems are even more difficult to deal with. The ventilation system has to be able to cope with not only spray and rain, but also the occasional wavetop.

This was the situation we encountered aboard *Intermezzo* when crossing the Indian Ocean from Cocos Keeling toward Rodrigues. The seas were moderate the second day out, with the wind at Force 4 from the quarter. The main-saloon hatch, protected by a weather cloth, was open 3 inches (75 mm) to allow some desperately needed fresh air. In the middle of the night an errant wavetop just kissed our hull amidships, sending buckets of water through the hatch. Three bodies and four sets of bedding under that hatch in the midships pilot berths all got a good soaking. Anybody for sleeping in soggy bedding?

Of course, we immediately dogged the hatch, but the damage was already done.

As you plan your ventilation system, keep the following issues in mind: one, the system must work well at sea, with water on deck; two, it has to work at anchor under rainy conditions; three, be realistic about your needs. The tropics will make the biggest demands, although in other areas summer cruising can also create challenges. Finally, the system must be flexible to respond to different climates, amounts of spray, and levels of rainfall.

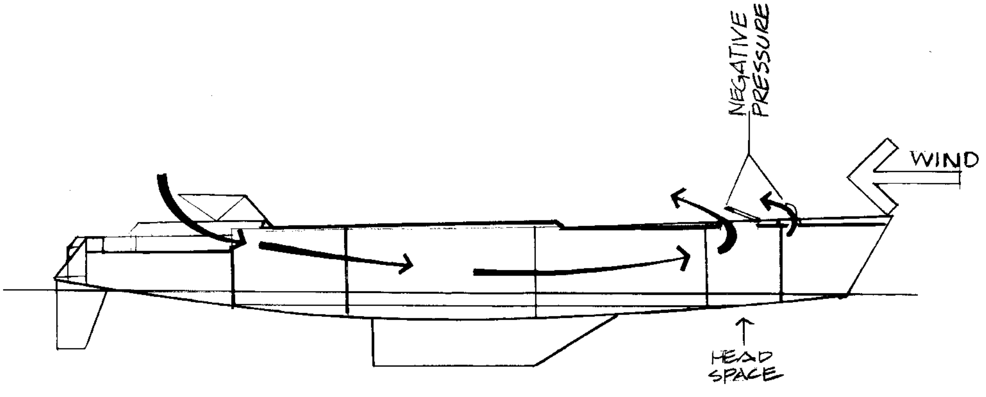
BASIC ON-BOARD AIRFLOW

Understanding the somewhat strange characteristics of airflow in the interior of your vessel is critical to making the right decisions about ventilation.

On an anchored aft-cockpit yacht, the situation is pretty simple. The breeze will enter aft through the dodger and companionway and flow *forward*, finally exiting through a forward hatch or vent. For this airflow to work the boat must have a foredeck opening hinged forward and facing aft to allow the air to complete its flow. While this may seem counterintuitive, it is definitely the case when the wind is from the forward quarter or right on the nose. In fact, the bigger the dodger is, and the harder the wind blows, the better will be the breeze inside.

I won a bet from my cousin Jeff on this subject. We were beating into a 35-knot northwesterly at the time, trying to get around Cape Hatteras, and Jeff wanted to smoke a cigarette. He said if he went right back to the pushpit rail around the stern we wouldn't smell his smoke. Not only did we smell it, but we ended up with ashes all over the cockpit floor and interior.

Reaching and running, the ventilation situation varies, depending on hatch and vent placement. Find the answers by experimenting. Since it will be difficult to duplicate all the situations that are



If you don't believe this works, anchor out some breezy afternoon, open the forward hatches (facing aft), and check the direction of airflow with a candle.

likely to arise before leaving on your cruise, it's essential to have a flexible means of approaching the subject later on.

With a center-cockpit layout, or where a large pilothouse is involved, the flow will usually be the same in the forward portions of the boat, although it can reverse in some situations, with air preferring to enter forward and exit aft.

With either interior layout it's always difficult to get good airflow into the aft part of the boat. There seems to be a stagnant air situation aft that only large dorades and hatches will overcome.

A good way to check airflow is with a candle. Walking around and watching flame direction when the candle is held at different heights will go a long way toward helping you uncover the mysteries of air movement aboard.

There are several basics to keep in mind. A hatch or vent opened toward the wind creates a positive pressure. Turned away from the wind, a negative pressure is created, drawing air out of the boat. The balance of positive and negative is important. Try to develop an approach that generates positive flow where there's little likelihood of getting water below, while keeping the negative sources for the wetter areas aboard.

This very nice looking timber hatch is going to have a devil of a time keeping water at bay if the hatch is not perfectly aligned with its bed and if the gaskets aren't in good shape. The cast hatch below, on the other hand, can't trap water and has a 1/2-inch (12.6mm) round gasket onto which it compresses. These cast hatches rarely leak.

Always have substantial airflow sources which aren't subject to drips in rain and can be protected from spray. Many boats we've built feature a head all the way forward, over which a hatch can be left open. Aboard *Wakaroa* this hatch is actually right over the shower compartment, so any errant wave tops or rain that find their way below don't create a problem. It's frequently possible to store a dinghy upside-down over a hatch to protect it.

Deck Hatches

The deck hatch has three jobs: to let in light, to let in air when open, and to keep out water when closed. Hatches should be as large as possible for air and light and should be positioned to reduce damage from spray that finds its way inside.

Positioning should also take into account condensation in colder weather. Even if the hatches are dogged tight, the condensation will drip, and any bunk below the hatch will get a bath.

Each opening cut into the deck increases stress around the corners of the opening. If adding a new opening, the frame of the hatch should be used to reinforce the cutout.

It makes sense to use double-opening hatches, which provide the most flexibility in directing airflow.

Good-quality, soft gaskets are critical to the hatch staying watertight. The gaskets should either be hollow, or of a 10-to-12-pound density neoprene rubber. A sharp edge that bites into the gasket from the hatch top or bottom creates the best seal.

Remember that the base of the hatch may not always be perfectly level and that the gasket will deteriorate with age. Some tolerance in the gasket system should allow for this.

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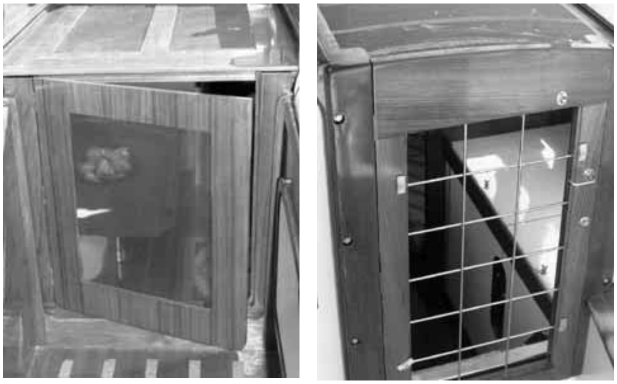
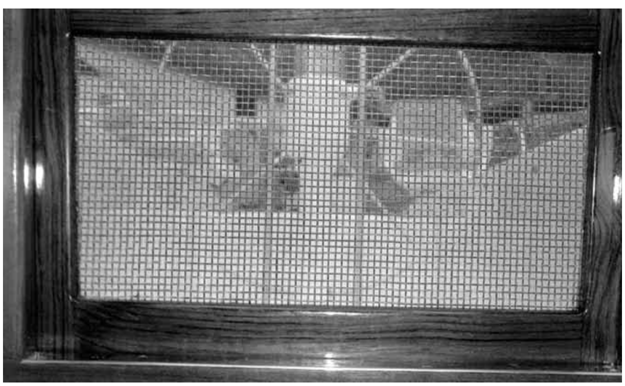


Maintaining airflow while keeping bugs out of the interior takes some creative design work. Both of these photos show the same principal. The sliding hatch (above) is replaced by a sliding screen. Then, a hinged door fits in the washboard slot. This makes access simple, yet gets the door screen closed quickly behind you. *Mistral* (right) has a structural door for security.

I was joking one evening with an owner about how nice it would be if one could simply push a button and have all his hatches close automatically when a rain squall passed (without getting out of bed of course). The next thing I knew this joke was on the to-do list! The air cylinder you see is actuated by a small compressor, and, yes, you can close the hatches without getting out of bed.



You may want to make up an extra hatch board with a screen inserted to improve ventilation in buggy anchorages. This one, aboard *Wakaroa*, has a heavy-duty stainless grid over the lighter insect screen for intrusion security, to keep the dog from breaking through, and to make sure that the kids don't fall down the steps.

Best results are obtained with dog fasteners on all sides of the hatch. This way the four dogs can really jam the hatch down on the gasket. Using only two dogs requires precise fitting of hatch, gasket, and hinges; over a long period of time a two-dog hatch is going to leak. Dog handles should be long in order to generate substantial leverage and must be adjustable to take into account the aging and compression of the gaskets.

Inside/outside opening hatches, with handles on the outside as well as interior, must be avoided where leakage can create a problem. Sealed with O-rings, the shafts on these dogs will eventually leak.

Hinges should be mounted external to the frame, so that a leak that develops in the fasteners won't get below.

Today most hatches are built with aluminum extrusions and plastic glazing. My personal preference, however, is cast-aluminum frames such as the ones that used to be made by Goit or currently by Bomar. The cast hatches don't depend on a lot of fasteners through the frames, each of which can leak, and their stiffer frames move less relative to the deck.

In glazing there are two choices of plastic: polycarbonates such as Lexan, which are extremely tough, and acrylics, which are stiffer. The polycarbs have two major problems, however: They scratch very easily, and the scratches can't be polished out. The material is so soft you can't even hit it with a deck brush without marring the surface. You can get around this by specifying a coated material such as Lexan's Marguard or the Rohm and Hass Tuffact. Acrylics aren't as impact-resistant as the polycarbonates, but they can be polished with an electric buffer and compound.

Treat very slippery plastic with some form of nonskid. One approach is to use nonskid tape over the support bars so that it doesn't show through to the interior. A light sandblast or an orbital sander can scratch the surface, providing privacy below.

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WINDOWS AND PORTS

Opening windows or ports must be extremely strong to withstand the impact likely to occur when a boat falls off a wave into a trough in heavy weather. For offshore work this removes plastic frames from consideration unless the ports are small and storm covers are fitted before you head offshore.

Condensation dripping off metal frames can be a major problem. One way around this is to have a self-contained shelf, which can double as a handrail or for storage, running under the ports. This shelf can then be sponged out from time to time.

Another issue is water accumulating outside. If the top of the port is angled toward the centerline of the boat, water will collect on the outside, ready to run into the interior the minute the hatch is opened. However, if the bottom of the port is angled outboard about 15 degrees this can be avoided. Most ports today have this feature built into their castings or moldings.

If your cockpit well projects into the interior, it makes an ideal place for several large windows. These let in additional light and are usable in adverse conditions since in all probability they're protected from rain and spray by the dodger. For windows let into the side of the trunk cabin, some form of shade or eyebrow should be developed to give protection from rain and spray.

In spite of anything you may read in manufacturers' catalogs, there's no such thing as a 100-percent watertight opening window, unless it is heavily made from cast (not extruded) metal with dogs placed at close centers around the perimeter. While they may be okay most of the time in a trunk cabin side, used in a hull side they're nothing but trouble.

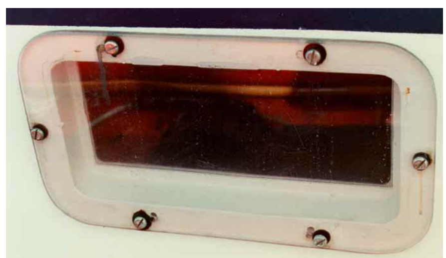
Size and Quantity

You can never have enough hatches and ports. The more there are, the better the interior lighting will be, the more open the interior will appear, and the better the ventilation possibilities are.

At minimum there should be one deck hatch for every cabin aboard. The saloon/galley ideally will have two. Again, the bigger the better. Use the very biggest that will fit on deck without causing structural or traffic problems.

Intermezzo came to us with these two lovely opening ports. The only problem was that they opened to the inside and trapped spray and rainwater when closed. So, you had to sponge them dry before opening. We reversed them, as shown here, which solved the water-trapping problem, but forced us to go outside to dog or undog them. They let in a lovely breeze when on the hook, something that was especially important to the cook.

In New Zealand we removed the lightweight aluminum frames and installed these 1-inch (25mm) Plexiglas windows/storm shutters. The scarred area inside was covered with a teak trim.



Here are two other storm-shutter treatments. In both cases heavy Plexiglas or Lexan has been fastened outside of the original window frame. This is not intended to be watertight; rather, they are designed to carry impact loads when falling off a wave.

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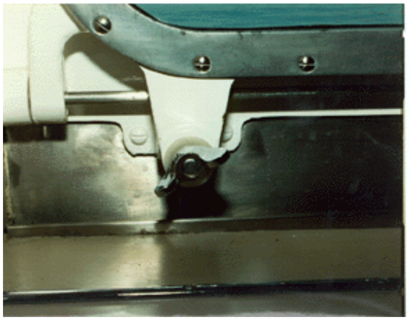

Opening hull ports pose severe risks. If they are inadvertently left open, your interior can quickly become flooded. However, if you are going to have opening hull ports this is a very clever system.

These are installed aboard *Galatea*, an 80-foot (24.7m) Palmer Johnson–built ketch. The window opens by sliding it along a track. When in the closed position, clamping pressure is achieved at the bottom so a pressure-resistant, watertight seal is created. But what I like best is the ability to easily remove the window for servicing. This means you can change or rebed a leaking or damaged window and replace a gasket that is past its prime. Of course, you do need a procedure to make sure that these hatches are dogged *before* you put to sea.

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SCREENS

The need for screens will depend on where you cruise. The problem is that screens are difficult to execute in a functional way, tend to be fragile, difficult to install, and a pain to stow. Typically, just when everything is set, a rain squall will come along and the hatches will need to be closed, with the screens in the way. Screens block a substantial amount of airflow, too. Normal fine-mesh screens will reduce air flow by 75 percent or more.

There are three basic ways to solve this tangle. One is with a screen sewn into a fabric frame and then fastened with either Velcro or snaps. Velcro is more practical but has a definite case of the uglies. If snaps are used, the frame will have to have some form of a gasket to press against the hatch coaming and seal between snaps. Sewn screens are easiest to stow. Just roll them up and toss them under a bunk.

Ports that open through the sides of coamings or houses should have some form of eyebrow or rain awning. This is a simple fiberglass molding and will allow this port to be left open in moderate rain (for more data, see the awning section).

Screens glued to timber or metal frames are easier to install and look nicer, but they are difficult to stow. A specific spot in a locker or under a deck head with a rack should be devoted to stowage. A timber frame can have a hinge in the middle to make it easier to reach in and adjust the hatch. However, the timber, which must be at least 3/4 inch (19 mm) thick, complicates stowage.

A metal frame made out of 3/16-inch (5mm) stainless-steel rod is a lot easier to stow. These are held in place in the hatch opening with small protrusions (a roundheaded screw does nicely). To install the screen, slip it into place, bending one side back by pulling on a short loop of monofilament line attached to the frame.

If building from scratch, consider putting the screens right into the headliner. In this approach the screens run in a track just under the deck, eliminating storage problems. Then, when you want to use a screen, just slide it out into place. A second pullout screen can be added for privacy. A thin, opaque sheet of plastic temporarily fastened on top of the bug screen serves the same purpose.

The companionway hatch will also need a screen. Although snap- or Velcro-fastened screens will work, they're really a pain when you're moving in and out a lot. Sometimes it's better to make a hinged screen that opens aft and drops into the washboard slot. The companionway hatch can then be opened and closed in conjunction with the washboard/screen unit.

If you have small children on board, you should-take a look at some form of hatch protection to keep them from falling through. These "corbels" (above) were installed in *Wakaroa*'s hatch after J.P. (the Schmidts' oldest) took a tumble and broke his arm in the process. Removable stainless-steel rods were installed when the kids were young.

Another way to go is to use a stainless wire rod to which screen is glued. This is held in place with a small fixed button on the coaming. A light piece of nylon or monofilament is used as a grab to deflect the rod inward to remove the screen, as shown in the above photo.

One way to deal with screens is to create a timber frame, hinge it in the middle for access to the hatch, and hold it in place with buttons or some form of turning hardware (left and right).

Sliding screens are the ultimate answer to keeping bugs away. They are self-stowing, easy to operate, and offer the additional advantage of providing a moisture barrier (if sealed with a bit of plastic in cold climates) so that condensation does not form on the underside of the hatch.

In the right you see the under-deck runners that hold the screen. The left photo shows the typical screen installation we developed for *Sundeer.*

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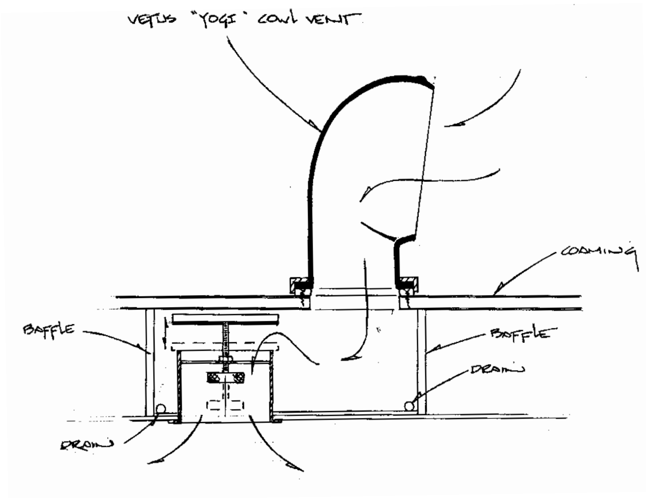

The *Sundeer* "throttle" system works really well at adjusting airflow as well as sealing the dorade pipe. One fact to keep in mind is you need to be able to reach the nut holding the cap so that the cap can be removed to service the gasket every year or so.

DORADE VENTS

The more efficient dorade vents there are aboard, the less your temptation will be to take a chance with a cracked hatch at sea.

The first rule is to make the cowl on deck as large as possible. More cowl area means better funneling of airflow. Paul Luke has made some nice-looking aluminum castings for years; they're wonderful at scooping up the breeze but are heavy and very expensive. Vetus makes some nice rubber vents, with reasonable cowl area, which are lightweight and relatively painless at the cash register.

The diameter of the cowl base and the through-deck pipe should measure at least 4 inches (100mm) in diameter, but 5 inches (125 mm) is even better, since a 5-inch (125mm) pipe has 50 percent more area than the smaller diameter 4-inch (100mm) unit!

The cowl should be mounted so that any water that finds its way into the dorade box can't drip into the inflow pipe. The edges of the two circles formed by the cowl base and inflow pipe should be at least 1 inch (25 mm) apart, preferably 2 (50 mm). The inflow pipe is cut off 3 to 6 inches (75 to 150 mm) above the deck, preventing a solid wave from swamping the pipe and dousing the interior. A higher pipe is better. However, it should be kept 2 inches (50 mm) below the underside of the box to allow for good airflow. Obviously, the larger the dorade-box enclosure, the better the design of the pipes and resulting protection from waves that find their weay to the cowl.

Small cutouts in the aft corners of the box allow any accumulated water to flow out. Using 5-inch (125mm)Vetus cowls with an 8-inch (200mm) high dorade box, I like to see a triangular notch about 3/4 inch (19 mm) per side.

In heavy weather the cowls should be removed and capped on the outside. There also should be a means of sealing the inside, both to restrict airflow in cold weather and to make the boat watertight in the event of a severe knockdown. A fixed ring with a screw-in cap can do the job.

Another approach we developed for *Sundeer* is an adjustable closure on the outside of the pipe, operable from the interior of the vessel. This is basically a threaded rod, with a handle at the bottom and a cap inside the dorade box to cover the pipe. As the cap is lowered, it throttles down airflow, finally sealing the inflow pipe totally with a neoprene gasket. This worked out so well that we've used it on all boats since.

Knockdowns

Every port, hatch, and dorade vent on deck has to be examined in the context of a mild or severe knockdown. How the boat floats at various angles of heel has to be figured and compared to the deck openings. With a lighter displacement, the boat will typically float higher when it's heeled down with the mast in the water. A design like *Intermezzo*, with her relatively low freeboard and moderate-to-heavy displacement, would have water flooding the middle of the deck when she was knocked flat. *Sundeer* floats a couple of feet (0.6 m) higher.

A more realistic look at a knockdown probably is a 65-degree heel angle. Here it's likely your decks will be awash. Hatches that lie outside of this point should always be dogged at sea, regardless of conditions. A surprise squall can send thousands of gallons per minute flooding below. To prevent mistakes on smaller vessels, it's a good idea to keep all hatches on centerline.

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Storm Covers

A good storm cover protects the hatch gaskets from direct impact of boarding seas, as a result extending the life of your hatch gaskets substantially. Of course, the cover will also protect the finish of the hatch.

A cover with a zipper side, with a triangular cloth sewn inside the zipper, can be opened to provide protection from spray if the hatch is cracked.

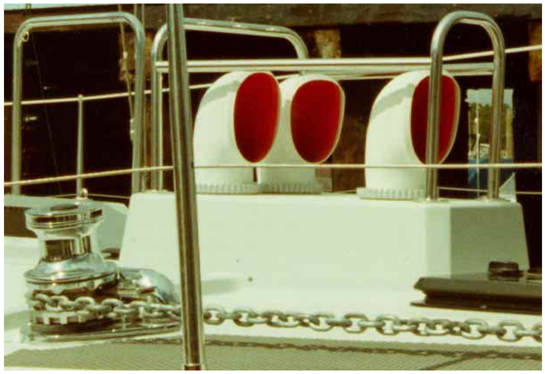
Storm covers need secure attachment. You can get by with snap buttons, but a boltrope track or molded overhang to tie under is better.

Creating a Plenum Chamber

Conventional dorade boxes act individually with the input of the cowl going only to a single area. The problem is that half the time that input is going to waste. When you are sacked out you do benefit from the vent above your bunk, but those in the saloon and galley are more or less going to waste.

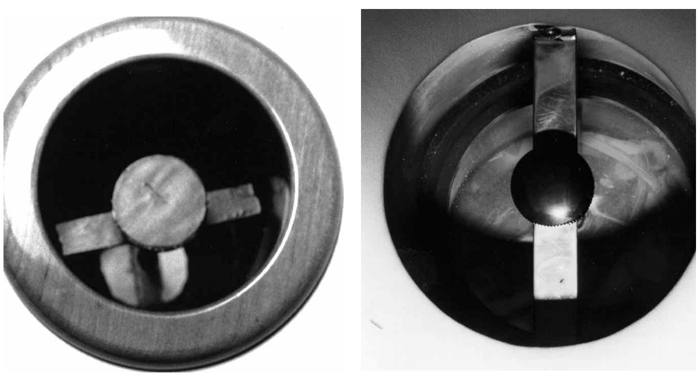
If you can create a structure that also acts as a large dorade box, or a plenum chamber in air-conditioning terms, and couple it with the ability to turn airflow on or off at each down pipe, you can then direct the total input of all the cowls to a few down pipes, thereby dramatically increasing the available airflow.

We accomplish this whenever it is practical by creating long structural coamings, which span several interior bulkheads and reduce deck spans in the process. These coamings act as long plenum chambers, which in turn allow the placement of as many cowls as we desire on top. The bulkheads can be tapped as required with vents to direct airflow to wherever it is desired.



Two views of the same dorade box (left and above). The aft two cowls are split between a head compartment and sleeping cabin. The forward cowl ventilates the forepeak. Inside the box is a divider so that odors stay separated.

This “eyeball” is a giant version of what you find above your jetliner seat. This one fits into a 8-inch (200mm) pipe. You can swivel it to aim the airflow, and there is a built-in throttle mechanism to reduce airflow or seal it off totally. This unit cannot be made 100 percent waterproof, but it will get you 98 percent of the way there. We’ve been using these on some of the production boats and on *Beowulf* with good results. They are made by Air Concepts in Tucson, Arizona.



Two different styles of our air-flow control. On the left it is installed in an aluminum pipe that has been welded to the aluminum coaming. On the right it is installed in a fiberglass pipe that has been bonded inside to a fiberglass coaming.

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Paul Luke vents may be heavy, but boy do they funnel in the air: a veritable hurricane in any sort of a breeze. If you use a large cowl like this, the size of the dorade box needs to be increased in proportion to allow for increased water containment.

This cowl and box have been placed strategically close to the mast so the guards can also be used for support when working on the mainmast.

A stainless dorade cowl, now available from Bomar (left), compared to the Vetus Yogi-style cowl (right). There is probably twice the cowl area for much better airflow. However, this unit costs six to eight time more and weighs about five times as much. Both of these units are on the foredeck, hence the three-way handrail/protector. Handrails like these should be optimized for holding onto rather than for protection of the cowl, which means they are typically a little bit higher than normal.

The coaming in front of this dodger is being used as a giant plenum chamber/dorade box. The stainless-steel grills theoretically circulate the air around the front of the enclosure and back aft to the folks sitting in the forward end. A more directional controllable vent, like those made by Air Concepts previously shown, would do a better job.

Drainage Issues

These coamings in effect become huge dorade boxes. As such, they have much more ability to accumulate water before it spills over the tops of the down pipes and into the interior. That's a big advantage when there is lots of water flying on deck.

However, because they span so much deck geometry, you have to be careful with how they drain at various angles of trim and on different tacks.

For example, on our boats the forward part of the windward coaming will drain forward rather than aft, so the inside forward edge of the coaming always has a drain point.

When the coaming is to leeward, all water will drain aft, so an outboard drain at the aft end is required. You will also find some accumulation in the aft end of the coamings on the weather side, so we end up with inboard and outboard drains aft.

If you take this approach you will want to be sure that there are no low spots with the boat upright which could trap water. Otherwise, you may find yourself with a smaller, stagnant pool of water in the middle of your airflow.

Also, you need to bulkhead off the coamings, where they are used to exhaust areas like the head, for obvious reasons.

Creating a Wind-Scoop Effect

One advantage of the long coaming concept is that it forms a large breakwater that protects the hatches inside from direct spray. They also form the edges of a giant wind scoop if you connect an awning to the sides and back edge. This awning traps the air moving down the deck between the coamings, forcing it into any open hatches. If the awning is made to overhang the hatches forward and aft, it will protect them in rain and spray. If the awning is quite low and secured on the edges, it can be left up at sea in moderately boisterous conditions. This is one reason why our boats have such a good reputation for ventilation in the tropics.

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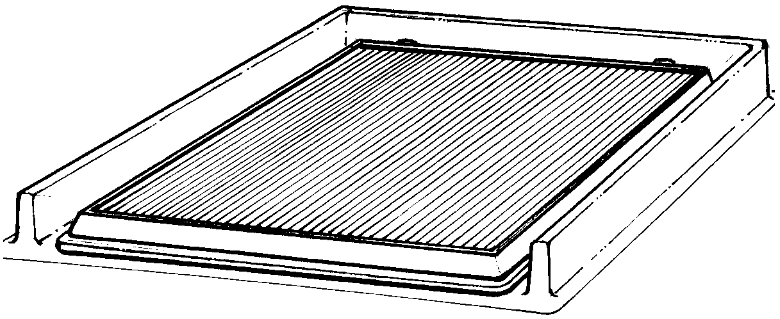

A hatch breakwater can be created from teak, plastic, or metal. On an aluminum or steel vessel we weld them right to the deck around the hatch. On our production boats they are a part of the deck mold.

For existing boats the best way to approach this is with a bit of bare teak and some 5200 sealant.

BREAK WATERS

A spray guard or breakwater around the perimeter of a hatch, standing an inch or two (25 to 50mm) above the gasket level, will go a long way toward protecting the hatch gasket from direct wave impact and the potential leakage that results therefrom. Breakwaters also form an ideal base for a storm cover (which can be snapped over the upstand).

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The two photos to the above and left are the breakwaters on the main saloon hatches for the Sundeer 64. Note in the left photo how the breakwater does not go all the way across to the coaming. This allows water trapped behing the hatches to drain forward. You can also see the drain pipe, which runs through the coaming (so that water flooding this deck area does not add to the water accumulation, if any, inside toe coamings).

The opposite page, bottom, photo shows the saloon hatches with surrounding breakwaters for the Sundeer 56. The opposite top photos is a timber breakwater on one of our custom yachts. Note how the timber is shaped with a hollow. This is to help hold on a storm cover.

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WIND SCOOPS

These are a definite mixed bag. A well-designed wind scoop will funnel large quantities of wind below, but it also lets in rain and is difficult to throttle down. In a breeze they make an annoying racket. Nonetheless, in light airs, especially where tied to a dock, they do have a place.

You'll want to be able to douse the scoop quickly in the event of a rainshower or squall. The scoop will need attachment points around the base, allowing the base to be secured in three or four directions to prevent oscillation.

A decision has to be made whether to go for an omnidirectional design or a scoop oriented toward the wind. I prefer the latter, as they fly more quietly; we've usually been able to predict the apparent wind direction.

FANS

As a supplement to natural ventilation, DC-powered fans are a must. A fan belongs at the foot of every bunk. A remote-control switch wired to the head of the bunk (it can be conveniently mounted in the base of the reading light) will save a lot of late-night moving around and arguments about whose turn it is to turn the fan off or on.

Fans are also essential in the galley and in one or two spots in the saloon. Note that a good fan system also helps move hot air down from the overhead, increasing the efficiency of heating in cold weather.

In the tropics during the summer you'll want all the fan power you can get. But in more temperate climes, a fan going full bore may create too much wind and noise. Putting a resistor on a switch in series with the fan circuit can reduce the speed to a more suitable setting. With a 24-volt system, using a 24-volt fan on the 12-volt circuit will accomplish the same thing.

VENTILATING FURNITURE

Keeping lockers and their contents smelling fresh is a function of ventilation. Air needs a way to get into and out of every space aboard. Louvered doors are one approach. The same thing can be accomplished with door hooks to hold doors slightly ajar.

One approach we've used with success is to cut slots into the backs, bottoms, and sides of all the lockers to promote airflow through the boat and bilges. Some of these, where we were concerned about losing gear, were covered with heavy screening.

The bilges, forepeak, and lazaret also need airflow to keep odor and mildew at bay. Remember that this means airflow into and out of the area in question.

HEAD COMPARTMENTS

Special problems are connected with keeping the head well ventilated. Hopefully the natural airflow will be out of the head and onto the deck. A lot of boats come with just a dorade vent, but a small hatch, just 10 or 12 (254 to 300mm) inches square, does a much better job. You can augment the dorade with an extractor fan mounted inside. But these are next to impossible to keep dry and operational over the long term. If you opt for this route, be sure the fan is easy to change, and carry several spares.

The head door should have a hook to allow it to be kept open when not in use.

GALLEY ODORS

A vent which is arranged so that it sucks air out of the galley will help those with queasy stomachs. It's also possible to work in an extractor fan and hood over the stove. Be sure the screen, ducting, and fan cage are easy to clean, as they will become caked with grease after a while and can pose a fire hazard.

Another approach is to have two dorade vents in the galley: one to blow air in, perhaps over the sink, and a second over the stove to pull it back out.

AIRFLOW AFT

As we've already mentioned, traditionally, airflow in the aft part of the boat has been difficult to achieve. This is a relatively stagnant area wind-wise, and there is usually a lot of windage in front from houses and dodgers, which blocks airflow further.

However, our daughter, Sarah, recently discovered something unique. If you have a lazaret hatch that opens on the forward edge (hinge line running across the boat on the aft edge of the hatch), it will turn the lazaret into a giant plenum chamber, with the hatch acting as a large scoop.

If you then cut hatches into the lazaret bulkhead, it relieves the pressure and you have a wonderful flow of air coming into the interior.

Since the lazaret can typically get wet if there's a bit of spray or rain around, it does not disturb things, and the lazaret traps the water before it gets to the interior. Used with quarterberths or aft owner's cabins, this airflow will make an area which would be untenable in the tropics into something which is very livable.

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