Dorade - Transatlantic Race - 1931
July 15th - Days run 208 miles.

RODERICK STEPHENS

HIS BOOK

Rod on Sailing, Lessons from the Sea

This book is dedicated with love to Marge, my wonderful wife for over 40 years, who died after a valiant struggle with pneumonia. Marge was a very quick learner and she never forgot anything or anyone we needed to know. She had a soft and friendly voice and had the most beautiful hair, morning, noon and night, and a ready smile to match. She gave us our lovely daughter Betsi, to whom this book is also dedicated.

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Preface

Iskareen was built by the Negling shipyard of Varvet, Sweden. It was probably the best 8-meter of the pre-World War II period.

I first saw the boat when she'd been delivered from Sweden to England and had been racing in the Solent. We were sailing on the 12-meter *Vim*, and we were further to the eastward and were knocking around the Solent. We got the papers every day and I was always disappointed to see that she was generally down at the tail end of the fleet that she was racing against. We had hoped for a good boat because she was developed from a wonderfully successful 6-meter named *Goose*, which we felt was the best 6-meter of the same period. So we'd hoped well for *Iskareen* but were very disappointed.

Finally I took a day off from *Vim* and went down to have a look at the *Iskareen*. I got to the harbor where she had been moored since arriving from Sweden, and the first thing I got was a big skiff so I could go out and see her and maybe take some things off. I had a feeling that she probably had a lot of junk on her adding weight and even worse, weight that is not in the right place. Anyway that's what I thought might be possible. When I got out to her I found that my guess was correct. She was filled with many unnecessary things; too many sails, too many tools, too many odds and ends that were not part of a racing 8-meter yacht. I pretty near swamped the skiff taking stuff off that was not required. I wanted to get anything off that was not necessary and then see how she was floating.

For meter boats, there were specific flotation marks and the boat must float right to those marks in racing trim, no heavier and no lighter. When I got through taking off probably 1,200 pounds of junk she was floating quite light so I got them to send out another big skiff with some lead pigs, each carefully marked with it's weight, to make up for the weight that I had taken off but would be better located in a place down low where it would help her stability rather than being spread around quite high in the boat. When I finished with that I got her right on her marks with about 1,200 pounds of very deep ballast which would certainly make her sail better.

About midday the skipper came down and we prepared to race with a class of about six or seven 8-meters. We got her towed out to the starting area and made sail and

the sails looked reasonable and the rigging was set up about right and we were sailing around and finally we reached an exciting moment as we were getting very near the start and as we approached the line in a pretty good position I was suddenly shocked to see the genoa come fluttering down. At the other end of the halyard was a pleasant local fisherman and I said, "What the hell have you done?" and he said "We shan't want that sail sir, as the course is 200-degrees and we should hoist the tacking foresail." I said "To hell with the tacking foresail now get that genoa back up, it's a heavy genoa and just right for this breeze."

We made careful checks of the sheet leads and everything and got it back up. It interfered with our start a little so we didn't get away first but we hadn't any more than crossed the line when we started to pass our competitors and we were very pleased to see that. The fisherman said, "Well, we shan't be able to do this when we have to tack." I said, "Of course we can tack with the genoa." He was a fisherman and he thought you needed a small jib for tacking. We went on and we finally did make a tack and it was immediately apparent that we had the right sail because we pulled right away from several boats that were near us and in due course we worked out quite a good lead. As we came to the finish line we were almost a complete leg of the course ahead of the next boat.

When we crossed the line I was absolutely amazed that they didn't fire any gun. We came close to the committee boat and asked what the matter was? The committee boat answered, "We thought you dropped out." I responded, "Hell no, we rounded every mark of the course." You see every day she'd been coming in last and here she was coming in a leg of the course ahead of the second boat and they assumed we had just dropped out.

We sailed back up to our mooring and I said to the crew "Now remember, none of this damn tacking foresail but use the genoa jib and that'll get you to win races." Well the downside of that instruction was that it was carried almost too precisely. After we got *Vim* down to the Isle of Wight about a week later for the first race of Cowes Week, it was a pretty breezy day and we were interested in watching the 8-meters and here they came and *Iskareen* had the big genoa up, the one we had used so effectively the day I sailed with them. It was really too much wind for that sail but she made it all right and they

won that day anyhow. Later I told them "Look, you should use that sail whenever you can but if it's blowing too hard you don't have to use that, you then should use your tacking foresail or whatever you call your smaller sail." So that was a very interesting race and on the basis of her winng record I would say she was about the best 8-meter of the immediate pre-war period.

The *Iskareen* was one of the very outstanding boats built by the boatbuilder Neglinge south of Stockholm, Sweden. Another boat they had built to our design was *Capriccio*, which was sailed in the Fastnet and she was built for the Bermuda Race at that time and we had a very good race around the racecourse and finally got to the finish line, not winning but we did beat several boats. We still had a very good race and she was beautifully built. Neglinge also built the yawl *Anitra* to our design.

In fact, the majority of outstanding boats of that period immediately before World War II were of the best grade wood construction and among the best builders I would also consider the boatbuilder Neglinge of Varvet, which we have already discussed, then another Swedish yard run by four fantastic brothers named Martinson. They built a series of three boats to our design, which were similar in size and general detail, and each one was a little better than the one before it. The last boat they build to our design was a boat named *Aja* for a Captain Bjornefeldt from Gutenberg, Sweden.

This boat was so beautifully built that I thought it was a shame to get her out into the rugged ocean racing business. I thought it better to just put her in a museum somewhere as the epitome of beautiful wood construction. One thing that particularly impressed me was the fellow in charge of the joiner work. I think it was Eric Martinson and Captain Bjornefeldt and I were having a little argument as to whether he should have a folding table or a swing table as I am a strong supporter of the swing table but they did something I had not thought possible. I was telling Captain Bjornefeldt that he'd need to make up his mind so Martinson could finish the boat and deliver it. Eric Martinson said, "Don't push him, it's all right, no problem."

What he had in mind was that he was going to make a swing table that could also be folded out of the way which I would have said was totally impossible. So when we came down for the acceptance trials I looked in the cabin and no table was evident. I said, "I guess I lost that argument." But Eric said "No, no we have a good one, you will

see." We gave him a couple of minutes and he went below and wrestled with some things and pretty soon there was the nicest swing table set up just the way I thought it should be but he had the ability to take it away when one wanted to have the main cabin open for when they were not eating. So that was an outstanding detail that the brothers Martinson were able to do. In addition, the trials, being the third in a series of three similar boats, was the best acceptance trial that I have ever had or ever will have. They did everything the way I wanted it to be done: they did it in advance; we just went out and sailed and everything was as near to perfect as it could be.

In discussing perfection in wooden boatbuilding we must include Aage Walsted of Svendborg, Denmark and the outstanding boat that he built, which was an ocean cruising yawl named *Kay* built for Sven Fresell. We had designed a boat for his father as well which was built by the German builder Abeking & Rasmussen several years before. Anyway the thing that impressed me about *Kay* was that when I was last aboard her she had made three or four Trans-Atlantic crossings and they were still cleaning the bilge with a vacuum cleaner, the bilge was so dry even in the deepest reaches. That's pretty good boatbuilding in my opinion. Apart from that the finish was beautiful and everything worked very, very well.

There were plenty of stories about *Kay*. As soon as the trials had been completed, Fresell, sailed her down to the Mediterranean where he planned to cruise for the summer. When he came into one port a yachtsman introduced himself and said, "My name is Shiffers and I want to buy that boat." Arnie Fresell said, "Well, she's just been finished, she's what I want and she is not for sale." Mr. Shiffers was not easily dissuaded and for the next two or three days as Arnie was coasting along the Cote A'zure, every time he came into harbor, Mr. Shiffers was there with his Rolls Royce and he said, "Now I am really in earnest about this. I want to buy this boat and even if you don't want to sell it I can make it worth your while." So what he did was to get the boatbuilder Walsted to come down so he could make notes of anything that Arnie wanted if he built a sistership and he said "I have rented you the house where you and your family lived when you were building this boat so everything should be the same."

The first we knew of it was when Arnie approached Sparkman & Stephens and asked what it would cost if he built a second boat to this design, as he had already paid

for the first one. We told him he could build as many as he wanted as long as it was for him. And so he told us the story of how this man Shiffers had convinced him that he should sell him his boat. Shiffers said, "I am an old man and I can't wait to built a new one. I want to have it now and you're a young fellow and you can wait. You can have that house and all the pleasure of building it again and it will be good for Mr. Walsted."

And so he sold *Kay* and and the second boat was built. I asked Arnie what he was going to change on the second boat. He said "Nothing." I said, "Well, there's one thing I want you to do." We had come into this new water lift exhaust system which was more durable, cooler and quieter that the normal system that we used to do where we build a standpipe water jacket to a high point and that did not have such a long life and was heavy and the new system was much better. Arnie was reluctant but he accepted this change and that was the only thing that was different in the second boat. The new boat was just as tight as the original and never leaked anywhere and the finish was beautiful so Walsted must take a front row in the highest quality of wooden boatbuilding in that period.

Besides from being beautifully finished and completely watertight, *Kay* was well ventilated and had a very nice characteristic; whatever course you put her on she'd go straight ahead that way as long as you centered the wheel and she'd hold her course for a long, long time which was very desirable and better than some very fancy autopilot. This was just inherently a boat that wanted to go straight and it endeared her to everybody who sailed on her.

It was interesting that when Mr. Shiffers bought *Kay* Arnie would not sell the name so what happened was they got the fellow from Walsted who had carved the "*Kay*" in the transom very beautifully, and being fairly smart, Mr. Shiffers go that man to carve an "A" in front of and after "*Kay*" so he had "*Akaya*" all matching and it looked like it had been there since the start so there was no matter of having to change something in the transom when the name changed. So now there is a *Kay* and an *Akaya*, both two wonderful boats of the finest examples of wooden boatbuilding.

And while we are discussing fine examples of wooden boatbuilding, we must not forget the Henry B. Nevins Yard of City Island, New York, where I more or less served an apprenticeship from 1927 to 1933, before joining Sparkman & Stephens. Among the

finest examples of a Nevins built yacht was *Brilliant*, built for Walter Barnum, which is owned by Mystic Seaport Museum and certainly represents the finest wooden boatbuilding you could find anywhere. In addition, Nevins did a beautiful job building the American 12-meters which were built in that period, all of them, and the best of them was *Vim*, which we sailed in England in 1939 and it's fair to say that *Vim* was the best 12-meter of all. I believe we won 18 of 22 races we sailed on the British Coast against a fleet of six or seven 12-meters and *Vim* held her own on every point of sailing in every race.

In the same category would be the sloop *Actea*, which was built by Nevins for Henry Sears and she was very good as an offshore racer and was ahead with *Baruna* and *Blitzen* winning two Bermuda Races. *Actea* was a good match for *Baruna* at coastal racing as well. Another outstanding Nevin's built boat was the *Rascal, which* was built for Frank Campbell. Now you've never seen a nicer finish and every detail was the very best that Nevin's could do and ranks with any other example of fine wooden boatbuilding.

In that period there was refinement of the very excellent joinerwork but there were no radical departures, none such as the carbon fiber rudders, which gave so much trouble in the Fastnet Race of 1979. There was an important, helpful development that resulted in a better adhesive for double planking and laminated frames. Otherwise it was pretty standard: just picking out the right quality material and having it beautifully built, with top quality joinerwork and a good varnish job.

I wish to include a little more on cabin tables because I've always been very sold on having a swing table. When I am eating I don't like anything on my knees and I like to set things down whether it's soup or a drink or whatever and the table won't go over when the boat heels a little more or less or rolls or whatever. In addition to what I mentioned about the very clever folding swing table on *Akaya*, was a very clever table for Thomas Watson's boat, *Palawan* and built by Abeking & Rasmussen. They had a swing table there which overcame most of the disadvantages of the average swing table of the old school which were too wide, but had to be wide to be close to your lap when you're sitting on the leeward side without hitting your chin but mustn't hit your knees on the windward side either, which is a difficult problem to solve.

What we did was make the tables quite narrow so although you have to reach a little more you won't get hit as described above. What Abeking & Rasmussen did, which was quite clever, was to build a swing table with a fixed edge on port and starboard, which could be heavily leaned upon. All the table did was swing the leaves which were split in the middle and one side would go down and the other would come up to take care of the heeling, so that the leaves were level no matter what.

On *Mustang*, we had the narrower swing table and although it required one to reach it was a good compromise. In that table we put all of the weight to counterbalance and slow the swing at one end of the table, which hit everybody in the shins when the weight got to swinging. We had a fairly heavy weight at the forward end of the table where there was less traffic and the weight was no nuisance at all and whatever kind of table you chose push for a swing table so things can be set down instead of having to eat from your lap. This makes for better crew efficiency and in fact will improve results because as Napoleon said the “Army travels on it's stomach” and so I say the same for the Navy and the offshore cruiser.

While this is in no sense a book about seamanship, when I mention seamanship I must mention the name of Irving Johnson I have to say that from what I know about various people that sail offshore he is head and shoulders above the rest. I know his approach to offshore cruising: it is a team operation, and this approach is a very important part of Irving's success.

One thing in particular caught my attention when he was telling me about sailing in the Indian Ocean. There were some very severe squalls around, and Irving was on deck and at the wheel when one real vicious squall hit his boat *Yankee*. It must have been pretty vicious as he is not one to exaggerate. When the squall hit he eased the mainsail and jib and headed down before the wind, which is not necessarily a natural impulse. One's natural impulse would be to round up into the wind. By heading up however, the apparent wind will actually increase and by heading down before the wind the apparent wind experienced will be reduced by the considerable speed of the boat. It can be a very safe thing to do, with no trouble at all.

Speaking of seamen, Irving urged me to get a book called "Zeb, A Celebrated Schooner Life." I have to put Zeb in a class by himself. He was the last man who could

make a go of commercial shipping along the Eastern Coast between Massachusetts and Maine. He was remarkable fellow. He was the equivalent of two or three people: big, strong and quick. He knew his boat, the *Alice Wentworth*, very well and I'm very happy in that the very first time I was in Nantucket we were cruising and this shiny green schooner came roaring in very fast and he luffed up and made the most beautiful landing alongside the fishing dock. We were anchored not very far off there so I had a first row balcony seat for that and his landing was so perfect he could have used soft-boiled eggs for docking fenders. Things seemed to happen quickly but he didn't seem to be hurrying at all. I wished I had been sensible enough to go ashore to the dock and help him tie up and shake his hand and I would've been happy if I could have.

Anchors

A well-found cruising boat should have three anchors aboard; a storm anchor, the regular anchor and a lunch hook. The size of each will depend on not only the size of the boat but also its relative weight and other factors that affect the load on the anchor which includes windage, which will be influenced by things such of the size of the superstructure and rig. I use a formula based on the weight of a mushroom anchor needed to safely moor a yacht of given characteristics. Obviously, the mushroom is heavier than the anchors mentioned above, and so the anchor weights are expressed as a percentage of the mushroom's weight. (See Appendix for formula.)

The formula gives you the desired weight of the storm anchor for your boat. Taking the size of your storm anchor as 100%, the other anchors should be 60% and 30% for your normal working anchor and lunch hook, respectively. On *Mustang*, which had a 32-foot water line and was 45-feet overall, with low freeboard, low deckhouse and relatively heavy hull, I carried a 75-pound storm anchor, a 45-pound plow as a working anchor, and a 22-pound Danforth lunch hook.

I like to have an old fashioned fisherman's or kedge anchor for a storm anchor. There are several names for it: The Herreshoff Manufacturing Company of Bristol, Rhode Island made the best ones; Paul Luke in East Boothbay, Maine, got some patterns and makes good ones. They're all pretty much the same, made in three parts so you can break it down for easy stowage.

Pound for pound the fisherman's anchor is not as efficient as the modern designs, but in bad conditions it's the best thing you can have on the bottom. It doesn't need as much scope as other types, which is important in a cramped or deep anchorage, and it's better in seaweed or eelgrass than anything else. Eelgrass makes almost any "lightweight" anchor quite ineffective.

Even without storm conditions, a big old kedge is invaluable if you have to anchor in deep water where you can't get a good scope angle. I learned that the first time we took *Mustang* to Halifax, where the harbor is so deep that unless you have a heavy anchor that works with a steep rode angle (that is, with scope of around three-to-one, you either have to find a mooring or go somewhere else.

Then for the regular work anchor, you can have a Danforth, CQR or the new Bruce, which seems to be pretty good all around, and is pretty well accepted. The best working anchor I ever had was a special lightweight plow anchor, which had a bigger fluke area, so that it was a better anchor in a soft bottom. But many people prefer the Danforth, which is certainly easier to stow. Now there is a new lightweight, penetrating type called the Fortress, which looks like a Danforth and seems to be getting high marks from cruisers who have used it. It's really a matter of choice, there is a ton of research available, and you have to balance effectiveness, versatility, weight, ease of stowage, and even price in figuring out which one you want. The important thing is that your working anchor is big enough to do the job and that is where you can get at it quickly when you need it.

I had a funny experience with my favorite plow anchor back in the early 50s, when they weren't as familiar as they are now, at least in this country (they came from England originally). We had sailed into Boothbay Harbor about midnight and anchored. Next morning was beautiful and still, and I got up about five o'clock as I like to do, and was quietly shaving in the head when I looked out the porthole and was astonished to see that we were moving slowly against a very light current; there was a mooring buoy, and we were moving past it at about a half a knot. I couldn't imagine what could make the boat go that way.

So I snuck up on deck and looked ahead and what I saw was a floating island; with a great mound of sticks and branches and debris sticking out all over. Then I realized it was a big skiff about 16 or 18 feet long. I could just see its stern below the underbrush and hooked over the transom was our plow anchor. There were two skinny oars sticking out the side, and by standing on my toes I could see over the brush pile an old man at the oars. He was rowing this whole ball of wax and was pulling *Mustang* besides. I said "Good morning," and he said, "Good morning. That's an interesting anchor you've got there. Seems to work pretty well. I'm just putting it in a better place because there's a launch starts running at 8 o'clock and it would make it kind of uncomfortable where you were. I didn't want to wake you up". Can you imagine?

It turned out his name was Harry Biggins and he was about 85 years old. He had gone to sea most of his life, and I was later told that his family size was determined by

the number of times he came ashore. Anyway, his job now was to row around Boothbay Harbor picking up all the debris floating in it. This particular morning he'd gathered a whole boat full.

When he'd put *Mustang's* anchor where he thought it ought to be, I said "Thank you very much; now can you tell me whereabouts we can get some gas and some good water"? "Well," he said, "Because of my position here I can't tell you where to go, but my son has a place up yonder. And there's about seven feet of water at low tide and he's got good water and clean gas, but I can't tell you that." So we went and got good water and clean gas from his son, and I've never forgotten old Mr. Biggins and his floating island. Maybe that story doesn't say much about anchors, but it certainly says a lot about what it was like cruising Down East in those days.

Finally we get to the lunch hook, which is used for short stops when cruising, when becalmed in a foul current, or to kedge off after grounding. (Don't doubt it, you <u>will</u> go aground sooner or later.) For all those purposes I think the lightweight, or high tensile, Danforths are the best. In order to kedge off in a hurry after going aground, to get off before the tide falls, you want to be able to take the anchor out in the dinghy, and you want the most holding power for the least weight. I think the Danforth fits that bill pretty well. And there's no problem about the anchor needing a very shallow rode angle, because you're going to be in shoal water anyway, or you wouldn't be aground.

Stowage is an important matter, because you've got to keep the anchor out of the way of the workings of the boat, but it has to be where you can get it over the side in a hurry. One of the best arrangements I've seen is one for a Bruce anchor that the Dutch builder Walter Huisman built into an S&S-designed boat named *Fly*. They cut an aperture right through the stem, designed so that the Bruce anchor is housed with its flukes curving right around the curve of the bow. The shank and chain go up through a narrow slanted tunnel that comes out on the foredeck; the chain leads past a couple of good sturdy fairleads and aft to the windlass. In the stowed position, the anchor is almost flush with the hull and does not interfere with docking lines or a mooring pendant or a second anchor rode. It's safe in every way and ready for quick release, a very neat rig.

Of course, it has to be built into the boat, and probably only a metal boat, since you need a lot of strength with that hole in the stem; furthermore, I think you could do

that only with a Bruce anchor, so it's definitely a custom job. But it's a swell idea. What I think isn't a swell idea is the common practice of stowing a plow anchor by hauling it up over a roller on a little sprit sticking out forward of the stemhead. This is handy for getting the anchor down and up and for keeping it off the deck, but the plow or Danforth type anchor hanging out there can really get in the way of docking lines and bow lines under storm conditions.

One time at the Nautor Swan yard a lot of boats were tied up at the docks in the usual way when it breezed up and got pretty windy in a hurry, and I was busy as the Dickens trying to rig suitable lines. The boats were bouncing around a lot, and I found that all those anchors pitching up and down on their roller sprits made it almost impossible to get proper leads on the bow lines. That's when I decided I didn't like that way of stowing anchors. But an awful lot of cruising boats use this bow roller for a plow or a Danforth, so I didn't expect to get very far with that position.

I would rather put the anchor on deck, if it's going to be used fairly often, or stow it below if it's light enough or if you're going to sea. Sparkman & Stephens has designed several boats where two anchors stow near the windlass, athwartships, sort of nested together. I think it's best if the rode is attached to and lives with its anchor, but that depends on how you stow it. Of course if you have chain, then it should be in its locker. In fact that's one of the few things I like about having a chain rode instead of rope, it's self-stowing if you have a good chain locker.

With line, though, the rode should of course be in a neat coil that is stowed so it doesn't get fouled up. And if the rode is going to live with the anchor when it's stowed, then the shackle should be seized with wire. Otherwise you might leave the anchor on the bottom sometime. Maybe the storm anchor, if it is broken into three pieces and stowed below, will not be permanently attached to its rode. But when you use it, take the extra moment to seize the shackle with wire after you bend it on.

Anchor wells are okay as long as they drain properly, but they don't get any ventilation, so the rode stays wet most of the time, which isn't too much of a problem with synthetic line. Anchor wells are fundamental, of course, and have to be built into the boat.

There is always a lot of discussion about whether to use chain or line for the anchor rode. I don't have much enthusiasm for chain. I think three-strand nylon is still the best. First of all, chain has absolutely no give in it. They talk about the weight of chain giving it some absorption, that protects the anchor and the boat from sudden shocks, but when it blows hard enough, forget it. Once that chain comes up taut, there's no give at all. Every time a wave lifts the bow, everything gets jerked; then comes a big wave, and BING! You break out the anchor, or you drag it, or break the chain or even the windlass bits. Furthermore, chain is very heavy, and it gets very dirty when lying on a muddy bottom.

So unless you have a big, heavy boat, a reliable windlass and a good chain locker, or are cruising where there is lots of coral, I think three-strand nylon is the way to go. With the right size, it is strong enough, it's lighter and is easier to clean. Most importantly, though, it has lots of spring. Ideally you'd, want treated nylon, which still has all the elasticity but doesn't get hard as it gets old, and it's twisted. None of this straight line will be as elastic. It's acceptable to have a short, relatively heavy bit of chain at the end to take care of anything, the weight helps it set and stay set well. Otherwise, I repeat: use nylon for the rode.

If you use chain for the anchor rode, and a lot of boats do, you better have a length of nylon to rig as a snubber. Use a chain hook and a length of relatively light nylon that will give some spring to the rode. After the anchor is set, pull the chain back in for 20 or 25 feet. Hook the nylon snubber onto the chain and feed the chain out again. Bring the snubber up though the chock, take the strain of the anchor rode and secure it to a bit or cleat. Let the bight of the chain hang down in the water. Now when the load comes on the nylon, it will give some spring and will ease the whole set-up against the shock when the bow lifts with the waves. This is very important if you expect any serious wind or sea while you're anchored with chain.

The matter of moorings is pretty cut and dry. The main thing is that they be heavy enough. A rough idea of how much weight a given boat needs can be determined by the formula in the Appendix, which we worked out when I was head of the Harbor Committee at the American Yacht Club in Rye, New York. We tried to devise something fairly simple that would be a guide to minimum mushroom anchor weights for home

moorings. Rye harbor was getting pretty crowed with boats, and we wanted to make sure that a summer squall or a fall storm wouldn't send boats crashing into one another or ashore.

Once you get the right weight mooring, and have a competent crew to put it down, the thing to worry about is the fastening holding the mooring cable or chain to the anchor and the cable to the mooring pendant. This is the most vulnerable part, and I'm very much in favor of peening the ends of the shackle pins so they can't back off. Wire seizing will eventually corrode and not be there when you need it. Peening the pins is a nuisance for the guys putting the moorings down, but not as much a nuisance as chasing around after a boat that's left her mooring.

That happened to me way back in the 1920s when we owned a 6-meter named *Natka*. She was moored in Larchmont Harbor, and when I arrived there one Saturday morning, she wasn't on her mooring. The launch man mentioned that the boat had gone out about 5 o'clock the evening before. He couldn't say who was aboard, but he had seen her going out the harbor.

Well, I didn't know anyone who could have been aboard *Natka* then, but I did know the boat had a cover over the boom that would act like a little sail. The wind had been blowing out of the northeast, so I went out in motorboat and headed across Long Island Sound, looking for a ghost 6-meter sailing herself south. Sure enough, there on the beach at Sands Point, Long Island, about 7 miles from Larchmont, I found *Natka*.
She was lying on her side and badly damaged, and lot of her gear was missing. But what really puzzled me was that her mast was gone too. A fellow who was a caretaker for the estate the beach was on swore that *Natka* hadn't had a mast when she fetched up there.

Well, that was strange, because there was no reason for the mast to come out of her just because a mooring let go. So I was a little suspicious. I looked around and saw up on the bluff above the beach a place where the ivy and plants had been all gouged out, and it was exactly where the masthead would have been if the mast had been in the boat when she beached. Having seen that, I walked right up onto this fancy estate, and came across a big garage. I flung open the doors, and there was *Natka's* mast, in good shape and neatly hidden away.

I got hold of the police, but they didn't seem interested in tackling the matter. I called the owner of the place, and he said he didn't know anything about a mast in his garage. So I told him I was going to send a truck to pick up my mast. The next day, without a word to anyone, we went in there and got our mast back. *Natka* was a write-off, but the following year that mast ended up as *Dorade's* mizzen.

What had happened is that one of the shackles on *Natka's* mooring cable had come undone, and the boat went sailing off on her own with her mooring pendant hanging down from her bow. That wouldn't have happened if the shackle pins had been peened.

I can't remember now whether it was a stainless steel shackle that let go, but I do know that stainless shackles can be extremely dangerous. A lot of people love them because they're trim and neat, and you can screw the pin in easily by hand and don't need pliers or a spike but that's just the problem. Many of them go finger tight right up to the last five or ten degrees of turn, and that's all you have left to get the pin really tight. It's not enough. The last full turn should be very stiff otherwise the pin will undo itself.

The old galvanized shackles used to turn pretty hard, with increasing friction, and you needed a spike to get the last few turns. Some people think that's an annoyance, but that's how you know the shackle won't come apart so if you use stainless shackles in your rigging anywhere, wire them. Even that is difficult with some shackles today.

Masts

A mast is supposed to be straight. You can try all sorts of bending tricks to shape the sails better when you're in the water, but nothing will produce a really good result unless the spar was basically straight to begin with. A little curve aft is okay, but any other bend is just going to compound the difficulties of getting the standing rigging in tune.

So how do you tell if the mast is straight? [**SEE SKETCH]** It's easy, if you take the time to check things over before you put it in the boat. Lay the mast on its side on a couple of sawhorses, and sight down the after side, that is, along the track of luff grove. This gives you a line on the mast's fore and aft straightness. If it is dead straight, that's fine; if it curves back a little near the top in a smooth, fair curve, that's okay, too. But if it does any double dips, or if the track curves forward near the masthead, then you've got a problem.

Now roll the mast up on its forward face, and chock it up there so you can check its athwartships straightness. Sight along the track again and hope that the line is straight as an arrow. Tiny variations are unavoidable, but they should be small parts of an inch. Incidentally, make sure as the mast lies there on the sawhorses that nothing is constraining it. You want it to take its natural shape.

What do you do if the mast isn't straight? Well, if it's a new one, that's easy: make sure the sparmaker fixes it before you pay the bill. If the mast already belongs to you, you're in a predicament, because it takes an expert to get the kinks out of an aluminum mast. Careful heating and application of pressure will work, but you have to know what you're doing; too much heat can weaken the metal.

When Sparkman & Stephens began designing the Swans for Nautor, I complained that some of the masts weren't straight, so they asked me to come to Finland and take a look. They had eight or nine masts there lying in a row, ready for their fittings, but they were all a little bit wrong, in various ways. And I said, "No, I want these to be straight."

Well, they very cleverly had learned how to do it right, with heat and pressure, and the next time I looked over some masts, every single one of them was just beautiful. From that time on they had a wonderful record with their masts. So it can be done, but it's not something anyone can manage in his backyard.

Of course, it helps if you own the company. When Howard Fuller built his *Gesture* mast in 1945, he decided he'd use the manufacturing facility of his Fuller Brush Company to make the mast. Although it was a very good mast, it was not quite straight, but nobody paid much attention to that until it was in the boat and sailing. I pointed it out to him one day, and before you know it he had the mast out and in a shed at the Nevins Boatyard at City Island. Then he got three or four of his key people from Fuller Brush down there, and they worked on it right there. In several hours they had made a real improvement on the mast. And next year *Gesture* won the Bermuda Race.

On the other hand, you might get lucky. I did when I bought Harvey Conover's New York 32 *Revonoc* in 1945 (and renamed her *Mustang*). The spruce Nevins mast seemed to have a slight curve forward above the jibstay (she had a fractional rig) even after I'd slackened the strut stays and taken up the permanent backstay. The forward bend wasn't much, but was still enough to tighten the mainsail leech, which gave the boat a noticeable weather helm.

So when we laid the boat up I inspected the mast as described above, and sure enough, it had a forward curve of probably three to four inches in the top ten feet. I showed it to Percy the sparmaker at Nevins and between us we came up with an elegant solution. We took off the mainsail and spinnaker tracks and a few other fittings, turned the mast 180 degrees and put them all back on. It's as simple as that.

When we put the mast back in *Mustang* the next spring it was absolutely great. It came back a little at the top, but we could tighten the strut stays and then use the permanent backstay to get exactly the right curve and to reduce the need for the running backstays. The weather helm was gone and the boat was suddenly very docile. The mast was easy to tune, and we seldom needed the runners.

A less dramatic solution for a slight forward bend or taper in the top of the mast is to fit long, thin, wedge-shaped shim between the mast and mainsail track. This will straighten out the track without major work on the mast.

While you're there in the yard checking the mast, it's worth taking the time to make sure the mast track is in good shape. A very common problem in hoisting and lowering the main is that the slides get hung up at the track joints and at the gate. This is

at best an annoyance; at worst, if you have to get the main down in a hurry, it can be dangerous. So you want to do everything you can to eliminate the problem.

First, let me say that those cylindrical slides, or slugs, that run inside an extruded mast groove are the wrong way to go. Cylindrical slides in a groove create at least double the friction or normal rectangular slides in a tunnel. And as for feeding the boltrope directly into the groove, don't even consider it unless you have an out-and-out racing machine with a large and skillful crew.

For all normal cruising and pleasure sailing, slides on a track or in a tunnel are by far the best arrangement. The normal American design uses slides that fit over the track, while the other way, more or less from Europe, is a tight tunnel track, where rectangular slides fit into the tunnel. There's not a big choice between them, but I lean toward the tunnel track.

The slide gate in the track or tunnel is the prime troublemaker. If you have only one track on the mast, its gate has to be above the stacked slides, which pile up when the mainsail is lowered. Otherwise you can't get the storm trysail onto the track. So every time you raise or lower the mainsail, almost all its slides have to pass through the gate. That's why you want to make sure the gate is well lined up and its edges beveled. You also want to make sure the track comes all the way down to the gooseneck to keep that mainsail stack as low as possible.

I've said earlier, and I'll never stop saying it, that any boat that goes to sea should have a separate trysail track on the mast. It should run alongside the mainsail track (but not too close) and down almost to the deck, so you can put the slides on while sitting down; at the bottom there should be a simple stopper. This arrangement makes it infinitely easier to bend on the trysail, which in turn means that you are that much more likely to use it, and you are more likely to get safely through the heavy weather.

But the separate track also provides another, every-day benefit. It means that since the trysail doesn't use the mainsail track, you can lower the main slide gate just above the gooseneck. That way only one slide at most has to pass through the gate every time as you hoist and lower the sail.

As for the mainsail and trysail tracks, the main thing is to be absolutely certain that the slides will slide on them. Even when the track sections are so well aligned that

you can hardly see the joint, mast stress can nudge them apart just enough to hang up a slide on the sharp corner. But if you bevel those corners where the track sections meet, you wont' have a problem.

Some people thought I was crazy, but on *Mustang* used to bevel not only the mating edges of the track, but also every single slide, all the way around, top and bottom edges and across. Then even if the sail had wind in it or the mast was under strain, those slides went up and down no matter what. Once again, careful preparation makes a difference.

A few years ago I went for a test sail on one of our boats in Finland and as we powered down a long narrow channel with the wind abeam I got ready to hoist the main. "You can't do that now," the owner said, and I said "Why?" and he said, "Well, it won't go up until we head into the wind." "Well, then," I said, "turn right around and let's go back to the dock and get three or four files and we'll all go to work on the sail slides.

He was puzzled. It was a nice day and he thought we should go sailing. But we went back, tied up and a fellow went to town, came back in 20 minutes with files and we all started filing on the sail slides, beveling and smoothing them. We then got underway again, and with the wind still abeam I hoisted the main hand over hand. Then I let go, and whoosh, it all came down in a rush. Well, he was amazed. "That's wonderful," he said. "It never did that before." It was a whole new ball game for him.

He's not alone. An awful lot of people grow up thinking you have to be pointed dead into the wind to hoist the sails. Well, I've tried never to hoist a sail headed right into any wind of more than three or four knots. It's the worst thing you can do to the sail, subjecting it to needless flogging, especially if the sail is a few years old and you still want to use it. Battens can get broken or thrown out, stitching is loosened and so on. You should always keep some wind in the sail to keep it quiet. And you can do that if the track is perfectly aligned and the slides are beveled and lubricated. Then you can hoist it easily, and when you want it lower it in a hurry it'll come right down, quickly and all the way - zing, zing, zing.

All this isn't just to make in-the-harbor maneuvers easier. If you're at sea and have to get the main down in the hurry, the last thing you want to have to do is head directly into the wind and seas. First of all, the waves and spray may flood the deck; and

second, you're likely to lose control and fall off on the wrong tack, which can be serious. You have to be able to get the main down while it has enough wind in it to keep you moving slowly and under control. And that means having slides that will slide easily under pressure.

Now, the easiest way to inspect the top of your mast is when it's lying at waist level in the yard. Before stepping it you want to make sure the Windex is lined up exactly fore and aft - and if you don't you won't have a reliable instrument for showing the helmsman the apparent wind. You may also have an electronic wind indicator reaching out forward, and that should be properly aligned, too. And there'll probably be a radio antenna on an arm reaching aft. **[See sketch]**

I also think the three-way masthead running light is a valuable addition. In rough weather in a seaway, running lights anywhere near the deck will be frequently obscured. So the masthead tri-color is a good bet. The masthead unit's stern light, incidentally, will also light up the Windex, which should be mounted between the light and the SSB antenna.

All these delicate instruments mean trouble if you want to fly a burgee at the masthead. Some people do. I certainly wouldn't give up the Windex just to put a flag up there, but if you have a long enough flagstaff (an old aluminum ski pole makes a pretty good pigstick), get the burgee up above everything; once up there, it's fine. Make sure the flag halyard block is absolutely as high as possible, if it's two or three inches down from the truck, then you've got to add twice that much or more on the flagstaff.

Now, when someone lets the main halyard get away while changing from mainsail to trysail, that's not the time to send the culprit aloft to retrieve the end. What you want instead is a messenger rove through a second block at the masthead so you can pull through a reserve halyard. That's why we always specify two sheaves tangent to the aft face of the mast. But if your mast has only one sheave there, it's very hard to install another in the mast. And that takes us back to the flag halyard block on the side of the mast. What you can do is make that block husky enough to handle an emergency main halyard, using the flag halyard as a messenger. That means that the block, besides being strong, has to be made with tight clearance, so the skinny flag halyard doesn't get jammed between the sheave and the cheeks. If that happens you must go aloft to clear it.

You can also used that cheek block to reeve a gantline that will take a man to work aloft. Make sure the flag halyard cheek block goes right on the center line of the mast, so that one half of the flag halyard comes down forward of the spreaders and the other half is abaft them. Then when you need to put someone aloft, you can hoist him either forward or aft of the shrouds, as desired. On a big boat I would have such a block on each side, which gives you another option, especially if you have to put a second person aloft, which is sometimes necessary.

How many other sheaves or block you have at the masthead depends of course on your rig and how you expect to use the boat. Even if you never plan to race, it is desirable to have at least two forward sheaves, if you have internal halyards, or two blocks if they're external. And even if you don't use a spinnaker much, it's also good to have a crane for a spinnaker halyard block aloft. In fact, I recommend two cranes up there, one with a block fitted for cruising and the other for use should you decide to race. You can keep the second block below, instead of letting it swing around up there idle, until you need it.

If you have internal halyards, the aluminum divider plates between the sheaves often get chewed up by wire halyards. This can turn into a serious problem, and replacing the worn plates can be a big job. The best cure if you have damaged plates is to add stainless guides that protect halyards being chafed by the cuts in the plates. Even better is to install them in the beginning, before any damage occurs. **[DIAGRAM]** I was particularly impressed by *Flyer*, the first boat we put these stainless guides on, which won the Around the World race in 1977**.** When she came in I got hauled aloft almost immediately, and looked at this and the guide had a few little marks where the wire had worn the stainless a little but you could go for another 10, 15 years; whereas another similar boat of our design the halyards had cut a deep nasty scar. So it's well worth installing these stainless guides.

If the mast is straight, the tracks clean and the masthead organized, the spar is ready to go in the boat. If you have a one-piece neoprene collar for the partners, don't forget to slip it on before stepping the mast. You can feel damn silly standing there with the collar in your hand and the mast already in the boat.

The exact transverse alignment of mast step to the partners, or deck mast hole, is critical to getting the mast standing up straight. The partners must be exactly in the center of the deck, athwartships, and be centered directly above the mast step. Otherwise you can get the mast straight in the boat only by putting uneven wedging and uneven tension on various shrouds. When the mast step and partners are properly aligned, the port and starboard shrouds should have equal tension to provide a straight mast athwartships, whether the boat is moored or under sail. Then the shrouds are merely supporting the mast in its natural position instead of distorting it into shape, and mast tuning is greatly simplified.

You can't take it for granted that the mast hole is exactly on the boat's centerline. One excellent builder, for instance, had a production line in which the hull moved on a car; when it got to where the decks were put on, they'd set them down on the hull and then nudge it so there would be a nice margin on each side for when they sealed it to the hull. But they should have been adjusting the deck so that the mast hole was exactly centered over mast step.

This is complicated, because you have to get the boat level, transversely, and that means hanging plumb bobs over the stem and transom and adjusting the hull in its cradle so the plumb bobs are lined up with the stem, horn timber and keel. Next you suspend a bob from the center of the mast hole, and it should hang right over the transverse centerline of the mast step. Then you know you have it right.

Fore and aft adjustment of the mast step, to control mast rake, is made a lot easier with a movable heel plate on the mast step. [**DIAGRAM]** It is bolted to the top of the mast step through two-inch slots, and can be moved fore and aft by a jacking screw threaded through the heel plate and into a fixed lug forward or aft of the plate.

When you step the mast, its heel should fit snugly into a raised collar on the heel plate, which **[See Sketch]** also has holes for a transverse bolt through the bottom of the mast. This detail is often overlooked, but remember that an unbolted heel may jump out of the step, which can inflict severe damage on the deck at the partners, and could menace crew members below; in an extreme case it could even damage the hull. It's best to bolt it in.

Whether you have sliding heel plate or not, make sure the mast step has a drain that is kept clear so no water will be trapped there.

Now you have to attend to the partners. (You have already secured at least the lower shrouds by this time, to stand the mast in the center of the partners. Make sure the hole at the partners is the same shape as the mast, with smooth parallel sides and clearance all around equal to about 10% of the mast's fore-and-aft dimension.

Ideally, to get the best stiffening effect of the deck in tandem with the mast step, the mast would be fully braced at the partners, as it is by the traditional all-around wooden wedges. But in practice, this isn't such a good idea. There is no way to keep the masthead from sagging a little when pressure stretches the windward rigging. If the mast is held absolutely rigid at the partners it will bend slightly near the deck in response to the inevitable masthead sag and create fatigue, which can lead to a very serious failure. So to keep the mast in column, and to prevent fatigue in the mast at deck level, it's best to give it slight but clear side-to-side play at the partners.

Except when high-tech competitive sailing requires a fancy hydraulic arrangement, the best way to provide this minimal play is to use two pieces of natural gum rubber of synthetic rubber (of a hardness of about 30 durometer) place in front of and abaft the mast on the centerline. The width of each piece should be a quarter of the mast circumference and its length enough to reach two inches above the deck and four inches below the lowest part of the partners. The thickness on the center of each rubber piece should be one and one quarter times the space between mast and partners. Thus, when they're in place the mast will be under considerable pressure from the rubbers fore and aft, but can move athwartships slightly as needed to reduce fatigue.

Those rubber pieces can't be forced into place, because they're thicker than the available space, and the rubber simply gets thicker if you try to push it in. So you need to pull the mast forward and slide in the after piece; then with lines leading back to genoa winches, sweat the mast aft to compress the first rubber piece so that the second can be slid in forward of the mast. Release the tension, and the mast is centered and secured by the rubber fore and aft, with nothing on the sides. (Another reason to use rubber in the partners instead of the traditional wooden wedges is that the wedges, besides being inflexible, may squeak in rough weather and keep you awake.)

Now fit the mast collar that you remembered to slip over the mast heel before hoisting it into the boat. A good arrangement is to have a watertight ring around the outside of the partners at deck level to take the lower lip of the neoprene collar. And then you tape the whole thing. If you don't have a one-piece collar, you can get a tight seal by wrapping a neoprene strip around the mast a couple of times. One way or another, you have to keep the water from getting down through the partners. With internal halyards, you're always going to get some water coming down inside the mast - that's why you need a drain hole in the mast step - but there's no excuse for water coming down on the outside of the mast.

Something else that has to come out of the mast is the wiring for the lights and electronics mounted on it. My preference is to lead the wires out through a slot in the mast about six or eight inches below the partners. The hole is just big enough so that you can push the wires inside to protect them from damage when the mast is stored out of the boat. When you need them again, just fish them out of the slot. Never run the wires out of the bottom of the mast, they're too likely to be crushed when stepping the mast.

Speaking of lights on the mast, a mast detail that's easily overlooked is the placement of the forward steaming light, what some people call the motorboat light. This (and any other obstruction on the mast's forward face) should be fitted very near spreaders. This prevents a slack halyard from getting caught around it.

What happens if the light is between two sets of spreaders is that when the boat is rolling around and the main halyard is slack for any reason, it can swing forward of the mast and wrap around that light fixture. If it's five or six feet above the spreader, it's mighty difficult to clear it, because when you try to flip it clear you can't get enough slack in the line above and ahead of the spreader to flick it off the light. So the best place for that light, or a floodlight, a horn or radar, is as close as possible to spreader height. This will guard the light from being fouled by any slack line swinging around from the after side of the mast.

I'm often asked why we don't step the mast on deck. After all, it makes for a shorter mast, there's no hole in the deck, and if the rigging fails it all goes harmlessly over the side. Well, the big problem with stepping a mast on deck is that you need a much stiffer section for the same load. This is because when the mast's column ends at

the deck, it can buckle out wherever it wants to, maybe at the spinnaker pole fitting or near the lower spreader, and it has to bend only at that one point. Whereas if the mast is stepped on the keel, when it wants to buckle out at the spinnaker attachment or lower spreader it must at the same time bend at the partners to compensate for the bend at the pressure point, but it can't because it's secured at the partners. So there's a strength factor of about two to one involved. This doesn't mean the mast has to be twice as big when stepped on deck, but it does have to have twice the capacity to withstand a compressive load, so it's going to be a bigger, heavier spar. Which is why we discourage people from stepping the mast on deck.

That also explains, incidentally, why it's important to constrain a keel-stepped mast tightly at the partners. Otherwise, the mast will buckle in whatever space is clear around the mast at the deck, and you lose the stiffening effect of those six, seven or eight feet of mast below deck.

Incidentally, if you do have a deck-stepped mast, be sure when replacing any rigging to keep some fore-and-aft and athwartships support at all times. I know if a fellow who was fixing the rigging of a mizzenmast and who let go all the shrouds, and the darn thing went right over the side. Lucky it didn't kill him. He wasn't really dumb, he just assumed the mast was stepped below the deck and would stand on its own.

The matter of what size and thickness a mast should be are highly technical questions that depends on all sorts of complex details: boat size and use, type of rig, kind of sails, number of spreaders, and so on.

In general, though, we can say that a boat designed for racing will have a thinner mast with as small a section as possible. This has two chief advantages. First, there's less windage, which is important for speed. Second, the smaller section makes for a more flexible spar that can be shaped to maximize performance. This means, though that the mast must have a thicker wall so it can stand up to the very high compression loads created by the need for extreme tension on the headstay for good upwind performance. Needless to say, such a mast also demands the constant attention of an alert, competent crew.

Now, a spar with a fatter section will be stiffer, and requires less sophisticated rigging, runners and such, and so requires less concern by the crew. This mast, say for a

boat meant primarily for cruising, doesn't need such a thick wall, and so, interestingly, will weigh about the same as the thinner mast with its thicker wall.

The two masts will of course perform differently, but as in all aspects of boat design the idea is to arrive at an artful compromise that best suits the need.

Weight aloft matters a lot in rig design, although I think lightness is often carried to a bad extreme in racing boats. Back in 1930, when the *Enterprise* was entering the final America's Cup defense trials, she was given one of the first big-boat aluminum masts, made by Martin Aircraft Company**.** With her wooden mast she had been fast in light air but not much good in a breeze. The new aluminum mast had so much less weight and windage that she won a very important, windy race against *Weetamoe* that she would definitely have lost with the old mast. Right after that she was selected to defend the Cup, and that's when aluminum masts really began to come into their own.

Standing Rigging

We launched *Ranger* in May of 1937 at the Bath Iron Works in Maine. She was 134 feet overall, the sleekest hull you ever saw. After we stepped her 165-foot mast and carefully set up the rigging, Harold Vanderbilt's motor yacht *Vara* took her in tow and we put to sea. *Ranger* was bound for Newport and the selection trials to select a defender for the America's Cup match against *Endeavour II* that summer.

We left about six in the evening and by sundown were steaming at 10 to 12 knots through an heavy groundswell into a calm, foggy night. We were headed out around Cape Cod, since *Ranger*'s mast was too tall for the fixed bridges over the Cape Cod Canal. Captain Monsell on *Ranger* had set a forestaysail, trimmed flat, to minimize rolling. Onboard *Vara* we could hear the flap of the staysail as *Ranger* rolled, but couldn't see anything of her through the fog.

Then about midnight there suddenly came a new noise that sounded like a super-large wind chime - rhythmic pinging through the fog that was a very worrisome sound indeed. We slowed *Vara* down so *Ranger* could drift close alongside, but the fog was so thick we could see nothing aloft. Captain Monsell reported that some piece of rigging had obviously some adrift, but there was no way to fix it under the conditions. So we changed course 90 degrees and headed for Marblehead, hoping to find shelter and smooth water, and crossed our fingers. Captain Monsell put one man at the helm and wisely got everyone else below, in case something came crashing down.

Daylight took forever to come, but it finally did and the fog lifted a bit, so we could see what was happening. It was terrible to watch. None of *Ranger*'s port shrouds above the lower spreader were connected. With every roll to starboard, her mast would just keep on going, bending until it was almost horizontal, although the boat was heeling only 20 or 25 degrees. On the reverse roll the mast would finally come back straight, and snap up hard against the starboard shrouds, which were still intact. Then she'd go through that awful gyration to starboard again. With all that motion, and the terrific forces involved, there was absolutely nothing we could do to stop it.

Finally at about seven o'clock there was a sudden loud bang, and on a starboard roll the mast snapped right off at the lower spreader and went into the water. The drag was so great that *Vara*'s towline came up taught and brought her almost to a stop even

before we could cut the power. *Ranger*'s crew swarmed on deck with all the right tools, and in six or seven minutes the last pin was driven out; the mast sank, and Monsell reported "all clear."

So we left the mast on the bottom in very deep water and went on to Marblehead, where it became my job to call Mr. Vandebilt and give the bad news. I always admired him, but never more than at that time. He didn't make a production of it, but simply said, dryly, "Well, I guess you can get through the canal now."

What had happened? It all came down to using compression locknuts on the closed-barrel turnbuckles. *Ranger* had hand-me-down rod rigging from *Rainbow*, made up in 16-foot sections - they were heat treated, and the longest heat-treatment equipment available in those days, used for making naval gun barrels, was 16 feet long. The 16-foot rod sections were secured top and bottom with fixed fittings; they were joined to each other and were adjusted by closed turnbuckle barrels secured with compression locknuts because they didn't want to drill any holes in the rods. The rigging had been very carefully set up, and everything was nicely cleaned and lubricated.

As we reconstructed it, when the boat started to roll and the tremendous weight of the mast fetched up on the rod rigging, the tension was enough to pull the locknuts away from the barrels a minute amount, relieving the pressure and allowing the barrels to turn just a fraction. Gradually they unwound, a little at a time with each roll. Eventually the barrel backed off altogether, and the rod sections disconnected. Maybe, under those conditions, the careful lubricating job we did on those turnbuckles worked against us.

Well, Mike Vanderbilt wasn't quite convinced by that explanation, and I think he wondered whether someone just hadn't tightened up his locknuts enough. So one day at Newport later that summer, when the mast had been replaced (we actually used the original lower section, and just added a new top section with a butt at the lower spreader), I said, "Well, Mike, I think I can show you something that will be quite convincing".

We were on the mooring, and I went up to the middle part of the starboard vertical shroud, about 16 feet up, where there was one of those connecting turnbuckle barrels with the locknuts. I had two three-foot wrenches adjusted to fit, and I held them out so Mike could see them from the deck, and put a real strain on them. I said, "Is that tight?" and he said, "Okay". So then we sailed out, around Castle Hill, on the wind, and

after the mast and rigging had worked a bit, I went hand over hand up the weather shroud to the specially tightened locknuts, which were now under load, and I turned them easily with my fingers. I came back and said, "That's what happened." I think he was convinced.

And that is a long way around to explain why we have never approved compression locknuts for securing any turnbuckle.

The old fashioned bronze turnbuckle with the open barrel and cotter pins is still the best way to go. They may not look quite as high-tech as closed-barrel turnbuckles or as decorative as chrome plated ones, but that's not the point. The open barrel lets you see exactly how many turns are left on the threaded ends, it's easy to lubricate, and you have positive twist control with properly fitted cotter pins.

Chrome plating sometimes reduces the clearance, making the threads very tight and the turnbuckles hard to turn; or else the threads have been chased a little to take the plating, and then the turnbuckle isn't as strong. Besides, you must lubricate the turnbuckles, which means they should be covered. So why spend money for chrome plating - which will come off anyway?

It's very important that all the turnbuckles turn the same way. I prefer having the end of the turnbuckle with the right-hand thread down so that they turn the normal way to tighten and loosen. But some shroud-end fittings require that the right-hand thread of the turnbuckle be up. In that case, for heaven's sake, be sure that all the turnbuckles are installed the same way. This will tremendously simplify making adjustments to the standing rigging.

And here's a little trick that makes it easier to make those adjustments, especially when tightening a turnbuckle that is under a lot of tension or that hasn't been properly lubricated. Instead of holding the upper end of the fitting with a fid of screwdriver and then turning the barrel against it, let the upper end turn with the barrel. This takes only half the force because there's only half the friction. Make a half-turn, then hold the barrel and turn the upper half back a half turn. Again the load is only 50 per cent of the maximum. It takes a little longer to get the required turns, but it also takes only half the force and puts less strain on everything - including you.

Incidentally, when your eyes get old like mine, and you have trouble seeing which way the threads go, you can use a similar techniques to find out. Just get a purchase on the upper end of the turnbuckle and try a quarter turn either way: if the barrel stands firm, you're tightening; if the barrel turns with the upper end, you're loosening. Simple as that.

The best way to make sure you won't have trouble adjusting the turnbuckles is to keep them lubricated. I've never found anything that works better than anhydrous lanolin. It's rather gooey, but it stands up well to sun and salt water, and one application will easily last a long season. Incidentally, I use anhydrous lanolin for all heavy on-deck and rigging lubricating jobs - mast and boom slides, genoa sheet tracks, companionway hatch slides, and so on. It's the only lubricant I know that will stay on for even two or three years in salt water conditions.

This is the place to talk about a most important subject: cotter pins. A very small item, but a vital one. Most people use cotter pins that are too long, too light and that have nasty sharp ends. Then they bend them back too far after putting them through the holes in the end of the threaded bolts or clevis pins. This overbending makes it very hard to take them out and put them back when you need to adjust the rigging.

The right way is to have a pin that fits its hole snugly but doesn't need a hammer or pliers to put in and take out. Its length (below the head) should be 1 ½ times the diameter of the threaded bolt or clevis pin it is securing, and then the ends should be spread not more than 10 º to each side - a total spread of 20º. That's all. The pin can't come out by itself, but when you need to take it out, you can. And you can put it back. (If you're really eager you can bevel the hole edges slightly to facilitate replacing the pins.)

If you make a big deal of bending the pin all the way back around the bolt, you'll never get it straight again. When you try to straighten the pin it kinks, which makes it twice as hard to take out and harder still to put back in. Finally, be sure to file off the ends of pin so they're round, no sharp points to damage fingers, sails, and lines. Incidentally, I think those split rings are a poor substitute for cotter pins. They're a pain to take out and still harder to put back in.

To secure turnbuckle barrels it is important to turn the cotter pin so that its spread ends are vertical - that is, lines up with the turnbuckle barrel. Then if the shroud tends to

turn, as it will, the cotter pin's two ends ill fetch up against the side of the turnbuckle barrel at the same time. If the spread ends are horizontal, they may straighten out one at a time when they hit either side of the turnbuckle barrel.

Finally, I like to put a blob of silicone sealer, which dries to a hard rubbery consistency, over the ends of the pin to keep them vertical and to cover the ends of the pin before I tape the whole thing. But silicone doesn't set up well in cold or rainy conditions, so if you can't wait for a dry day, fold a piece of tape on itself six or eight times to use as a pad over the pin ends before wrapping it with a few rounds of tape. This makes a neater job and uses less tape than winding the tape round and round the turnbuckle half a dozen times.

One last word about turnbuckles. When you're setting up the rigging for the first time during trial sails, a slick idea is to leave the adjusting cotter pins out and instead to run a line through the open barrels and tie it off. You can untie the line easily to adjust the turnbuckles as you fiddle with the rigging, but the lines will hold the turnbuckles in position till you get the rig right. Then when you finish, put the pins in properly.

Which is better for standing rigging - wire or rod? Well, they both have good and bad points, and there's no absolute answer. For general pleasure sailing, though, in boats with conservative rigs and reasonably wide shroud angles and chainplate spreads, I think 1x19 wire is best. First and foremost, wire will slightly cushion heavy shock loads on the rigging, which definitely reduces the danger of breaking something.

Furthermore, wire is easier to handle, transport, and stow, and it will take more abuse without serious damage. You must always get expert application of terminal fittings, either swaging or the mechanical Norseman type. But for a quick, on-board fix with wire you can always use bulldog clamps; the Norseman-type terminals make an even stronger temporary repair with no special tools.

Another advantage of wire is that when it begins to fatigue, an individual strand may break and stand out from the wire. This is a good early warning system for fatigue in the wire. Rod rigging gives no such warning.

But rod or bar rigging has virtue for racing boats with more radical rigs - short spreaders and narrow shroud angles - where you need more strength for less weight and diameter. For maximum competitive performance, the hottest thing is lenticular rod

rigging, that is rod, that's been flattened out into a more aerodynamic shape. If a round rod has a quarter-inch section, for instance, the lenticular equivalent will be slightly over one eight, which means less resistance aloft. We tune lenticular rods very carefully so that when the boat is sailing closehauled, the weather shrouds are angled into the wind to reduce resistance even more.

But there's a problem with leticular rigging that needs careful attention. If your rigging hums, watch out. That flattened rod is like a piano string - under certain combinations of length and tension, it vibrates when wind goes past it. It can happen when you're sailing or when moored - more likely the latter, perhaps - and it's bad news. The humming means it's vibrating, and is a vital warning of destructive metal fatigue that can cause your rigging to fail even while the boat is safely tied up to a dock or marina and you're sitting in your office.

You must eliminate the humming right away. The first thing to try is tuning the mast with less tension. If that doesn't work try putting a slight restriction at the mid-point of the humming shroud: tie a piece of light-twine from the shroud to the mast; even a small weight such as a wrapping of tape at the mid-point may do it. If the damn thing still hums, go back to round rod rigging. And don't wait until the end of the season. We've had too many cases where an owner has come back to his boat on Friday to find the shrouds just dangling.

The question of what is best arrangement of shrouds and stays for a given boat is too complex to get into here, but a couple of generalizations are in order. The benefits of the masthead rig are pretty obvious - it's neater arrangement and with a sufficiently strong mast and conservative rigging plan you don't always need running backstays. But the fractional rig also has advantages - the headsails are smaller, and you have to live with your headsails. The spinnakers, too, are smaller which reduces the danger of knockdowns and broaches. The price is having to pay more attention to running backstays. But they are not that much trouble - on *Mustang* even with a fractional rig we used them only about 10 to 15 per cent of the time (**See Chapter TK, Running Rigging**).

In fact, I'm very much in favor of having running backstays on any boat that may be sailed offshore, even with a masthead rig. As explained in **Chapter TK (Storm**

Sails), I think any boat that goes to sea should have a removable forestay, and that means runners to match. With a masthead rig you won't use them much, but if you ever get caught in a hard breeze you'll be very glad to have an inner forestay and lower runners to reduce the mast pumping and to save your bacon is anything happens to the headstay or permanent backstay.

Another fundamental question of the standing rigging setup is whether to have single or double lower shrouds. Single lowers are more efficient for several reasons. There are fewer fittings, obviously, and less windage. (Each of the shrouds in a double rig needs to be almost as strong as a single shroud, because each one must be able to take much of the load under certain conditions.) A single lower also lets the main boom ease farther forward under extreme conditions, and allows the spinnaker pole to square aft more. Furthermore, the single shroud also facilitates the use of a blade jib whose foot is about equal to the foretriangle base - a good rig for a big boat in moderately heavy weather.

But a single shroud has one big drawback: you have to have a baby stay. This vital little stay keeps a slight forward bow in the mast so it won't pump or turn "inside out." The baby stay can be a real pain with a spinnaker - you've got to get it out of the way to jibe, and then remember to set it back up again to counteract the thrust of the pole if the wind comes ahead and you strap her down on a spinnaker reach.

In other words, a single lower shroud/baby stay arrangement requires more watchful attention from the crew. With double lowers, you don't need to worry about this problem, so from a practical standpoint I think well-spread double lower shrouds and no baby stay is the best arrangement except when competitive sailing is the boat's primary purpose.

Even double lowers aren't foolproof. I remember a Fall weekend race on Long Island Sound when we were sailing not far from Bob Derecktor, a very competitive sailor and designer as well as a fine boat builder. We were running under spinnaker from Old Field Point across to Connecticut when we banged into a good hard northerly shift. We got in the spinnaker and set a jib, trimmed down hard. Then we got squared away, we looked up and realized that Derecktor had lost his mast.

Bob's boat had double lowers, but it turned out that in trying to get just a little competitive edge he'd disconnected the forward one because he had a jib that trimmed better that way and he could also set a bigger forestaysail under the spinnaker and square the pole a little bit more. Well, when the breeze came in hard ahead, in the fuss of dousing the spinnaker he forgot about the forward lower shroud. When the new strain came on the rig, that vital forward support was missing, which caused the accident. That was the same thing as forgetting to set the baby stay with a single lower shroud. If the good crew that usually sails with Derecktor can make that mistake, what about an average yachtsman?

Another detail to pay attention to is the design of the tangs that attach the shrouds and stays to the mast. They must come away from the mast at exactly the same angle the shroud is going to take. Otherwise both tang and shroud will be subject to fatigue. Second, the tang's plates should be symmetrical; on badly designed tangs the mast side is virtually flat while the outboard one is quite steeply angled, which induces an uneven strain and puts the clevis pin at an angle to the lines of force **[DIAGRAM**].

The clevis pin that goes through the two tang plates and the shroud terminal fitting must be just the right diameter and length, so that it makes a good fit and doesn't stick out unnecessarily. And, of course, its cotter pin should be correctly fitted. (Here is an especially good place to countersink the pins' holes a little. If you ever have to replace a shroud aloft, you'll be glad you did.)

One more thing about the tangs. All the bolts or screws securing them to a metal mast - including those holding the spreaders to the mast - should be tightened up with Loctite or a similar product, so they don't loosen themselves.

The spreaders need special attention, and the first thing is to make sure their inboard ends conform exactly to the mast fittings and that the clevis pins are exactly the right size. If there's any slack at all, the spreaders when on the lee side will work, producing unacceptably destructive wear. It's also vital that the outer spreader ends be secured to the shrouds at just the right angle so that when the shroud is under maximum tension it will be pushing straight in on the spreader, and not trying to pull the spreader end up or down at all. And of course the spreaders mustn't be able to slip when the shrouds are loose on the lee side.

To keep the spreader ends from chafing the overlapping headsails, you want to get the ends as smooth as possible. If you do it right, so that the metal end fittings are absolutely smooth and beautifully polished, then you'll have less wear on the sail - and less delay in tacking - than from spreader ends that are covered with tape or leather or even plastic.

You also don't want your spreaders to be sharp on the trailing edge. A reasonable streamline will slightly increase the upwind efficiency of the boat, but if edges are too sharp, they'll damage the sail.

I can't stress too strongly the importance of discontinuous rigging. This is something that we at Sparkman & Stephens have insisted on for a long time. The principle is simply stated: Any time more than one shroud passes a spreader end, the shrouds above should be terminated at the spreader end and only one shroud carried down from there.

There are several reasons for this. All rigging elongates a bit when under heavy tension. The longer the wire or rod, the more elongation. That movement under strain over the end of the spreader produces serious fatigue in both rod and wire, but especially in rod.

Furthermore, if the masthead shroud passes over the spreader end with an intermediate shroud, which is a shorter length and carries a different strain, there's going to be relative movement between the two. And that complicates the problem of fixing the shrouds in the spreader ends.

Let's take the simplest example: a double-spreader, masthead rig. The top shroud has to handle the maximum load when a heavy No.1 genoa or a spinnaker is set; the intermediate shroud is tuned to support the thrust of the upper spreader plus the minimum load created by the mainsail. Now say the wind strength is greatly increased, and we shift down to a double-reefed main and forestay - no sails going to the masthead at all. Now there's no load on the top shroud, but maximum load on the intermediate. This causes unsafe relative movement in the shrouds, which creates undesirable problems.

But if you end both those shrouds at the end of the lower spreader with well-designed link plates, and then go on down with a single rod or wire attached to the bottom of the link plates, there can be no relative movement whatsoever over the

spreader end. Therefore no friction and no fatigue. And because each of the shrouds is materially shortened, there is a great reduction of the amount of change in mast alignment due to changing sail loads. This gives a stronger rig under a wider range of conditions. Finally, the link plates eliminate the danger of the shrouds coming adrift from the spreader ends.

So, terminating each shroud at the spreader ends with link plates solves a lot of rigging problems, and makes a very neat arrangement besides [**DIAGRAM].** For some years a lot of designers felt that continuous rigging was the right answer, but now I think practically everyone has come back to using discontinuous. To put it most simply: only one shroud comes down from any spreader end. It's the only way to go.

To keep rigging elasticity to an absolute minimum, it should be sized so that its maximum expected loading is less than one-third its catalog breaking strength. With this loading there will be no measurable stretch. Many designers today, looking for better performance use a reduced factor of safety, but it's at the price of shorter life for the rigging and serious danger for the mast in extreme conditions.

Now, a lot of modern racing boats are loaded with hydraulic controls - backstay, headstay, mast partners, baby stay, boom vang, Cunningham - and the high-tech racers have got themselves in a position where they need to do it that way. But in general, I think it's a great mistake. Maybe I sound too conservative, but it just kills me to go out and see someone with very little knowledge pumping away, reading some figure on the dial and getting everything so tight that you should fear for your life.

You do want to be able to change the tension on the backstay, and there are units that work very well, that fit right on the stay. There is just one place to pump, so you know exactly what's being adjusted. But when you have one pump with a central switchboard where you switch the knob and pump by the numbers… well then you can get into a lot of trouble, especially at night, when it's hard to observe the results of what you're doing.

Not long ago I had a trial sail on a boat we designed, for which Eric Hall of Bristol RI had made an excellent, aggressive spar. Before we got underway he said, "Now I want to have it understood that no one fusses with the hydraulics except myself." Well, that was fine with me, because I don't like the damn things anyway. But the point

is that Eric had made a very light spar, and if everything wasn't done just right it might come down. I think he is one of the best sparmakers around, so this isn't anything against him. But it shows the danger of the average sailor fooling with hydraulics to push and pull a minimum-strength spar around.

I remember sailing on another new boat in Europe several years ago. Someone in the crew was fiddling with the hydraulics and all of a sudden I noticed the boom was getting a terrific bend. I said, "Hey what are you doing?" "Tightening the inner forestay," he said, still pumping and pumping. Well, it turned out he was tightening the boom vang by mistake, and had put a great bend in the boom. But there was no feel in what he was doing. That's what I have against hydraulics.

There's no doubt that technology has made a lot of improvements possible. But I still think that when it comes to standing rigging, simpler is better. And I can't help remembering my experience with *Mustang*. She had two well-spread lower shrouds, intermediates, top shrouds and strut stays for her fractional rig. All 1x19 wire. We had no turnbuckles at all on the intermediates - they were made exactly the length I wanted them and the first year I had the boat, and that's the way they stayed. So we had a much safer and simpler rig. And no adjustments were ever necessary. Except for the permanent and running backstays, we never changed the tension on anything, never adjusted a turnbuckle, for the next 25 years. Zero.

In the autumn I'd back off six turns on the starboard shroud turnbuckles, oil them, pin them and put a tag on them. Then in the spring when the mast was stepped, we'd put those six turns back in again. Once or twice the boat was launched just before a race, and we never were at any handicap - we knew everything would be just right. And that is how it worked out.

Storm Sails

When I go out on sailing trials, people are always anxious for me to look at spinnakers and genoas, and I always say "Fine, but then let's look at the storm trysail and storm staysail." Well, it often turns out that those sails are at the bottom of the sail locker ashore. I have a little trouble keeping my voice down at this point, but I say 'Okay we'll set storm sails at the dock." And then it takes two or three trips to the boathouse locker to find everything needed to set these small but very important sails.

When we finally go to hoist them, we often discover more problems: the slides don't fit the track; the halyard shackle won't go through the head cringle; the sheets aren't bent on, or aren't there at all or if they are, there's no place to lead them; the hanks on the headsail won't fit around the forestay; no one knows how high the trysail gets hoisted, and so on.

Well, I try to keep cool, but I think this is a very serious matter. Storm sails, with particular emphasis on survival conditions, should be at the very top of the priority list. Once you get everything sorted out and have set the storm sails in easy conditions, go out and have a practice session in the dark, preferably with a good fresh breeze. Then start worrying about how your .75-ounce spinnaker sets.

Now here's an example of what I mean. In the 1984 Sydney-Hobart Race, which was very rough, one of the big boats had installed a new rig just days before the start. Then when it began to blow over 50 knots the new main tore, and the gooseneck broke, and they tried to set the trysail. Well, the old trysail slides just didn't fit onto the new mast track. It's as simple as that. And they quit the race. Now, they probably would have anyway, one hundred and twenty five other boats did. The point is that no one had thought or had had the time to test the trysail before they left, and when they got into a bad situation, they couldn't set it. You don't have to be in the Tasman Sea for that to happen. It could happen anywhere, and could be very serious.

I think it's best to stow the two storm sails: the trysail and the storm forestay sail, each with one sheet permanently bent on and the other end tied to an eye inside the sail bag. Set the sails with the one sheet on each so if you have to tack or jibe later, or if you decide to heave to and need to back the staysail to weather, you'll have time to bend on the other sheets. The clews of both storm sails should be easily reachable from the deck.

The main halyard should have a clear marking that positions the trysail at the right height, and the tack pendant should be marked, too, so it can be secured before hoisting. Then all you have to do is hoist the sail till the luff is tight, and it will be set correctly. (To get the best height for the trysail, start with the sheet lead. The sheet should go to a sturdy turning block on the quarter and then probably to the mainsheet winch, and that lead should bisect the angle between leach and foot. That will determine the proper height to hoist the sail.)

The sheet should also have a mark for normal close-hauled trim or for heaving to; that way you can cleat it before you hoist, and thus minimize flogging during the set. Flogging is the primary cause of sail failure, and in extreme weather, a sail that is allowed to flog will not last much more than parts of a minute. Neither will a snatch block, incidentally, and I strongly advise against using even the best-made snatch blocks for storm sail sheet leads. There will inevitably be some flogging, and a snatch block can self-destruct in no time.

Most sailplans show the clew of the trysail quite near the boom, but that's definitely misleading. One if the virtues of the trysail is that it is set loose footed, while the boom rides out the storm securely lashed. The best arrangement for this is a fixed gallows frame with positions both port and starboard or a low boom crotch that can be set up either side or, failing that, in the middle. Then you don't have that heavy spar crashing around, which can be one of the biggest hazards in storm conditions. And the lashed-down boom gives you something solid to hang on when working around the deck.

Now we get to the problem of storm sails and luff grooves. I am against grooves anyway, except on boats used only for racing, and I'm absolutely against grooves for storm sails. If you've always got seven or eight or nine young men aboard, then grooves are okay. There's no doubt you can change headsails more efficiently and keep the boat moving faster during sail changes with a double grooved headstay, if you've got the manpower.

But if you're ever shorthanded and get into bad conditions, then watch out; away go the sails as they come down out of their grooves. During the '79 Fastnet Race a couple of the bigger boats spent several hours trying to get their mainsails back on board,

and the guys were sick and cold and on the edge of hypothermia. If they'd had a track and slides, they would have been able to stow the sails ever so much more easily.

Now, I realize that many boats have mainsail grooves, and that not many owners are going to rush out and change them. But if your boat is bigger than twenty-five feet or so on the waterline, then you should at least have a separate track for the trysail. Run it up the mast as high as the head of the trysail will ever be set, and down to the deck, with a gate about eighteen inches from the bottom. The track presumably should be to port of the groove, in the northern hemisphere, anyway, on the theory that in a storm you'll probably be sailing on the starboard tack to get away from the center of trouble. The trysail will set better if the luff is on the leeward side of the mast.

If the trysail track extends down to the deck you can put the trysail slides on the track while sitting snugly on deck, lashed to the mast if necessary, and you can put on all the slides and secure the tack pendant, previously marked before hoisting the trysail and keep everything under control. With a groove you have to hoist the sail as you feed it in through the trysail track gate the gooseneck, and it's flogging around and you're standing up trying to keep your balance with one arm around the gooseneck or the mast. Then you'll wish you had a track and slides.

Now, as for the storm headsail, a really good seaman can get a small luff-grooved jib down and stowed all by himself in heavy weather but he's got to be good and the sail small. Otherwise it gets away, slips under the lifeline and then all hell breaks loose. And trying to hoist a storm jib into a grooved headstay can also be a problem if you're shorthanded, and there's really no satisfactory way to attach a storm headsail to the grooved headstay except by using the groove. So if you have a grooved headstay and nothing else, you're going to be in trouble when you need to shift down to a storm sail unless you have a boat full of strong hands. Your headstay should be 1 x 19 wire. A grooved stay is also difficult to stow when not being used.

That's also why I'm one hundred percent in favor of a wire inner forestay. It means a fitting on the mast and one on the foredeck about halfway between the mast and the stem. And it means having to secure the stay when you're not using it. But that forestay, or storm stay, can be a lifesaver, literally.

First of all, since this forestay should be made if straightforward 1 x 19 wire, you can hank the storm staysail to it, which keeps the sail under control at all times, raising and lowering.

Second, it means that when you're setting the staysail on the inner forestay, you're not going to be horsing around out at the end of the boat, which isn't a safe place to be in storm conditions. The mid foredeck is a better place to work. With an inner forestay, you have a wider, drier more suitable working space.

Third, in terms of balance, the boat will behave vastly better if the headsail is not all the way forward on the headstay. Out there it tends to pull the bow off the wind when it comes up out the trough of a big sea. If you're sailing her, this makes it hard to steer; if you're hove-to, it keeps pulling the bow off, whereas it's better to maintain a constant angle to the wind (ideally between forty and fifty degrees). The point is that closer both sails are close to the boats' center of lateral resistance the more balanced, controllable and safer she will be.

So there are three good reasons for having an inner forestay, or storm stay. The best foredeck fitting for the stay is a fixed, two-hole casting, not a pelican hook, which are dangerous and vulnerable, or clumsy turnbuckles that take time and effort. At the bottom of the forestay you should have a Sparcraft snap shackle, the smaller one for boats up to forty or forty-five feet and the larger one above that, which snaps into that fitting. To set it up, you put the staysail halyard shackle into the after hole of the deck fitting, take up on the halyard and take the strain until the forestay snap shackle will reach the forward hole. Slack off the halyard, and you are in business. Reverse the operation to unship the forestay and take it back to the mast, where you can secure it around a quadrant on the deck near the base of the mast and a small tackle to take a strain and snug it in. The forestay will live there comfortably and won't give you any trouble when you don't need it. I hope you never have to use it in bad storm conditions. But if you do, it will bring you home safely.

Incidentally, one thing you never want to do in heavy weather is to simply drop the main and sail with just a jib out on the headstay. This is easier than setting two smaller sails, but it's hard on the rig. It puts seventy five percent of the strain on the

headstay, and with no sail on the mast to spread the load, it has lead to a number of mast failures.

The size of storm sails stirs up a lot of controversy. Don't forget that your storm sails are for storms. You set them on a Sunday afternoon with the wind blowing twenty five to thirty five knots, and they don't seem big enough to give you any control of the boat, and so you think they should be bigger. But remember that when calculating the pressure of wind you square the velocity, so that the effect of a sixty-knot wind is almost exactly four times that of a thirty-knot wind. When it's blowing sixty, small is beautiful.

An excellent rule for determining the size (see appendix) of storm sails is the combined area of trysail and storm forestay should be not less than the figure represented by the boat's righting moment raised to the .7 power, nor more than the righting moment figure raised to the .7 power times 1.4. This makes sense, because the whole point of storm sails is to keep the boat stabilized and under control in conditions that are just a little under the extreme worst, and the righting moment is a measure of the boat's stability. Unfortunately, many of the measurement rules don't exhibit a boat's righting moment; but it's not too hard to determine by actual tests, and then you'll have a target figure for your storm sail area.

Finally, after you have set the storm sails enough to know how all the gear works, then fold them up neatly in their bags, they're not much bigger than a football, and stow them away, onboard. And hope you never need them.

Heavy Weather Sailing

It can be most instructive to analyze the factors, which govern the variation and experiences in a large number of boats that encounter extremely adverse weather. The 1979 Fastnet Race has been so extensively reviewed and reported that this provides an interesting field for study.

What was it that allowed a fair number of the participants to race effectively while maintaining some semblance of order on board, while at the same time and under basically similar conditions, there was an unacceptably large number of fleet, which were quite unable to cope with conditions encountered.

As would be expected, there are a large number of contributing causes, none of which individually determine the outcome, but when a sufficient number were in the positive category, it made it not only feasible but of course much easier to maintain an orderly and essentially safe situation on board.

When there were too many negative factors, this will lead to a situation were the crews lose faith in their boats and where they look elsewhere for safety.

The biggest single factors are the basics of hull design, of hull and deck construction, and details of rig and sail equipment. It is unfortunate that the quest for competitive excellence has thrust so many of these basic factors very much in the wrong direction.

It's entirely healthy and normal to expect crew capability and skill to contribute to facing success but it is clearly in the wrong direction to go offshore in boats which require too high a degree of crew skill merely to survive.

It's clearly obvious that a high righting moment at wide angles of heel should have high priority for heavy weather sailing. This must be combined with adequate hull strength to take the inevitable stresses that occur in heavy weather sailing.

It's equally important to have a rig that will be pretty sure to withstand anything that might be encountered, hopefully without needing extreme expertise and constant adjustment to keep it altogether.

In addition, the deck structure, cockpit hatches, all must be fully up to the heavy stresses that occur. It is inevitable that water will come aboard when it gets rough enough. Never be confused by the enthusiastic owner who states that no green water ever

comes on his particular boat. All he's saying is that he's been awfully lucky in what conditions he's encountered but to have a boat that's well able to stand any green water that may come on board.

Assuming the boat has reasonably acceptable fundamental characteristics, the next basic requirement is that appropriate preparations be made, not when the weather begins to deteriorate, but long before any offshore passage is initiated.

By making the proper preparations, it's quite analogous to a carpenter who has the right tools, the work becomes relatively easy and this enables the crew to concentrate without having to play catch up by patching up things that are not right to begin with.

Another important factor is crew experience and the word experience must cover a multitude of hope for virtues.

The majority (hopefully all) must have that fair quality which enables them to do whatever is required even if bothered by mal de mer. It's no favor to any skipper or any your shipmates to go offshore if rough water can render you inoperative which not only leaves the job to someone else but it increase worry on all the others who are disturbed both physically and mentally by your own problems.

Never overlooked the fact that good rough weather ventilation as well as maintenance of clean engine and bilges can play a tremendous part in minimizing seasickness. Hence, one if the many details that can contribute to effective and enjoyable rough weather sailing.

The skipper must have inherent ability to make primarily sound decisions; the navigator to keep track of where you are and which is the best direction in which to proceed; and the cook to provide nourishment and of a sort that provides energy with a minimum chance of upsetting the digestive process. I can remember going off with a very experienced and seasoned crew and having a delightful dinner under relatively favorable conditions with an absolutely divine pizza that have been provided by somebody's wife or friend. Fortunately the weather stayed reasonably moderate but just about an hour after dinner, there were nine or ten people most of whom claimed they have never been seasick, all spending their time at the lee rail. Fortunately it was a boat that had a fair amount of ballast, so we could continue to sail with a reasonable degree of efficiency in spite of much temporary discomfort.

Another very fundamental requirement is the need for maintaining dry bunks, dry change of clothes and adequate protection for vulnerable food stores. This again leads to installation and maintenance of really tight hatches and companionway and again backed up by effective hatch covers analogous to a man who wears a belt and suspenders. Where adequate ingenuity and determination are utilized, the deck can be made really watertight and still include what's mentioned above, some reasonable rough water ventilation.

Where a choice exists, it's important to avoid excessive cockpit size. I think the big cockpit gives a false sense of security when weather is moderate but when it really gets bad, more or less the smaller the better. Most emphatically this must also include the security of cockpit hatches which all too often are merely moderately water tight and a gradual ??

While in the area of minimizing water, apart from the very vital and important desirability of deadrise and a central bilge pump that will catch water, there must be a really effective hand pump systems including one pump handy to the helmsman assuming he's alone on deck and one pump operable in the cabin, and ideally both pumps identical which provides additional chance of getting one working in case some trouble is encountered.

An important corollary for effective pump systems is that the discharges be arranged so there's absolutely no way of water backing in and don't ever count of some kind of check valve to accomplish this – rather five vented loop centrally mounted so no normal angle of heel could start water siphoning back. The deck pump should discharge where it can be seen on deck so the pumper can at least be encouraged by what he can occasionally see or hear coming out, whereas the below deck pump should be monitored by seeing whether you are gaining or losing with what's in the bilge or sump.

The security of all tanks, batteries, tolls, inside ballast, anchors, etc. should be absolutely beyond question. This of course is only important in ultimate conditions but in ultimate conditions it can be ultimately important so don't count on being spared the need for this important security.

This should also go on to locker doors and drawers all of which should have a soluble back-up system.

The need for ample hand holds and rails both on deck and below should be quite apparent and any large space below deck should be broken up either with heavy weather life lines or some kind of mishap railing to minimize acceleration. It can be awesome when you lose your hold on the weather side of a big cabin.

Much more than normal care should be devoted to bunk boards or bunk canvas, whatever you wish to call it, in order to have real security when you are attempting to sleep. This can be of great importance four hours later when it's your turn to battle the elements.

I probably have gone much too far in the how to get ready department but I'm really trying to emphasize the fact that with proper fundamental preparation, the problem of coping with poor weather are greatly simplified.

While proper preparation has an extremely beneficial effect of apparently lowering the wind velocity, no degree of preparation will eliminate the need for intelligent sail handling on deck.

We must acknowledge a big spread from the tactics employed by the well equipped and well prepared dedicated competitor to the tactics employed when one is sailing offshore for pleasure where both comfort and safety demand a different approach.

The racer will not only have a powerful crew but most of the sails will be in grooves and while these considerably expedite much of the handling involved in competitive sailing, they greatly add to the burden of short handed pleasure sailing as much more power is needed to take care of a sail that being taken off and this makes it most advisable to minimize manpower required by having a well lubricated track for the mainsail luff with slides intelligently located so they don't block the luff reef cringle.

The mainsail with luff slides, the headsail on hanks can be dropped very quickly in case of sudden deterioration of the weather, with virtually no change of losing the sail overboard, even tough some part of it may get in the water.

Here again when looking for security, change down a bit ahead of time even though this is a tactic that wouldn't help you win important races.

When it's really rough when making headsails changes, it's very important to get the bigger sail off and below before the replacing sail is brought forward.

In the same vein for security, it is better using only light genoa with a reasonably high clew that you can see under, where the very weight of the sail dictates changing down before it gets too rough, going to the Yankee under which a forestaysail may be set if the boat us that size and so rigged. Here again using a sail with a high clew that as weather deteriorates further can be dropped with a very small part of the sail ever reaching the water – quite different from what happens if a normally shaped genoa is lowered after the breeze has increased.

Even though the boat in question may be pretty stiff, or conservatively rigged so that reefing is seldom necessary, it is extremely helpful to have practice sessions reefing so that when it is necessary, it can be done with a minimum of manpower and time, and if the crew is really right, there should be no need for lights even in the darkest weather using lights only if something out of the ordinary happened where light must be used to identify the problem.

There are innumerable things that can facilitate reefing. First the right luff slide location so there's plenty of light between the slides to get under the gooseneck reef hooks. This is further facilitated by having D rings secured through the normal luff cringles and some shock cord arranged so that when once on the gooseneck hook, the sail won't come off, even if you're a little slow tightening the halyard.

Halyard marking is also very helpful so you know just how far to lower to make it possible to get the luff cringles or D rings on the hook, avoiding the time and effort wasted if you don't lower quite enough or if you lower too much.

If the mainsail is going to be stowed, it's very helpful to have a secure position for the boom hopefully on each side, when the mainsail is furled off slide, it is best to have the boom on the lee side but quite low which also helps catch anybody who is unexpectedly thrown across the deck.

The storm trysail is an extremely vital piece of equipment even if seldom used. If conditions get to the point where you really need it, there's just no way to get along right without it. The too often attempted practice of "laying a hull" with no sail set is, to put it mildly, a very desirable alternative.

The storm trysail should have luff slides similar to those on the mainsail. Where the boat is sufficiently small so it's easy to reach a gate located just above the stacked mainsail, then the normal track can be used for the trysail introducing the slides, top one first, using the gate. Then closed the gate and secure the trysail tack as well as the trysail sheet before starting to hoist the sail.

Where the boat is large enough so the stacked mainsail gets to a point that's difficult to reach, it's far better to have a separate track for the storm trysail, starting very close above the mast coat, going up generally on the port side of the sail track and extending several feet above the point where the head of trysail is expected to reach when the sail is properly set.

This separate track has a further advantage in that if the weather moderates, the trysail can be lowered but it's certainly wet, and it's quite practical to stomp it securely on deck amidships while the mainsail in set. With this arrangement the trysail is ready to use again in case the weather deteriorates and it's also in a position to be dried out easily when the weather clears up.

The trysail tack should be marked clearly to hold the tack at a point which will provide the correct sheet lead when the sail is fully hoisted. Normally, it's good practice to pass the tack around the mast back through the cringle again and then to a point below the gooseneck. In this case, there should be a tapered end to facilitate passing the trysail tack back through the tack cringle and as stated above, it should be clearly marked so the sail will go to the right height when it all fetches up tight.

Trysail sheets should be on the sail in advance and it's good practice to have exactly the right line made up with the sail to avoid the possibility of picking up a line that's too big, or too small or perhaps not sufficiently long.

Setting the trysail should be practiced again and again, including sometimes when it's dark and when the weather is reasonably difficult and if this procedure is followed, you will be rewarded by the fact that it will be extremely easy to set this sail in the difficult conditions that always prevail when a storm trysail must be used.

There would normally be two headsails that would be appropriate to use with the storm trysail – the first something analogous to a normal forestaysail on boats fitted with a conventional double head rig. A simple rule of thumb – such sail should have an area

about 7% of the foretriangle height squared. This sail would be used whenever reasonable headway was desired and of course when it wasn't blowing so hard that it is difficult to carry this area.

For extremely bad conditions, there should be a sail about half this size or less perhaps 3% of I squared in area and this can be a vitally important sail under survival conditions and in fact under any conditions when, for various reasons, it might be desirable to heave-to.

Both these headsails should set conventional hanks on a stay and particularly for the small sail, it is desirable to have it quite near the mast to minimize the tendency for the bow to be blown off when rising up over a steep sea.

Sheets for both these sails should have a clear lead to a strongly mounted deck block on a line from the tack not less than 7.5 nor more than 11 degrees off centerline. The block should be a very conventional single block shackled to an eye and it's extremely important never to utilize a snatch block which is very apt to open itself at a critical moment when the sail is being set or when the boat is being tacked and this can lead to almost certain loss of the sail if it's really blowing hard.

When tacking with such a sail, it's very important not to slack the sheet rapidly and not at all until the boat has gotten well around on the new tack and then the sheet should be slacked slowly, as the new lee sheet is being taken in.

When conditions are really rough, it is extremely important to over trim the headsail and finally when conditions are such that it's desirable to heave-to, this sail should be brought aback.

It is important that in this condition, the weather sheer does not contact anything that would tend to chafe it.

With the storm staysail slightly aback, the storm trysail trimmed as it would be for normal windward sailing and the wheel or tiller set to try to bring to bow up, the boat should maintain an attitude around 45 or 50 degrees from the wind and should make very little headway with speeds through the water of between ¾ of a knot or may be a knot and quarter.

At this reduced speed, the impact of the waves is greatly reduced and the waves are taken at the most favorable attitude so that the broken wave tops the minimal impact

against the hull or superstructure, while the reduced speed minimizes the tendency to drop off the back side of a very steep wave as it passes underneath. And the position of the rudder pretty much eliminates the chance to gains undesired speed if the head id momentarily forced off, as the rudder does bring the boat up toward the wind as speed increases.

At the same time, the slightly backed storm trysail will prevent the boat from inadvertently tacking even though the rudder tries to bring it up, when it is temporarily gaining more speed than is desirable.

Never forget that a key feature of survival in extreme condition is the ability to reduce speed. This should be done without any arrangement that lets a sail shake, as the sail that is shaking in really heavy weather will not last long.

At the same time, no hardware should be used that could be inadvertently shaken open. While it's bad for a sail to shake, it is absolutely fatal if the sheet comes off, which means not only loss of the sail but also loss of control of the boat which was vitally depending on the sails being carried and being properly trimmed.

Don't let anybody coax you to go anywhere beyond the harbor mouth without having the right storm sails on board and adequate knowledge of how to set and trim these sails; and never make your plans too dependent on the weather reports. They should always be checked but just because you have a favorable weather report, don't think it's going to be safe to go out without the storm sails, as time and again the weather will get a lot worse than predicted. The important thing is to be so prepared that you can take what comes, even though you can hope to be lucky and to avoid the extremes.

Ventilation

I heard a nice story a while ago and it might even be true. Two young fellows were walking down a marina dock in Seattle and they saw our former old *Dorade* tied up there. One of the men said to the other, "Why do you suppose anyone would name his boat after a ventilator"?

Well, that made me laugh, but it also made me feel good, because ventilation is something that Olin and I have always felt very strongly about in our designs. And if the *Dorade* ventilator has become a basic part of sailors' language today, then that's fine.

The trouble is that not enough designers, builders and sailors seem to understand how important ventilation is. I have sailed at least once too often in a boat whose cabin, after a day or two at sea, feels like the inside of a bedpan. I don't ever want to do it again, and I can't imagine why anybody else does. Nothing contributes so much to crew efficiency and comfort as a clean, sweet and dry cabin. It makes for easier, sounder sleep and is wonderfully effective at reducing mal de mer. It's a pretty subtle thing, sometimes, but I think bad ventilation may cause more non-sailors that anything else.

And there's a collateral argument for good ventilators that is pretty darn important. I'm convinces that lack of proper ventilation played a major role in the tragic sinkings of at least three large sailing vessels in the recent past - *Albatross*, a 92-foot North Sea pilot vessel converted to a yacht that went down in the Caribbean Sea in 1960 and the 137-foot *Pride of Baltimore* that sank north of Puerto Rico in 1986 and the 000-foot British WHATNAME, lost north of Bermuda in 19TK? [CHECK ALL THESE FACTS.]

All these vessels had major hatches open when they were hit by some kind of white squall or microburst, as they now seem to be calling those sudden violent winds that hit without warning. They were knocked down, and simply took too much water below before they could right themselves. And why were the hatches open? Not enough ventilation below. (See Chapter TK, "The Corwith Cramer".) This may not be too serious a problem for most modern yachts with small hatches, but it certainly builds a case for not having to rely on large open hatches to keep the air moving below.

The key to good ventilation, of course, is getting enough air down into the boat without letting in water, and then getting the air back out again. I have very strong

feelings about this, and consider it the biggest architectural failure being made by naval architects today. No more that one in 500 boats out there is properly ventilated.

Part of the problem is that a lot of people don't understand how ventilation works. It's amusing to listen to people at a boatshow when they count the portholes and hatches and wisely agree that the more of them there are the better the ventilation will be.

Not so. Companionway hatches with spray hoods, and aft-opening deck hatches with tent type waterproof hatch covers are terrific for exhausting air from the cabin, and this is an important part of ventilation. But they don't get any air into the boat. And a forehatch that opens forward works okay when you're at anchor in fine weather, but it's useless for ventilation at sea.

Portholes aren't any better. Of course, when you're lying in that sheltered cove, it's very nice to be able to open the ports and let the gentle breezes blow through the cabin. But then someone forgets to close one of those ports before you get underway, and that's when your weekend guest decides to wash off the anchor mud with a full bucket of salt water. And it's right over your bunk. Well, if you're like me, that's the last time those ports are opened. And of course at sea with the spray flying, you can't open the ports anyway.

Another thing about opening ports is that if they're in a cabin trunk that is not vertical, they collect water, which then leaks into the cabin or at least falls onto a bunk when you open the port. We've tried eyebrows over ports, but they don't really do the job. And unless the port is first-class construction, it's going to get banged into and bent, and then the seal isn't tight and you have a leak directly into the cabin.

The one exception to this rule, I feel, is in the head. That's where you need all the ventilation you can get, and it's not too bad if some water gets down there occasionally. So an opening port in the head may be a good idea. Even so, you can be sure of one thing: sometime, somewhere, someone is going to leave a port open when it should be closed, and you're going to have water below. And the whole point of a cabin is to keep the water out.

So how do you get air below? There's only one workable answer: proper ventilators. Way back in the early 30s, when *Dorade* was launched, we first tackled the problem by making up four special ventilators with four-inch diameter necks and eight-

inch cowls, about three, which were two and a half feet high, that screwed directly into the deck in a waterproof deck plate. The cowls were on joints so they could be turned away from the wind when the spray was flying. You couldn't buy them that way, so we had them manufactured.

That was the beginning of the Dorade vent. But after the Trans-Atlantic race of 1931 and two Bermuda Races we considerably improved this scheme by fitting the same vents onto boxes that offset the ventilator from the downtake pipe that gets the air below. This downtake, or standpipe, extends above the deck four to five inches the box, to within an inch to the top. Now, when the air and water come through the cowl into one end of the box together, the water falls to the deck inside the box, swirls around the standpipe, then goes out the scuppers in the after end of the box and the air is forced down the standpipe into the cabin.

We originally designed the Dorade box with two holes for the ventilator to screw into - one offset and one directly over the downtake for use in fine weather. But the offset pipe worked so well we just eliminated the other hole altogether. So that's how the classic Dorade vent evolved - and I honestly think that there still isn't a better way to do it.

The trouble is that all these elements of the ventilator have to be designed correctly for the idea to work right. The cowl area has to be four times that of the standpipe - that is, twice the diameter - or else it won't collect enough air. The box has to be at least six inches tall or the downtake pipe can't stick up far enough above the deck to prevent water sloshing down it into the cabin; and the box has to be big enough so that there is enough volume for the air and water to get separated inside it. There has to be one good-sized scupper - at least one inch square - on each side of the after face of the box, so the water can get out whichever way the boat is heeling, but so that a minimum amount will get in when a sea comes aboard.

So these are the basics for good ventilation: boxes that are big enough and high enough; vents that are tall enough and cowls that are big enough; scuppers on the after side of the boxes.

The ventilators should also be as far aft as possible. (Although I had one with a four-inch vent on Mustang's foredeck and it worked fine.) And they are more efficient

when on the centerline; if they're too far off center they pick up less air than they should, and too much water if the boat really heels over. The rule of thumb here is that the vents should never be off center more than 60 per cent of the distance from the centerline to the deck edge abreast of the vent. Thus if your boat is 10 feet wide in the way of the vent, the vent should not be more than 3.0 feet from the center.

If you carefully follow these specifications - proportioned to the size of the boat - and if you install enough ventilators, the cabin will be sweet and dry at the same time. But this seldom happens, and it really amazes me that good, sensible naval architects can't understand how important it is.

One of the problems, I believe, is that a lot of ocean sailors and races think that being wet and living with bad air below are inevitable - sort of macho givens of the sport. John Illingworth, for instance, was certainly one of the best ocean racing sailors of his time, and he wrote a good book on deepwater racing; but he said you just have to get wet. And anyone who sailed on *Myth of Malham* knows that she was not only a very fast boat, but also a very uncomfortable one. Myth's bunks were usually wet.

Well, John was a fine sailor, but he was wrong in this matter. You don't have to be wet below, and you don't have to airless either. Another Englishman, Ted Heath, told me that on his various *Morning Cloud*s he's had splitting headaches every time he stayed below in rough weather. Then he fitted some ventilators with big enough cowls, and he and the whole crew felt better - and enjoyed their racing more. But it took him several boats to see the light.

I just don't like getting wet at all - in fact, I'm not sure that I like sailing enough to do it if I had to sail wet all the time. In Mustang when we invited people to cruise or race with us, we'd ask them to please bring their boots. Sometimes they'd say they didn't care about wet feet, and I'd say - politely, of course - "Well, I care. I don't want your damn wet socks lying around the cabin even if your wife did knit them for you." It's just as bad to get water below from peoples' clothes (except in the oilskin locker) as it is to have it come in through bad ventilators.

I'm sure that another reason so few boats have good ventilation is that a lot of the naval architects and the owners they design for have been subjected to badly designed ventilators. Take those little atrocities with flattened rubber cowls that people like

because they're out of the way and they bend if you hit or foul them. Well, all those things do is squirt water into the cabin. They're worse than useless. So, naturally, if you've sailed once with those, you think ventilators don't work. And next time you say "I don't want any of those damn things. I've had enough water down my drainpipe." And so they go without ventilation.

And then there are the people who think ventilators look ugly. Well. I admit that a proper-sized ventilator looks pretty big sitting on the naval architect's desk, or in a booth at a boat show. So the client says. "Fine, but let's make the cowl half the size and cut the ventilator box down good and low so it doesn't look bad or foul the jib sheets." And that's the ball game, because those smaller cowls, lower down, pick up less air and more water. And so you come up with another badly ventilated boat.

As for fouling the running rigging: remember that you want to keep the ventilators abaft the mast if possible, and as close to the center line as you can; if you've done this and still have a fouling problem, with the jib sheets, say, you fit stainless guards over the ventilators. And it works. They just never give trouble if the hoops are properly placed, strong enough, and bolted to the deck, and they make a pretty good ???? Incidentally, if have screens in your ventilators, cut them out. The friction reduces the airflow by 50 per cent. And fortunately, mosquitoes aren't a problem. They get nervous or something, and can't seen to figure out how to get down the vents.

Now I want to talk about lazarettes. Unfortunately, in the modern boats with their tails sliced off in long, sloping reverse transoms, there's no room for lazarette. Where do they put all their fenders and dirty dock lines and such gear, I wonder?

But if you have room for a lazarette there's no better way to get air below. The hatch should always be on the center line, have a coaming raised several inches off the deck, and be hinged aft so that it opens forward and can be carried open at a 35 degree angle. Then it provides a wonderful blast of forced air down into the after part of the boat. (A little rain and spray will get down there, but just make sure that whatever's in the lazarette can take an occasional wetting.)

I learned about this back in 1946 on my first Bermuda Race in *Mustang*. We were going along nicely and I had nothing to do so I was neatening up the gear in the

lazarette and had the hatch open. Olin was off watch, sleeping in a quarter berth. When I got through stowing, and closed the hatch, Olin said, "Hey, why'd you do that?"

"Do what?" I asked, and he said, "Well, it was nice in here a few minutes ago and now it's hot." Then it dawned on me, and from then on the boat never sailed a mile without that hatch being open. This means you should have big enough openings in the after bulkheads to let air from the lazarette get into the rest of the boat. *Mustang* had a couple of doors at the aft ends of the quarter berths, and I took them off the first day I had the boat and put them in the locker and never used them again. But can I get people to design air holes in the after bulkheads? No. So they get in there in hot weather and sweat and roll around and get soaking wet and everything smells.

It's crazy, especially since you really can get plenty of clean, sweet air below. If you're starting from scratch with a new boat, of course, it's easier; but even most existing boats can be modified to get enough ventilators, and, hopefully, even a lazarette, if you don't have one of those terrible cut-off sterns. But how many ventilators is enough?

Well, I have a little formula for figuring an answer to that. It compares the total area in square inches of air vent intake to a rough figure in square feet of boat space to be ventilated, which is determined by multiplying waterline length times maximum beam.

Let's take *Mustang* again. She's 32 feet on the water with 10.5 beam. That's 336 square feet. She has a centerline ventilator with an 8-inch diameter cowl forward of the mast and one with a 14-inch cowl abaft the mast. Now if you remember the formula, area equals πr^2, you'll see that that adds up to 50 and 154 square inches respectively, of vent intake area. The lazarette opening is 20 inches wide by 18 inches high, or 360 square inches, for a total of 564 square inches of air intake area. Divide that by 336, and you get a ration of 1.7 square inches of intake area to each square foot of space to be ventilated. Experience has proved that in warm weather you need a ratio of 1.5 or higher; because anything below 1 is too little in any weather.

This sounds complicated, but it's not, and it works. I've always been disappointed that when we were doing that book for the Cruising Club of America on the specifications of the proper ocean-going yacht, I couldn't get the other authors interested in my little formula. The late Lyn Williams (absolutely one of the best,) was interested in ventilation, but he wanted to go to the airline people, Douglas and Boeing and so forth, to

get complicated velocity figures. Well, what do you get from them? Nothing that's useful, because they're talking about powered ventilation.

This rough formula will really tell you what you need to get good ventilation. Don't cut it down, use the right vents, and your cabin will never smell musty again.

Hatches

It's hard to separate the subject of hatches from ventilation, since the one contributes so much to the other. But I think hatches are important enough to deserve their own chapter.

I've already discussed the importance of the lazarette hatch in Chapter TK (Ventilation), and pointed out that because a lazarette opens forward it contributes a lot of positive airflow through the boat. All of the other hatches should be hinged forward so they open aft.

I don't care what the boys in the tropics say about hatches that open in different directions to catch the cooling breezes; I don't think you want a two-way hatch in a vulnerable place like the foredeck or forward on the cabin house because the double hinged arrangement just isn't secure enough. Maybe it's acceptable amidships, or for small venting hatches, but otherwise, no. That's why you need Dorade ventilators; they get the air in, even in bad weather, and the aft-opening hatches get air out.

So what hatches do you need besides a lazarette, the companionway and a forehatch? I think you want small aft-opening exhaust hatches in the head, over the stove and, in a bigger boat, if possible, over the engine space. These can be little hatches - only about 100 square inches - but they make a big difference in eliminating unwanted smell out of the cabin. And for boats over about 40 feet waterline I think these little hatches could have mechanical exhaust fans mounted in them to help keep the air moving. They draw very little power, and do an efficient job. Most boats have a hatch over the main cabin, and that's one place it's probably okay to have a two-way hinge fitted so you can open it forward in fine weather.

The most important, and most-often neglected, accessory to hatches is that they should have canvas covers. The covers have boltropes that slide into continuous, watertight retaining grooves fastened to the deck around three sides of the hatch opening. **[DIAGRAM].** The outer part of the groove is open at the forward corners so you can thread the cover into the groove, but the inside of the groove is continuous clear around so that when the cover is in place it completely protects the hatch from heavy water on deck. The canvas cover is shaped so that in wet weather you can open the hatch, facing

aft, about 30 degrees. This protects against rain and spray, yet still gets air out of the cabin even when the boat's buttoned up. (Of course you have to have good Dorade ventilators to get the air in.)

I remember being really irritated at a well known Harvard professor and writer who chartered one of our 65-footers years ago and made a cruise in the Bahamas or the Caribbean. He complained loudly about how everything got wet down below. Well, the boat had canvas hatch covers, but he wasn't using any of them! No wonder he got wet. In those days skylights usually leaked pretty badly anyway so you needed the covers just to stay dry.

Today hatches are pretty watertight, but you still need cloth covers so you can open the hatches in bad weather to keep air circulating. Too few boats have them, so you have to dog down all hatches at the first sign of rain or spray. It's ridiculous.

Speaking of leaky hatches, I was amused to hear that the crew of the J-boat *Shamrock* during their heavy weather delivery passage from Europe to Bermuda in 1988 hat a pet name for the fo'c'sl: the "Aquarium." I suspect that that old forehatch didn't have a canvas hatch cover.

Modern hatch covers made of transparent plastic are a great help in getting light down below. But if you don't need the light - as in a lazarette hatch or a cockpit seat locker - then the underside of a hatch cover is a very useful place to rig a canvas bag to stow items such as sail stops or odd bits of line.

It's an all-too-common practice to place vent hatches over bunks. DON'T. No matter how well hatches are made or how carefully they are handled - including covers and so forth - there is always the chance they will let some water below. And if there is any possibility that a hatch will be used to pass things below - <u>anything</u>, from a sail to a wet watch cap - then the likelihood of getting the bunk wet is doubled.

The worst thing of all is a nice big double bunk in the middle of the aft stateroom with a nice big square hatch right over the center. On a beautiful warm moonlit night, it's great. Then comes just a quick squall or a brief thunderstorm, and you've got a very wet bunk. Even if you get closed in time, any hatch will drip a little when opened after rain or heavy weather, and I don't see any reason to take even a slight chance of getting a bunk wet.

The same thing applies to the forepeak. As designers we go to great extremes to get the hatch behind that forward triangular bunk, with steps on the bulkhead or partition to get to the hatch. Then the hatch can be open and if a bucket or two of water comes down it won't do any harm. (Unless, of course, someone has left clothes or gear lying around, in which case he only gets what he deserves.)

I was in the Caribbean once on a boat with hatches over the bunks, and two nights in a row I was the one who got up and closed the hatches when the squalls came - the if I didn't get up to open them again ten minutes after the squall, we'd have all been too hot. Then I thought myself, "If this were my own boat, I would never have had to get out of bed at all." If the hatches are properly placed, it's nonsense to have to close them temporarily just for a quick squall.

So put the hatch just forward or aft of the bunk, and you'll do everyone a favor by helping to keep the bedding dry. Sure, you want air in the bunks, but don't get water with your air.

Over a sliding companionway hatch you need a canvas cover that is rigged the same way as with other hatch covers, that is one with it's edges through a deck-mounted groove around the hatchway; but here you should also have a folding metal framework the width of the hatch that swings up to a vertical position at the after end of the companionway. [DIAGRAM?] OR PHOTO. This will hold the canvas cover higher so you can get in and out of the hatch easily. The cover folds down forward, flat and out of the way, when there's no spray flying. (This is different from the bigger Bimini tops, which are fine for providing shade in tropical weather, but which has too much windage and not watertight enough for bad-weather ventilation.)

A small but useful suggestion is to make sure the companionway hatch slide has a slight camber on top. Otherwise little puddles of water collect on the slide and are dropped below when the slide is opened fast.

If you have a foredeck hatch that is used for access as well as for gear and sail stowage, it's best where possible to have it hinged forward and opening aft. Either way, it's extremely important that the handles be the through type that let you open the hatch from deck and also dog it down from on deck as well as below.

You'd do well to eliminate the standard risers furnished with most hatches and substitute those simple hydraulic units commonly used in the back of small Japanese hatchbacks and station wagons. They work fine, they last for some years and are easily replaceable, and they're cheap for a marine fitting. You want to rig them so the basic pivot point is fairly near the forward hinge, and work out the geometry so the hatch doesn't open more than about 65 degrees. That way no one is going to fall through the hatch when working on the foredeck in the dark or when the hatch is covered by a sail.

Finally, I think it's pretty obvious that all major hatches should be on or very close to the center line. In a relatively narrow and high-sided yacht the companionway hatch can be slightly offset without a problem. In big vessels, though, this is a very dangerous practice. I deal with it at greater length in Chapter **TK**, "Corwith Cramer"

Cabins

The last thing I want to do here is tell people how their boats should be laid out below, because it's nonsense unless you're talking about a specific boat and to a specific owner. People and boats offer too many options.

But a few fundamentals are essential to cabin comfort. Ventilation is at the top of my list, and hatch details would be next, because the thing that I feel most strongly about, and I don't mind repeating myself, that you keep a cabin dry. Some people seem to think that when it's raining hard or blowing twenty five or thirty you're just going to have wet bunks and smelly air. Well, you don't, and I deal with this in the chapters regarding Ventilation and Hatches.

Beyond that there are some ideas for cabin arrangements that apply to any boat and that I think go a long way to making a cabin safer and more habitable.

First of all, everyone knows there shouldn't be any sharp corners in the cabin. But you'd be amazed how many boats have them anyway: on tables, counters, locker doors, striker plates on locker latches and so on. Go through the cabin and file off or modify any corner sharp enough to hurt you if you bang it with your hand or get thrown against it. The chances are that someday it will happen.

Doors

The fewer the better. Doors are heavy, they make a lot of needless noise if they get loose, and they cut down circulation. When I bought *Mustang* I think I took, off three doors right away. I hung a curtain up in the forepeak and one in the after stateroom, and those doors were out of the way and it was quiet and easy.

For the doors you do have, make sure they're placed so that no two doors can bump into each other when they swing open and so that each open door lies flat along a bulkhead. This takes a little planning sometimes, but it will save you a whole lot of aggravation.

It's also important that all doorways are the maximum height possible. If a necessary structural member reduces the height of a door opening, then it should be carefully shaped and faired on each side so that if you hit your head there's a smooth

sloping surface instead of a sharp edge. Similarly, you don't want anything across the bottom of the doorway that you could trip over.

Every door should have an automatic catch that holds it firmly when it's open. [DIAGRAM] A door simply must not be able to swing back and forth with the motion of the boat, not only because it's dangerous but also because the noise keeps everyone awake. That's why the normal hook and eye is a terrible rig: if you're in a hurry it's hard to hook one-handed; and once you get it hooked, it never stops rattling.

On *Mustang* the door to the head had a very neat spring-loaded latch arrangement that raised up when the door swung all the way open against the bulkhead, and then snapped down and held the door fast against a little rubber pad behind. The door hit once and was caught and held there until you tripped it off.

The other important thing is to make sure the head doors open in. An out-opening door takes up space in the passage; it makes a noise every time someone bumps into it going by, and it's vulnerable to being busted. Furthermore, if it opens into a passageway where you're likely to be passing sail bags back and forth, the bags can, and will, snag on the door, which is an annoyance.

But if the head door opens into the head and is held tight with an automatic catch, then it's out of the way all the time. If you want privacy, you can close it easily. But if you're just going into the head get some paper towels or to wash your hands, you don't have to touch the door at all. So the door is almost always open. That, plus a small ventilating hatch overhead, is the secret to keeping a clean head sweet.

You don't need a big head to have the door open in. You can make it work on an existing boat by changing the fittings and, if necessary, cutting the bottom corner off the door. That way it will swing over your feet when you open or close from inside the head. Fill up the missing corner in the doorframe and you're all set.

Stoves

The best arrangement, if you have the space (and the money), is a stove that lies athwartships so the cook faces forward or aft. That way you aren't in the line of fire when boiling water is on and the boat's rolling violently (pitching is almost always less of a problem). An athwartships stove needs a strong pinion on the center line; it is a custom

item and therefore more costly, but special stoves like this have been made, and they're fundamentally safer.

In most boats, though, the stove is fitted fore and aft, so that you stand facing outboard when cooking. For a boat that's going to do any offshore sailing, the stove certainly should be gimballed (Actually, 'pivoted' is a better word, since it's swinging in only one plane.) The crucial point here is that there be enough space behind and below the stove for it to stay level when the boat is heeling hard on either tack. A lot of stoves go thirty-five or forty degrees one-way and only 10 degrees the other way before hitting the stops. That's worse than having no pivoting at all. (Be sure the stops are soft enough to provide a little cushioning if the stove does fetch up against them.) If you stow solid things like frying pans under the stove, be sure the bottom edges of the stove will clear them at extreme angles of heel.

It's best to have a friction device to control the quickness of the stove's swing, depending on the conditions. You want to be able to adjust it but it mustn't be able to change itself. This is something that Bob Hall created years ago that was beautiful, and it made a lot of difference. [DIAGRAM IF WE CAN GET ILLUSTRATION]

Be very careful that the flexible fuel feed hose is really secure where it comes off the fuel line and where it attaches to the stove. It must be long and flexible enough to reach the full swinging range of the stove without coming up short or kinking or being jammed between the stove and the bulkhead. Remember that the stove is staying more or less put while the boat to which one end of the fuel hose is attached is going to be moving violently around it.

And here's a tip to make life easier in the galley: if you have a protecting rail installed to keep the cook from falling against the stove (and you should), be sure that it projects out a few inches from the front plane of the stove, or else fit the rail so it can be temporarily removed. This will make it possible to open the oven door at any angle of heel when the protecting rail would otherwise block it. (That's the angle you always seem to be sailing at when it's time to serve the casserole.)

As for the best stove fuel, well, I've always done fine with alcohol, and I like its low volatility: there's virtually no chance of alcohol exploding. In our twenty five years on *Mustang* I don't think my wife Marge ever had a flare-up. But I know alcohol has its

problems: It's expensive and sometimes hard to find; it doesn't burn as hot as propane; it is much more trouble to light. So I think we have to accept propane. But you want to make sure that the propane bottles are properly stowed in a dedicated locker and has an electric solenoid switch. Then fit a bright red indicator light in the galley as a reminder to turn the gas off when you are through cooking.

It's also desirable to fit the boat with bilge sniffers that can detect and notify you of a build-up of heavier-than-air propane gas in the bilge. They're not infallible, but anything that will help prevent an explosion is on the plus side. I remember a boat at the Abeking and Rasmussen yard in Germany not long after World War II. They'd been working on the engine and the gas-stove fuel blew up. Well, you could hardly a find a piece of that boat that was more than a couple of feet square. Fortunately the boat was at a slip in the harbor and nobody was aboard. But it just disappeared, a nice 45-footer.

One last stove-related word: There's a lot to be said for fitting a stove pipe, through the galley overhead to get the cooking smells out of the boat. I'm sure a lot of owners feel that stove pipes are old-fashioned and don't go with sleek modern lines, or that they'd get in the way of lines on the deck, or that they'd leak. Well you can fit one through the deck very easily and it won't leak, and you can work out the fouling problem. And it's worth it because the stoves pipe makes a huge difference in cabin comfort.

All you have to do is get near a good, working stove pipe on deck and get one whiff of the fumes coming out of it, and you'll wonder how you ever lived in a cabin without it's own exhausts.

Sinks

A double sink in the galley is most desirable, if you can possibly find room. Fit them with those extending and swiveling spigots so you can pump into either sink. And the closer to the centerline they are the better, so they'll drain easily on either tack. If there's any chance of seawater backing up the drains when you're heeled, install cutoff valves in the lines under the sinks.

Unless you have a big boat, so that the head basin will be well above the waterline and near the centerline, you should also have a valve in the head sink drain, as stoppers in the drain hole never seem to keep sea water out. And, like the galley sinks; you want to

keep head basins as close to the centerline as possible. I have always disapproved of having the sink too far outboard, because when you're pressing the boat hard, water can flood up through the basin drain.

I remember one boat of our design on which the owner had changed the designed position of the sink in the head, putting the sink farther outboard. The owner said it wasn't a problem, as they had sailed the boat quite a lot and it was absolutely okay.

He asked me to race on the boat, and I arrived on board right from the airport after an overnight flight. I volunteered to get some sleep soon after the start. We had beautiful conditions with a fine breeze and all hands except for myself were on deck enjoying the excellent sailing. But it was lucky I needed that catnap, because I hadn't been below long when I heard the sound of water coming from somewhere. Sure enough, on the starboard tack, whenever we got a little extra wind, the basin in the head was letting in water, which then sloshed onto the floor. We solved the problem simply by closing the seacock on the basin drain, fortunately he hadn't changed that detail, but it pointed out quite clearly the risk of moving the basin outboard.

Incidentally, we've found that 39-inches is about the right height for the head sink counter, both to make it comfortable to use and to ensure good drainage when the boat is heeled. Another little secret is to have check valves in the fresh water lines where they come out of the tanks. That way the water stays in the line, and you get water out of the faucet with the first or second pump, and don't have to drag it all the way up from the tank every time you pump -- less pumping, less noise, less wear and tear. It's just a small thing, but it makes life aboard that much more pleasant.

I think it's desirable to have seawater pumps in the galley and head, especially if you plan any long voyages. You can save a lot of fresh water, for instance, by rinsing dishes in salt water before washing them in fresh.

A neat trick with the galley sink is to have a hinged drain board with low fiddles around three sides. You rig a simple lanyard from the end of the drain board to the overhead, and with a nice rolling hitch you can adjust the drain board to the angle of heel so the dishwater always drains back into the sink. When not in use, the drain board swings down and can stow against the bulkhead, out of the way.

Lights

You want enough overhead lights in the cabin so you can see what you're doing. But don't put them where they will reduce headroom. Get them over the table or near the corners where tall heads won't bump into them. I think it's nice to fit the bunks with reading lights, but make sure they don't throw light into the cockpit through the companionway.

Bunks

As for the bunks themselves, I have three imperatives:

1) Get them as parallel to the centerline as possible. The more at an angle to fore-and-aft - center they are, the more your head rises and falls with the healing of the boat. If a bunk can't be strictly parallel to the centerline, get the angle of at least its inner edge down to no more than 10 degrees.
2) Keep the bunks as low as possible. This also minimizes the boat's motion when you're sleeping, and it reduces the danger of injury if you're thrown out of a bunk in really rough conditions.
3) Make sure they have really secure, full length bunk boards. On the outboard pilot berths, the best arrangement is padded boards that fold down inboard. When they're down they make good backrests for those sitting on the transom berth; when they're up and latched in place, they not only keep you in the bunk, but keep you there comfortably. [DIAGRAM?]

The next best thing is strong lee cloths that lie flat under the cushions when not in use. Fit the cloth with a stiffening rod through a sleeve in the top, and at least three lanyards that snap into padeyes on the overhead. The lanyards shouldn't go up vertically: they should go up and outboard at about 45-degrees and be kept very taught. Otherwise they won't really hold you in when the boat's heeling. If the canvas is allowed to sag, the edge of the bunk will give your rump a pretty hard ride if it's rough sailing. [INSERT PARAGRAPH ABOUT ZWERVER …]

I've said this before but I'll say it again: Don't have any hatches, even little vent hatches, directly over any bunks. It's a serious mistake, because above all you want to

keep the bunks totally dry and you positively won't if there are hatches over them. With a good design and some care, there is absolutely no reason why you can't keep the bunks dry. The idea that any time it's blowing over 25 knots you have to expect to sleep in a wet bunk is just crazy. You do not.

As for stowage, we had a wonderful arrangement on *Mustang*. Each bunk had its own marked zippered canvas sea bag that held a pillow, sheets, fleece, towel and one or two blankets depending on the season. Each bag was color coded with a small colored triangle sewed into a corner. Everyone stowed their bedding that way every day, and each bag was secured with straps up in the joint between the deck and side of the hull. So they were out of the way and didn't go flying across the cabin when the boat heeled. That was a fine cruising amenity, but more important, the bedding never got wet. Incidentally, something like those bags makes a nice boat present.

Drawers

Keeping drawers from opening when the boat heels or lurches is always a problem. Some latches are better than others, but I think the best solution is not to have a latch at all, since they eventually seem to give trouble of some sort. Instead, I recommend the drop-sash drawer, which has notches in the two lower runners that drop the drawer onto the sill when it is closed, so it can't slide out without being lifted.

The drawer has to be built right, though. The notches have to be far enough back so that the drawer drops into the locked position every time you close it, no matter how gently. With a bad design, the drawer won't drop unless you slam it, or push hard on the bottom as you close it. This of course is worse than no latch at all

Tables

After good ventilation, few things make a cabin more livable than a solid, well-designed swing table with hinged leaves that fold down. If the boat's small enough, you can swing the whole table. With a bigger table, though, the swinging range is too great, so it's impracticable to pivot the whole table; then you can mount just the center section on a pivot, while the leaves are fixed.

If your table has no pivot at all, it's a good idea to bolt a high-sided box along the center, between the leaf hinges, and stow unstable items there such as bottles, salt shakers and so on. Unless the table is never going to be used when the boat's heeling, you certainly should have fiddles for the outer edges of the leaves.

And speaking of fiddles, there's no point having a fiddle that has breaks in it on the corners, say. That makes it easier to clean the table, but if someone spills milk or something on the table, it is going to run right out onto the cabin sole or right into the settee bunk. The same is true on counters in the galley: continuous fiddles are best.

And, finally, be sure the inside of a fiddle is perpendicular to the counter or table. If it has a bevel or curve, then it will just flip anything that slides against it up and off the counter like a ski jump.

Charts

It's best to stow charts flat, not rolled. I like to stow them in racks under the deck overhead or side deck overhead if the location of the chart table is well thought out. The racks have to be thin, though, so they don't use up headroom, which means you need two or three of them -harbor charts here, ocean charts there and so on. That way you don't have too big a pile in one place.

Bilges

The first thing to do in the bilge is to make sure there are adequate limber holes between all the bays. You want to get all water down into the lowest part, into a sump, if possible, so it won't slosh around in the cabin. Stainless or bronze chains should be threaded through the limber holes, strongly secured in the forepeak and the lazarette and with about two feet of slack overall.

Then tie a piece of shock cord over a bight of each chain at the ends to take up the slack (like a nylon snubber on an anchor chain). Now wherever you grab the chain you can move it back and forth all the way along to clear accumulated gunk out of the limber holes. But when the shock cord deteriorates (and it will), the chains will still be secured at each end.

A really important precaution is to isolate the bilge sections under the engine from the rest of the bilge. This means caulking or glassing those bilge bays so they are watertight, then laying a pipe or two across the bays between the after and forward limber holes and making them absolutely tight at each end. That way, water that comes in through the stuffing box or the lazarette can run forward to the deep part of the bilge without sloshing along with it any oil and gunk that's might be in the engine bilge. (The bilge chains run right / through the limber pipes.)

This means, of course, that you have to bail out the engine bilge bay by hand periodically. But it's a small price to pay for keeping the engine's inevitable mess out of the rest of the bilge. Every effort should be made to keep the engine and its pan seal tight.

Hanging Lockers

If your hanging locker is more than 20 inches between bulkheads, you'll get much better stowage with an athwartships extension rod. This kind of hanging rod can be extended into the passageway or cabin space, outside the locker, and you can take anything off the rod or put new hangars on without upsetting adjacent clothing because it all frees up when the extension rod is pulled out. This permits much greater stowage and better access than the conventional fixed fore and aft hanging rod.

Companionway Steps

There's no single proper way to design the steps or ladder in the main companionway, but it's important that they not be too steep and that there are plenty of handholds or railings both for going up and coming down. If you're coming down frontward with your hands full, you need something to lean against to keep your balance so you don't falloff on the way down and land on the cook or navigator.

Some owners like a wide, comfortable top step to make it easy to get on and off the companionway ladder, or even to sit on (I happen to subscribe to the theory that only Marines stand or sit in the companionway. On *Mustang* it was strictly forbidden --except of course for the captain or his wife.) Anyway, a wide top step is fine as long as the ladder has enough of a slant so that it's not too steep below the top step. And as long as

the companion slide can go forward far enough; if not, the wide top step will make for a tight and uncomfortable exit

Dacron spray panels alongside the ladder or steps are a good idea, too. They should be in a groove at the top, in the overhead next to the hatchway, and have shock cord to hold the bottom in place. That will keep water out of the galley or the navigation station and especially the quarter berths when there's some spray on deck but not enough to close the hatch all the way. They can be rolled up out of the way when it's dry. Even better is the rig on Ed Greeff's yawl *Puffin*, which I sailed on quite a lot. She had an after cabin, and the companionway steps had Plexiglas panels on each side. They worked fine, let light in but kept water from drips or wet oilskins off the bunks.

And up forward, it's important to figure out where to install sturdy stepping places to make it easy getting up or down through the foredeck hatch. It should not be an acrobatic exercise.

Cabin Sole

Inevitably the removable panels in the cabin sole swell up and get stuck sometime or other. To reduce this problem, it's important to bevel the bottom edges of these panels back about 10-degrees all around. That way the panel will find its way down into place easily, and if it swells up only the top edge will press against the fixed boards. You don't want too much of a gap, because a lot of dust gets into the bilge, but you don't want a tight fit either, because it's sure to jam when it gets damp. Under beveling solves the problem.

And avoid those little cast brass finger rings often used for lifting the panels; they either hurt your finger or break off when most needed. Instead, install strong through-bolted plates with a keyhole eye in each panel and have a good strong key with a handgrip so you can really put a load on it when the panel is to be removed.

And here's a general note about the cabin sole: Keep it clean! There's nothing worse than a slippery floor when there's a lot of motion and you're trying to work below or put on your oilskins.

There's also another reason for keeping the galley floor clean. I remember one transatlantic voyage when the second watch to eat usually got the short end of the meal.

But one time there was a nice soft meal and I was astonished at how much we got when we came below to eat on the second shift. There was plenty for a change. So we ate it all and then someone told us that the whole meal had gone on the floor just before it was served to the other watch. No wonder there was so much left. Well, after that I said, "Okay, this cabin sole is going to be scrubbed twice a day, every day." You never know when you might have to eat off the floor.

Bilge Pumps

I had a very interesting experience in December of '43. I was in Provincetown conducting sea tests of the amphibious truck DUKW which we had been working on for the Army, and we had headquarters in a small hotel in Provincetown and had a dock there, and, of course, the amphibious trucks didn't need a dock. They came out of the water and stood on their own wheels in the parking area. But when we were starting lunch, a rather worried looking lieutenant was brought to my table. He was an Army lieutenant, Army and he was in command /control / skipper of a 60-foot small cargo boat which was under the Army registry, and he was brought to my table because he'd come in, he looked worried and he said he had problem with his boat and who might be of help. And so, they said, "Well, you might talk to Mr. Stephens", which he did.

So, he told me that his boat, tied to the dock now, had been leaking quite badly, but he didn't know where it was coming from. He didn't know what to do to stop it because the pump / compass wouldn't keep up with the in coming water. The main point was, this demonstrated the stupidity of having small electric pumps unless you have a big enough vessel to have duplicate generators and high electric capacity so that the really powerful electric bilge pump could be installed, okay. But if it's a matter of a little pump with about a three-quarter inch discharge pipe, all you're doing is inviting trouble with the batteries and you couldn't keep pace with any important leak anyhow.

So, I went out with him to look at his boat and sure, it was tied up there and it was quite all right. About a 65-foot boat, was under the Army registry, and there was a miserable little electric pump discharging about a half inch or three quarter inch dribble and all that was doing was threatening to run down his batteries which were of considerable importance to him for operation of the boat. ????????????.

So, I suggested that he shut off the electric pump which obviously wasn't doing anything constructive really and also that he turn some off the numerous waives, there were several manifolds, nothing marked, and he didn't know what they were for. And I said, "Just close about everything you get your hands on", and as we will make a clearmark and you must be hungry - there's not much cooking facilities on this vessel. We'll give you lunch and then, we'll come out and see what's happening.

Well, he was kind of nervous about that, but we did make a mark in the bilge showing how deep the water was, more or less so ?? we can instruct /check depth of water / precisely in the bilge and came in and I had my lunch and he had his. He was very happy to be fed because his vessel did not have many cooking facilities. So, while he was rather nervous, but he was hungry and he ate with some enthusiasm and I ate and when we got through, we put on our gear and went out to have a look, and the place we had marked for the water was exactly the same. He was immediately greatly relieved.

Then, he was satisfied there was no immediate danger and I said, "When you get to a place where they can do some worthwhile work, get that ridiculous little electric pump taken out and discarded and get at least two high capacity hand pumps. Edson makes very good diaphragm pumps for this service and try to simplify the piping and the trouble with these - everything should be clearly marked so you know what opens to pump from where and what to open in order to pump from where".

So anyhow, he was very pleased that the water wasn't coming in anymore, even though he had stopped the pump, and I said, "Well, he should make a business of getting a decent Edson diaphragm hand pump or two of them which could be both pumped simultaneously and that would give him some real capacity". He might have a two-inch discharge rather than a three-quarter-inch discharge, which was worse than a joke.

So, he went on his way thinking he was bound for Boston or somewhere Eastward, and he was much relieved because just lost his fear that the boats was going to sink underneath him, and I did urge him to be sure to get that pump thrown out and get a decent pump, and he would not have to worry the next time there was some real leak.

It's most important to have several pumps quite independent with a very simple piping system and sea cocks and manifold valves clearly marked. Where possible have a discharge that's visible so you can see what you are doing, and you feel much better when you can see the water squirting out than when you just have to look at it. You can't tell how quickly it's coming in or not except when you make a careful mark and even then, if it's rough water, it's hard to tell very soon whether you're gaining or losing.

I remember a case of one Bermuda race where one of the competitors called for help from the Coastguard. His problem, he had a fairly bad leak and he had one of these stupid electric pumps, which was just about holding its own, but he had to keep his engine running in order to keep the pump going. So, he borrowed some diesel fuel and two or three cans from the Coastguard, and he thought with that he could make his way to the finish all right. But, that's a very peculiar position to be in because with a good hand pump, you can pump as long as you have to, but with an electric pump, it depends very much on the generator, and the battery capacity and the fuel to run the generator, a generally dangerous situation. So, let's go for hand-operated high capacity diaphragm bilge pumps. Again Edson makes a very good line of these pumps.

And, in an auxiliary sailboat, I feel there should be one pump in the cockpit that can be operated by the helmsman and don't get fouled up by one of these super diameter wheels which even if there seems to be competition, who in the largest area has the biggest diameter.

They had one boat in the stormy Fastnet race had a very sad story. They had a pretty good pump system, but the cockpit pump could not be operated because the wheel diameter was so much, the helmsman had all he could do to steer the boat with that stupid big wheel. And, the pumps down below were inoperable because they had all their sails piled on top of the bilge floor??? area, so they couldn't get at either ?? pump, couldn't use either pump. That was a very poor situation. At least, electricity was not to blame in that case.

Speaking of the correct arrangement, there should be the cockpit pump discharging into the cockpit so the helmsman can see what's he is doing and down below, depending on he size of the boat, and they come - size of the pumps available, there could be one or may be two pumps, but they should be so installed that they could be used in rough water when the boat's being thrown around a lot and no change of the pumper with - as he's using the pump handle would damage the pump. He must be in a secure place so he can pump even though the boat is rolling around or pitching pretty rapidly, and it would be bad if that resulted in some damage to the pump or made it hard to pump it. You've got to be able to pump even in the roughest conditions, pump with reasonable comfort and reasonable safety.

One last thing to remember, unless you have a real big ship electrical system where you've got at least two powerful generators of enough capacity so you can have a high capacity electric pump, otherwise forget it because with usual little electric pump, you're limited on how long you can run it because you're going to run your batteries down. Then you can't run your engine any longer and you can't use your radio, etc. So, stick with a good high capacity hand pump system.

Cockpits

Newcomers to sailing seem to like a very deep cockpit with a high coaming; it makes them feel more secure, I think. But a deep cockpit really isn't a good idea, for a number of reasons.

First of all, a deep cockpit with high coamings may be comfortable to sit in, but it holds too much water if the boat is knocked down or if heavy seas are coming aboard. That won't necessarily sink the boat, assuming everything is tight, but it certainly will make her hard to handle, and temporarily increase her vulnerability. Related to that is another point of safety: the lower the cockpit floor is (the closer it is to the waterline), the slower the water will run out. It goes without saying that the lowest part of the cockpit sole should be above the water line in all-normal conditions.

Then there's the visibility problem. Nothing is more important than to give the helmsman really good visibility. The deeper the cockpit well, the lower the helmsman is, the less he will be able to see. This problem of decreased visibility, by the way, is why I'm strongly opposed to below-deck steering.

It's also much harder to climb out of a deep cockpit. This is not just a matter of comfort; it's a matter of safety also. A couple of seconds lost clambering out of the cockpit may be important in a crisis, especially for those of us who seem to get a little less nimble as we get a little older.

Finally, remember that the deeper the cockpit is, the less room there is underneath it. With an amidships cockpit this is a real problem, because it's generally necessary to walk underneath a cockpit seat on one side or maybe both sides to get to the after quarters. Even with an aft cockpit, although you don't have to walk under it, there's a lot of stowage space underneath and it's nice to be able to use it. So for all those reasons, I argue against deep or wide cockpits.

A nice way of making the cockpit more comfortable without increasing its water-holding capacity is to add a strong handrail to the top of the coaming, absolutely in line with its inner face. This sturdy grab rail will give you an additional 3 to 6 inches of back support and can be a big help getting in and out of the cockpit safely in bad weather. (It's not a good idea, though, to attach your harness lines to this grab rail in heavy

weather. They should go to something stronger such as a jack line rigged along the deck, or to padeyes in the deck or in the lifeline stanchion bases.)

How about width? Well, in a small to medium-sized boat, the cockpit should be naturally narrow enough that you can easily get your feet up on the lee seat to brace yourself when the boat's heeling. In a bigger boat the cockpit may get wider, but your legs don't get longer. So now you're going to need something fixed in the center of the cockpit sole to brace your feet against when the boat is heeling or rolling. A center locker or a fixed table is a solid solution.

For really big boats, we've developed what I think is a pretty good idea: permanent stowage for the inflatable liferaft or rafts right in the center if the cockpit. This is an ideal place for the raft if it's ever needed (much better than in a deep locker somewhere) and it provides a good foot brace. And you can mount an excellent cockpit table in the structure without obstructing access to the liferafts.

It's become popular to have a T-shaped section at the after end of the cockpit, if that's where the wheel is. The cockpit juts out on either side just abaft the pedestal, not only providing clearance around the steering wheel, but also permitting the helmsman to sit farther outboard to leeward or windward, depending how he likes to sail. But there are a couple of important design factors to consider here, including the size if the wheel itself.

Be sure not to get the wheel too close to the aft end of the cockpit. You want to have enough room to stand and steer without banging the backs of your knees into the helmsman's seat. The feeling that you're about to fall over backward is an uncomfortable one and it doesn't make for good steering.

The other important design feature of the T-shaped cockpit is the bevel of the sole at the outboard ends of the T. You want some angled surface to brace your feet against when the boat's heeling, and we have found that a 20-degree slant is about ideal. It also ensures that water doesn't collect there when the boat is heeled.

Which brings me to probably the most crucial factor in cockpit design, both for comfort and safety: scuppers. For obvious reasons, it's desirable to have the cockpit drain as fast as possible in all conditions. A very good rule for scupper capacity is that

75% if the total volume if the well plus 25% of the total volume of water that could be contained by the coaming in the area above the well must drain out in two minutes.

Here's why: In conditions under which you have to worry about having too much water in the cockpit, your boat is going to be rolling around so much that the volume of water in the cockpit well will never be more than 75% full; the water sloshing around on top of the cockpit seats inside the coamings will never be more than 25% of the total volume of that area. So that's the amount of water your cockpit scuppers should be able to drain in two minutes. This is asking a lot of scuppers, but I think it's necessary if you want your boat to cope well with very heavy weather.

There's a simple way to test your cockpit drains against this formula. Cover the scuppers and fill the well to a depth if about one foot. Multiply the length and width of the well to get the volume of water in the well. Then uncover the drains and time how long it takes for the well to empty. That gives you the rate at which your cockpit drains.

Next you work out the volume of the cockpit well, up to level of the cockpit seats; then figure the volume of the space from there enclosed by the low point of the surrounding coamings. Adding 75% of the (well volume) former volume to 25% of the (volume contained in the coamings) latter will give you the total volume of water to be dealt with. Using the actual rate you got from your test, some arithmetic will tell you whether your drains are good enough. Chances are you'll come up with a time of three or maybe four minutes instead of the desired two minutes.

The first solution to try is removing the scupper screens, which may seriously reduce the flow, and see how fast the wells drain now. Those round screens with a bunch of small holes in them can cut the flow in half. You need gratings on the scuppers so things won't get lost or jammed down in a curve of the drainpipes but this grating should be a very thin cross.

If the cockpit still doesn't empty fast enough, look to the routing of the drains. This is often more significant than the size of the pipes. You must have a clean, smooth sweep from cockpit to discharge without too many curves, and no right angles at all. The Swan 65, for instance, was a good sea boat, but in our tests the cockpit took about 3-½ or 4 minutes to drain. Someone suggested putting in bigger drains, and I said, "Don't make

them bigger. Just put them in right." And we worked out a nice routing for the pipe that eliminated all sharp turns, and easily got the drain time down under two minutes.

If you can't get the time down any other way, your last resort is to put in new, larger scuppers. Installing new scuppers means you also have to change hull outlet fittings, so it's a big job, but one you shouldn't flinch from. You might find a better way to arrange things anyway.

This two-minute rule of thumb, obviously, applies to any cockpit size. The bigger the cockpit and its enclosed surroundings, the larger the capacity of the drains must be.

With a center cockpit, it doesn't matter whether the scuppers are forward or aft; normally it will be plenty high to get good drainage, and the accommodation below decks will dictate where the scuppers should go. With an aft cockpit, if the boat is big enough so the cockpit sole is comfortably above the waterline, the drain pipes should go from the after corners straight through the transom. Then you have a fair, smooth lead and no need for seacocks.

Remember that a small boat with a reasonably powerful engine will build up a lot of water near the stern when moving fast under sail or power. If she has a deep cockpit, that will put the sole below the waterline. For that matter, a bunch of people having a drink together can also put the cockpit sole below the waterline if the well is too deep. In that case, it might be better to have the scuppers forward and let the drains discharge forward of the cockpit, where the waterline under those conditions will be lower. Remember that the rate of drain will be controlled at a given moment by the height of water alongside the boat relative to the cockpit sole. If the drains are pushed forward, though, and end up below the normal waterline, then they will need seacocks.

Wherever the scuppers are located, it's desirable to have the cockpit sole angled toward them enough so that the well will drain completely even if the boat is temporarily trimmed slightly off her lines. It's not a great treat when it's raining to be standing in a couple of inches of water just because there's not enough angle in the cockpit floor to get the water to the scuppers.

And as for that beautiful teak grating on your cockpit floor: take it home and grow Morning Glories on it. A grating looks nice and gives you good footing, but in every other way it's ridiculous. A grating is expensive. It's a supreme dirt catcher. It's heavy

and cumbersome and usually a real pain to take out and put back in. Small items get trapped in the grating openings, and all sorts to gunk collects underneath, usually over the scupper screens. Back in the 70s, Nautor started out putting gratings in all their boats that we designed because they thought the teak lent a classy touch, and they said that boats wouldn't sell in Europe without them. I had to be very firm to get them to stop. Eventually, though, everyone seemed to agree that anything that cut down on weight, cost and aggravation and reduced the drain time all at once was quite a good step forward.

People asked me if it's a good idea to have cockpit seats that open into lockers underneath. That depends on the interior arrangement. If you don't have quarter berths, then lockers under the cockpits seats are fine. But they must close really tightly. The seat must have a particularly strong hinge and close down against a gasket, and it must have a really positive lock, like a non-ferrous trunk latch, that will put some pressure against the gasket. Otherwise you are asking for trouble. It's just like going to sea with a big leak in the deck.

There should be a little ridge around the edge of the locker opening, and the edge of the seat is raised about 3/8 of an inch from then surrounding level. [DIAGRAM] That reduces the leaking, but of course cockpit lockers will always leak some, so you mustn't have anything underneath that will be damaged by a little water.

If there is a quarter berth below the cockpit seat, you can still have a small, watertight box under the seat that drains into the cockpit. That's useful for stowing small things you need on deck like snatch blocks and sail stops.

As for cockpit cushions, I think it's silly to have fancy fitted cushions that go all the way around the cockpit. They may look splendid in port, but they don't do too well at sea. They are bulky, hard to stow, and bad for footing. I prefer to just have a few of those square canoe cushions around. They stow anywhere, they float and can be thrown easily if someone gets overboard. And you can replace them without breaking the bank.

Many cockpits have engine instrument panels set into their sides, sometimes protected by a Plexiglas faceplate. And many skippers trustingly assume these panels are waterproof. Well, often they're not. More than one crewmember has woken up in the middle of the Gulf Stream to find a waterfall pouring in on his feet at the aft end of a

quarter berth. So when you test the drain capacity of your scuppers, test the instrument panel for leaks at the same time.

Finally, here's an idea that makes modern cockpits much more habitable when the boat's not underway. The big steering wheels used today take up a fair amount of room in the cockpit, and Steve Gilley devised an arrangement on his Stevens 47 *Pakelikia* that gives him a much more usable cockpit when the boat is tied up or safely moored or anchored. He just takes the wheel off altogether. Then people can sit all the way around the cockpit instead of being cut off from the after end by the wheel.

All you need is to put a little grease on the taper where the wheel hub fits on the horizontal steering shaft at the top of the pedestal, and to keep handy a wrench that nicely fits the nut on the end if the shaft. Of course, you want to be sure the key in the keyway is secured by a small fastening so it won't fall into the cockpit when the wheel is removed. Then you figure out a convenient place to stow the wheel where it will be both secure and easy to reach in a hurry, which is normally in a bracket against the lifelines.

Now you have a much more habitable cockpit, and it's only a matter of seconds to put the wheel back on the shaft and tighten the nut. But don't forget to put the wheel back on before you turn in. There's no telling what perilous things may happen in the night.

Compasses

I learned to navigate offshore and to pilot alongshore before the days of navigational electronics, all these simple electronic solutions to these problems, so I developed a tremendous respect for a well installed, high class magnetic steering compass. If the boat is over 30 feet or so on the waterline it is very appropriate to have a second compass, which we refer to as a standard compass but is not a standard feature on a stock boat that you might have seen but it is very desirable.

By having this second compass installed right at the outset and if this is presumed to be a good boat made of fiberglass or aluminum ally of good specification wood there would be no reason to have any correction and if both compasses are correctly aligned and the boat compasses are accurately lined up on the centerline then they should agree on all courses. If they do agree, there's no way for any error to be in either compass. So there's no reason to waste a day to have the compass "adjusted" because it should not be necessary.

If it's a steel boat, just forget what follows in this chapter because this applies to wood, fiberglass or aluminum alloy boat with a good specification, this eliminating magnetic tie rods or any deck beams or any bell frames or anything that might create a deviation and that's not too much to expect. The majority of boats that I have seen have been quite right and I am strongly opposed to the built in correctors which are furnished most of time, because of the compass manufacturer doesn't press that he'll loose most of his market, which is really very unfortunate, because there’s no reason for the correctors. All they do is reduce a compass's performance at wide angles of heel.

I'm going to mention several personal experiences which all point in the same direction. One was on *Puffin* where I sailed with Eddie Greff on several Bermuda Races and I was always concerned because in fresh breezes the compass seemed to be sluggish and in fact in the '72 Bermuda Race when it blew pretty hard for a while we mostly paid attention to the Windex at the masthead which was illuminated and by using that we could hold a pretty good course. If we stayed with the compass we would be all over the place because the compass swung off badly.

I urged Captain Eddy to teach those little corrector things how to swim and he was a little bit hesitant because he just paid the going price to have his compass adjusted and he had a nice new deviation card with a lot of zeros in it and looked very fine. Anyhow I kept pushing, pushing, pushing and finally some time later got word from Eddy in the Azores. He, after spending some time in Bermuda, had got on across and he had taken the bull by the horns and did teach those correctors how to swim. And he said the compass was definitely better, it made navigation easier from every respect, and more accurate.

Puffin was an example of a beautifully built wooden boat with very high specification and we would not have expected any materials there to cause any deviation. One of the most important parts is the steering gear, which can cause trouble, and it is very wise to get a very simple little Boy Scout compass that you can put up against everything from your winches or your parts to the steering gear and this will tip you off if there is anything magnetic. If there is you may have to do some small adjusting to overcome that. If adjusting is necessary I have found the Ritchie compass to provide a very good mounting unit, which has a number of advantages. First and foremost, it has, small tubes one on each quarter from the forward and aft centerline, one on the starboard and port side centerline for East and West, and then you put any minor corrections, I know in my own boat I had something like a very fine Eversharp pencil refill that was a magnet and that went in for the North and South where I had about a half a degree error and I put tape around it and put it in the little tube with plastic caps and I need nothing on East and West and I have never had any measurable deviation on any course under any condition.

There was this experience before the start of the Whitbread Race with one of our boats, a welded aluminum yacht, built by the Royal Huisman Shipyard of Holland. I noticed that they were using rotary correctors, which I feel so strongly against, and I mentioned to the navigator that I thought he'd be wise to get rid of them. Well, he was a very competent individual and he knew probably a good deal more about compasses than I did. He said he though they'd be satisfactory. Well, he was a gentleman too, because about four weeks later I received a cable from Capetown where they made their first stop and he said, “I want to admit to you that I was wrong and you were right about those

compass adjusters". He said he got ride of them about halfway down to Capetown, the compass behaved much better, and he appreciated my recommendation.

I next checked with Stu Hotchkiss who is a wonderful navigator and is very well informed and he agreed with my hypothesis that if you eliminate any magnetic object in the vicinity of the compass in a quality boat built of wood, fiberglass or aluminum, that there should be no correction necessary. He was very fussy about having a compass right because he did a lot of navigating and did it very skillfully and very successfully.

I next checked with my friend Burton Sherman who is the sales manager of Ritchie Navigation Instruments who makes the excellent mounting that I spoke of and the excellent provision for magnets if they are necessary, and he completely agreed with me that on a wood, fiberglass or aluminum yacht of good specification, with nothing magnetic in the vicinity, having a steering and standard compass was a very good check because you get in the habit of comparing the two and if there is a difference, it will put you on the alert and with your sighting compass you can check which is the one that's correct, and one should take time at the end of a cruise to get it squared away. It may be loss of fluid, it may be some wear or damage to the jewel on which the compass card pivots but in any case you should be able to have the two compasses read the same. You should make a habit of comparing them on all courses just to be certain, if nothing else it will warn you when someone has left an exposure meter or beer can too near either of the compasses.

I was particularly pleased with how many people accepted the fact that there should be no corrections needed although my opinion was that just about everybody who bought a new boat signed on the list of options to get a compass adjusted and they buy it with the corrector magnets. I asked Mr. Sherman of Ritchie why they wouldn't forget those and he said "Well, we like to stay in the business, and there is not much of a market and the people who order the compasses always believe they should have those unnecessary correctors".

There is one reason for them, let me add, and that is in a powerboat where there are numerous instruments and revolution indicators and so forth, not a good place for a steering compass. There’s a good place to have them because it's hard to fasten the regular magnets although the little Ritchie holders are good.

It seems appropriate to mention two other examples, which are *Yankee Girl*, and *Charisma*, both built of aluminum alloy by Palmer Johnson. Both were built with compasses with the rotary correctors that cost us being high point boat in the 1971 Admiral's Cup, because in the Channel race, which was one of the important races, we had the best boat in the fleet and we were well ahead of everyone until we started to come back from Le Havre, France, to the British Coast. Our navigator was a very competent fellow, I enjoyed looking over his shoulder from time to time, and he had figured out the current and we allowed enough to keep us downstream to the eastward, but when we sighted the isle of Wight we saw that we were about five or six miles to leeward of where we should have been. We had to go around Nabb Tower to the finish, which was one of the ports of the Eastern part of the Isle of Wight, which was exactly the same as the course from Cherbourg back to the Nabb Tower. So when we saw what it was if we went on the magnetic course from the Nabb which is a fixed object, and the Fort, which couldn't be moved with anything less than an Atomic Bomb, it showed the fault was not the navigator's judgment but it was the compass, because when we heeled over considerably, and it was pretty good breeze, the compass just went off and that got us down to leeward. We lost enough there to miss being the top boat in the Admiral's Cup series.

During the New York Yacht Club Cruise a year or two later, I was on *Charisma* and I was disappointed to see that she had these correctors in and I asked the captain and he said "These work fine". He had just had the annual compass adjustment just recently a few days before I got onboard and he had a beautiful card with a lot of zeros and I said, "That's fine". Well, we came through Quick's Hole beating down there, and now we were going to go up towards Mattapoisett and it was very clear and there was no problem finding where we were supposed to go but it was immediately apparent, if we used the magnetic course that we got from the chart, we would have been way to the right of the finish line and it would have cost us dearly, so that was just one more case of when we heeled the correctors, which had been very professionally installed, were very much of a booby trap.

I would like to repeat my recommendation that in addition to the steering compass there should be a properly installed and lighted standard compass. Hopefully you can

find a place where the helmsman, with little trouble, can read both compasses at the same time. On *Mustang* and *Dorade* we had a standard compass on the stern. That wasn't a good place but there wasn't a good place forward and you can look at the aft or lubber line and you can read what course you are making and you can compare it very easily. In both cases it was very useful and warned if there was any problem.

I learned a very good lesson from Bob White of Nautical Instruments when I'd gone down to Marblehead to see a movie show and I was given a nice new spherical compass which we were going to install as a standard compass onboard *Mustang* and he said "Which card would you like? I think a 2-degree card and he said "I think you would like a 5-degree card", and I said "Gee, that sounds like nobody's being very careful", but I was wrong about that one, because with the 5-degree card it's very clear if you are on one of the points, exactly, and if you are in the middle of the 5-degree points you know it's 2-1/2-degrees. With a 2-1/2-degree card there are too many numbers that are too hard to see, especially when you get older.

Steering

There just doesn't seem to be a better steering wheel arrangement than the chain, cable and quadrant system. There are other ways of doing it of course, push and pull rods, gears hydraulics, drag links, but they all seem less satisfactory and we always come back to the chain, cable and quadrant.

The first consideration is strength of all parts. The next thing is elimination of the friction. Even if your steering gear is strong enough, you're going to have trouble if the bearings are tight, or if the quadrant and sheaves aren't big enough or the rudder stock is a little bit out of line. The boat will not only be hard to steer, but she'll seem to be out of balance.

We at S&S have always put tremendous emphasis on getting rid of friction. It's made me unpopular at many shipyards, because it takes a lot of persuasion to get friction to the minimum - the yards want to get their final payment and get the boat out of there, and I try to get the owner to hang in tough until the steering is right.

I remember Harold Vanderbilt's big motorsailer *Versatile*, built just after WWII by Simms near Boston. Vanderbilt and I went to the yard for trials, and he went right to the bridge. She was an 85-footer with the bridge quite far forward, so it was a long way from wheel to rudder. She had a chain and cable gear with a big quadrant on the rudderstock. Now many builders will tell you there's no way to minimize friction, as we want it with the wheel so far forward and the big rudder so far aft. And sure enough, Mike Vanderbilt kind of fiddles with the wheel, before he did anything else he said, "Mr. Simms, I don't like it this way. Will you fix this up so it's nice and free, and then we'll come back for trials"?

Well, Mr. Simms was very anxious to get the last $50,000 due on completion of trials, and his face fell about a mile. Now, I didn't put Mike up to that, but it worked out just fine, because I had been leaning on Mr. Simms myself, telling him I wanted to be able to turn that wheel with my little finger right at the hub. He thought I was kind of overreacting. Now here was Mike saying the same thing. So Mr. Simms very reluctantly drove us to South Station and we took a train back to New York.

Now two or three days later Mr. Simms called me and said, "You tell your friend Mr. Vanderbilt that this wheel is the freest it's ever going to be; he can come back

anytime he likes." So we went back right away, and it was beautiful. Every sheave was in perfect alignment, the bearings were all free and that wheel, you could almost turn it by blowing on it. And even though she was a heavy boat and with considerable beam she was then, and still is today, delightfully easy to steer, even in a fresh breeze, because there's no measurable friction.

So now I have a simple little rule: 1 foot-pound should turn the wheel in still water and that's it. For trials I wear a knife and spike set that weighs about a pound, and I put it on a horizontal spoke of the wheel just 1 foot out from the center. If the wheel doesn't move, I say to the builder "How about it?" He says he'll fix it, but then some of them will tell the owner that it's impossible and that this guy Stephens is some sort of nut. But it is possible, and it is most desirable. Often in a "beautifully balanced" boat, fifty percent of it is simply the lack of friction in the steering gear, as much as good basic design.

Every once in a while it's easy to fix the friction problem. I remember going on a trial of a Swan 65 with Ingemar Granholm, who was Nautor's chief engineer and a very good mechanic. He looked a bit worried when I started tweaking the steering wheel, and he told me to go have a look at the mast or something, and the next thing I know he has the wheel off and the steering shaft and everything is all over the place. He went in with a knife and scrapes the plastic bearings off, put it all back together and said, "Come have a look." And that wheel was perfect. What he'd done was to "lap" to the top bearings for the wheel shaft where they were a little too tight.

Usually though, it's more difficult. We like to put a bearing for the rudderpost at the heel of the skeg, and then there's one where it comes through the hull and maybe one at the top, above the quadrant. Well, that's three bearings that have to be perfectly aligned over the distance from the rudder skeg heel fitting to the deck, and that's not easy. The best time to get it refit is when the boat's building, obviously. But many people buy stock boats or second hand, and then it's harder to correct the friction problem. But here are a couple of tricks that I've found can help.

Then there's the question of how big the wheel should be. For many owners' it seems to be a status symbol. They think the bigger the wheel is the more people will ooh and ah when they come into the dock at Miami or St. Petersburg or Newport. Well,

wheels shall certainly be bigger than they used to be. You get more leverage and finer control. It's also nice to be able to sit to weather or leeward and still reach the wheel. So that's all right. But, EXPLANATION TK [ROD: What is the problem with the wheels that are too big? You say in the transcript that you think Hank's wheel is a little too big and that FLYER'S wheel was too big, but you don't say why.]

We tried a cute solution to the big wheel problem in *Enterprise*, the '77 America's Cup contender. Lowell North wanted to be able to hang way out where he could see --mostly for WHAT TK [Rod: Transcript garbled] --but we couldn't make the wheel bigger because the main boom came down too close to the deck. We felt that two side-by-side wheels are heavier and add friction, so we put a hiking stick on the wheel. Not a perfect solution, because I think there are times when you WHAT TK? [ROD: Transcript garbled], but Lowell (CK) got used to it and it worked OK. Incidentally, they're finally trying to discourage the deck-sweeping main on the 12s, which is a very good thing. It's caused many, many accidents, and I hope they get that boom up higher.

As for tillers, they are coming back in bigger and bigger boats. A tiller is certainly simpler and less liable to failure than a wheel, with all its cables and sheaves and quadrants. And the tiller gives you a direct and very good feel of the boat. One drawback is that when the boat gets pretty heavy and is heeled over, you can't apply as much force as easily as you can with a wheel. Now, if the boat is reasonably balanced and the rudder isn't too wide, and especially if you have a little balance on the rudder itself you can pretty much solve this problem. But the main objection most people have to the tiller is that it takes up too much room in the cockpit. And there's not much you can do about that.

Finally, I think it's really important to work out some sort of emergency steering gear for every long-range boat. I'm not talking about an emergency tiller- of course, every boat should have that, and even ones that never go to sea, and it should have been fitted and sailed with at least once. No, I mean some way of steering the boat if the rudder goes.

And I don't mean spinnaker poles rigged off the stern. There's nothing worse than a 15- or 20-foot horizontal thing sticking out there that the waves are going to hit; if they don't break the pole, the pole may get you. No, I mean a more or less vertical, well-balanced thing with strong brackets on the transom, like part of a vane steering set up.

Corwith Cramer

I don't know whether to say .. normally superstitious after all there are many [powers] you're pretty much on your own and I had a fair amount of superstition and best of all I felt quite convinced that I'd been born under a very lucky star. Starting with my grandfather Stephens he was a wonderful man one of the best things he ever taught us was "there's no such word as "cant"." Then going down the line my father and mother did everything they could to help my brother and myself sail every high school vacation, several times they went along in a car and met us at various waypoints. This was in the late 20s and not the easiest time for a parent to keep us supplied with boats so that we could enjoy summer cruising but that's what Father did for us. He had a business friend who had had some sailing experience who came along just to go from Rye to Edgartown which was our first cruise, that was Charlie Dayton, from him I got some good advice, which he said "eternal vigilance is the price of safety". We went up one Friday evening and about midnight the breeze had kind of dropped down and the tide was turning against us so we went in behind the center breakwater in New Haven and stayed there until the tide turned with us again, then we made relatively quick time in spite of a light breeze because of the good tides in that area. Next at New London, where we again anchored to wait for the race and to the turn of the race to turn in our favor. That was our last stop on that cruise; we went down to Edgartown in good time. Going on with my good luck, my brother was quite in a class by himself and I was so lucky to have had a number of summers of his undivided attention and also many years working with him and I was lucky also about my sister she was a great addition to the family. Finally, my wife Marge and from her my daughter Betsy of which just wonderful, so I guess I was born under a lucky star. I learned sailing from Sherman Hoyt who made a trans-Atlantic trip to Norway on a cruise with us and also from Mike Vanderbilt who I sailed with in 1936 and 1937 on *Rainbow* and *Ranger*, a pretty good example of having good luck. One of the luckiest things was my acquaintance with Giff and Sally Pinchot who are completely responsible for stimulating my interest in Sea Education Association by organizing a passage for me from South Street Seaport to Woods Hole, Massachusetts on their … the Sea Education Schooner *Westward*. In that case I guess I was hooked at the first cast

because they were such a pleasant group of people, the crew were made up of the professionals of the SEA who are very competent and quiet and knowledgeable and the working crew were mostly some alumni who'd just come back from some of the sea semester cruises on *Westward* and they blessed me with what they had to say about their experience with SEA. So that led to my further involvement with regard to their so-called New Ship Committee and there I felt I was able to help them by trying to stimulate their confidence with the Coast Guard who were making regulatory regulations which would apply to their New Ship for which the SEA had already bought a very fine set of plans but which had to be somewhat further refined in connection with the requirements the Coast Guard regulatory people were producing that would apply to the finished vessel. And when they got the desired regulation, the desired clearance from the Coast Guard, that went very smoothly indeed. I simply urged that they were working with an intelligent organization and group of people and therefore should give them every confidence and attempt to work with them and not to work against them. When I first joined, they were kind of upset because they - the people that were in-charge for SEA - said that the Coast Guard was trying to reduce the sail area in the interest of safety and because there had been accidents which they hoped to eliminate and so I thought that's not any reason to try not to work with them, every reason to try to see if we can't push them in the direction we want them to go. So we stuck to our guns try to have a boat, fundamentally similar to *Westward* including enough sail area so she could make good time without having to call on auxiliary engine and the in view of [watchman] ??? happened recently, anything that saves oil is a step in the right direction. However, they were quite concerned because one vessel in some ways similar to what we were thinking about building and that had been lost in the Gulf of Mexico with unfortunate loss of life. It was our feeling that the incident occurred because of what is known as downflooding because as it gets pushed down heavy breeze it may be very temporary water comes in and that reduces our stability …. That's what we thought caused the *Albatross* to sink but there were no plans or records of her stability or her lack thereof but while the alumni Kirk Firestein volunteered to look them up because he lived in San Francisco and then Wallace Stock our marine superintendent had discovered that the architect that had done the drawings was no longer living but he had lived in San Francisco and had apparently

very orderly files from which we could dig out the information we might wish to show the Coast Guard to try to get them to believe that it was simply a mater of downflooding which is what you get when the vessel keels over so far the water begins to come in skylights or companionways or some openings and they believe in the original North Sea pilot schooners, that's a rough body of water I sailed through it twice, and I have good respect for it, and these vessels always had very narrow openings on the centerline where the *Albatross* accident occurred they then had big hatches partly to provide ventilation but there're better ways to do that, with so called Dorade ventilators which we have worked out on the new vessel. Anyhow, be that as it may, our alumni did dig out the necessary plans after a long search and got all the figures necessary to show that the *Albatross* was in fact definitely lacking on wide angle stability and very vulnerable to downflooding which I gathered from one of the survivors who spoke of water coming in the main skylight while he was trying to get up; anyway water was coming in there and those things had been on the centerline that accident would not have happened at all. When we produced the figures to substantiate our opinion about *Albatross,* that put us in a much stronger position with the Coast Guard, which I thought was very important because I'm definitely interested in our own success and anything that could make the boat safer in case of a serious accident doesn't do anybody any good unless you learn something from it. So the new ?? ship looked as though it would get the necessary Coast Guard approval and contracts were made to build it in Spain actually and the new ship was appropriately named *Corwith Cramer* honoring the man who founded the Sea Education Association had picked up the *Westward* in the Pacific at the end of WWII and brought it back and was developing the Sea Education Association to the point where they had now arrived where they headquarters on shore in Woods Hole and had this new ship committee hoping to build a boat in function similar to *Westward* but to increase the onboard capacity also to provide a backup in case one boat needed some attention didn't stop this so called Sea Semester which the SEA had … 5 or 6 weeks of shore studies of naval history and oceanography and the fundamentals of sailing after which they had a kind of reward of going on a 5-weeks cruise on a schooner offshore *Westward* where the undergraduates did much of the handling of the vessel and had a chance to learn

something of oceanography and sailing and seamanship as well as everything they ??? history of the … marine history.

Meanwhile, the *Corwith Cramer* had been contracted for favorably, the builders were extremely cooperative and ultimately she was finished and had sailing trials off the Spanish coast and looked as though she was going to be a good vessel … all involved were very pleased with the result. Fortunately another thing occurred cause the first year we sailed from Edgartown to go out to Nantucket and while we were there I was so happy to see this lovely old schooner by name *Alice Wentworth* being handled by a man and a boy that came sailing in on a good fresh breeze and all I can say about his seamanship was that all he needed for docking fenders would have been soft boiled eggs, he made the most beautiful landing under sail at the fisherman's dock there in Nantucket and I wish I had known as much about him as I do now cause I would have certainly hastened aboard to help tie up his sails and meet him and shake his hand anyway. Wonderful man. Name & book

What I've seen of the *Corwith Cramer* is a very good example of how things can go when people are knowledgeable and work together and that comes from the professionalism of the Sea Education Association, the builders in Spain (name) and the designers (name) from Booth Bay Harbor. Anyhow …. Contribute greatly to the future I've asked the SEA to afford an opportunity to be out on her as I only has a rather short acceptance trial and one day sailing in Boston Harbor since she's been completed. Then I'm looking forward to more in the future.

Further review of the various accidents which we don't like to read about but which we try to learn all we can from them have tended to substantiate our concern about this downflooding business. It's my hope that our influence has tightened up the requirement to eliminate that unnecessary cause of trouble and it should bode well for the future of vessels [of this source of this type.]

In efforts to supply the safest possible boat, we went to considerable extremes; there are no opening ports in the side even in the lavatory which is a big deckhouse more or less amidships I think I got it wrong with some of the scientists involved cause they had nice big 12-inch opening ports and they said they'd keep them close if the weather was bad but I didn't like to have anything that anybody could fail to do and same thing

about opening ports on the side of the hull, I never have favored them because we've had people to have electric indicators over there, locked or shut or not but my idea was let's make it so nobody can do anything wrong and that gives the element of safety and I think that's going to prove very sound basis and should in the future minimize the accidents that occur in boats that are built under these new Coast Guard regulations.

About the Ducks

Well, there were three battalions to be trained when I got there. At the time, there weren't any Ducks. I went to the nearest airport and borrowed a two and a half-ton truck. This was a definite conversion of that vehicle (the Duck). For the first several days we were teaching them how to drive this regular truck and at the same time telling them where the differences would be. This we did after we got word that a ship was coming in from Liverpool or some Duck farm.

How long had the Ducks been in production at this point? This was in '42 or '43, early in the war. It was very memorable because I met Lord Mountbatten. He had a very unfortunate attempt to raid the coast in the usual landing craft: with men carrying everything on their shoulders and so forth. Mountbatten could not believe that you could take this truck and go inland as far as you wanted. He just couldn't get enough. It was wonderful… he wanted to order 2,000 immediately for his men.

No one in the U.S. Army had the thought of having trouble with spare parts. The difference was that you could go and get a motor, or an axle, just like with any other two and a half-ton truck.

So he got word that they were coming in from Liverpool? "Yes, and one of the officers said that he had checked them out very carefully. I said, "You haven't checked them at all. I know more about these vehicles than any one in the world." There were about 900 men there, whom we were trying to teach. Around the clock, three shifts.

Roger Warren was with me. We didn't get any sleep for the first two or three weeks. I must say that the kids were so anxious to learn that they were wonderful. They were very nice to teach to. I remember everyday they would send some motorcycle police to escort us back up. One time we got up and left before they got there, they started looking for us.

And so how many Ducks did come in on that shipment? Six. Those boys were very glad to see them. These were the first six Ducks that had ever been seen in Europe. Mountbatten kept saying that these were exactly what we needed. As for everyone in Washington, well, they thought of the Ducks as more new thing to help win the war, one

more headache. Being so wary, they didn't want them at all. The first operation these were involved in was the Sicilian invasion. As it happened, the day after the invasion, a big storm hit and demolished these temporary docks they had set up. For the first week, almost all of the supplies, fuel and ammunition came in on Ducks.

Both Eisenhower and Patton were involved in that invasion. They sent a very complimentary to the War Department. They recommended that the officer responsible should be appropriately decorated.

So, did it make a difference once Eisenhower and Patton joined in? Yes. At first, we had steel propellers; the bronze couldn't be wasted on a low-priority machine. After Patton and Eisenhower, we got the bronze. The brass gave us anything we wanted. It's a good thing to have a little brass behind you.

So how many Ducks were manufactured eventually? About 25,000 or 30,000. These were used right on through the war. They required an awful lot of training to get them to be used right. The Army has all of this written down; they teach it at West Point. I wrote an operation manual, a photo offset xerox. I carried around as many as I could and passed them out.

And where did you go in trying to promote the Duck? When I got home, the Navy was somewhat interested. I crossed the Pacific on the AKA. I had 2 Ducks and 6 enlisted men assigned to me. We had classes everyday.

On the AKA? Yes

What was your arrangement? Well, I didn't have any rank. The enlisted also had some sort of no-nothing. Really, I was only called Mr. Stephens.

Was there anything particular that out of your sailing experience or vice-versa that went from the Duck back into yacht design? Yes. A wonderful pump system.

I went to General Motors, in Pontiac, with a letter from the National Defense Research Committee. The next thing I knew, I had a Duck in the water with 50 persons on it standing up.

Was that one of the requirements, that it be able to do that? No we were just trying to impress some of the people in Washington, who were against this from the start.

What was their objection, besides the fact that it was more headache? Did they really think the Duck wouldn't work out? That it wouldn't be a useful tool? They just dreaded having to worry about a new piece of equipment that didn't have spare parts. See, they didn't realize you could get spares anywhere… at an airport, the Air Corps. We had all the parts we needed for a two and a half-ton truck.

So you just took the basic Army truck and put a hull on it? Yes. This was an inversion of that truck. The first time we demonstrated it, these people were absolutely astonished. We were in Fort Storey, Virginia in the early December. They had a couple of landing craft and we had two Ducks. We came in loaded and drove across the beach, went far inland, then drove back around. Meanwhile, their landing boats had ran aground. The water was icy, they were cold and not too happy.

Then there was man, Dr. Bush, who was the head of the N.D.R.C. He was just one step below the president of the U.S…. He talked to an important officer who said, "The Duck and all this doesn't fit into our plans." Then Dr. Bush said, "Then maybe our plans ought to be changed."

So how long did it take from the time you proved that this vehicle was workable to the time the Army started ordering for them? There was this wonderful general named Anthony MacAuliffe. He was the guy at the Battle of the Bulge; when the Germans said, "We've got you surrounded… we'll shoot you all or you can come out now. MacAuliffe yelled, "Nuts!" Anyway, he was the guy who saw some of the first testing. He signed the order for General Motors to build the first 2,000. I was hoping to see him but he died. He really pushed this thing across. The next thing happened after the Sicilian invasion. A cable came in from Patton and Eisenhower saying that the amphibious trucks were important to the landings there. That was the first time we got any real support from the Army. Eisenhower and Patton were very good men to get support from.

I met Eisenhower when he was being inducted as president of Columbia; before he was president of the United States. I went with a graduate friend of mine, who was invited, to this big soiree. When we got to Eisenhower, my friend told him I was the one

in charge of the Duck project. He just stopped! For the next ten minutes, he talked only about the Ducks. Behind us, there were murmurs of, "What's holding up the line?"

He must have been thrilled to meet you? He really was. We talked about the cross-Channel affair. The reason they succeeded was that the Germans didn't really think there was a way to surprise two million men. They didn't take it seriously at all. That's why their defense was not good. In the first weeks, 75% or 80% of all vehicles landed were Ducks. The same in Sicily, where the temporary docks were destroyed, and other landing craft swamped.

So was that the Ducks function? To get stuff ashore, take it to the depot, then go back and do it again? That's right. There weren't any trucks or railways … nothing where they could come to a dock and trucks would load the stuff on a train. If you came in on a Duck, you can go wherever you wanted… usually to an airstrip that was protecting the operation. So yes, they were primarily water vehicles that could go on land when they have to.

There wasn't another truck as good as this one. We had big, special tires for going across a beach. The driver could put in any amount he needed. At Iwo Jima, the sand was so soft you could not get across the beach if you had more than 4 pounds of pressure. This meant an almost-flat tire on a hard surface.

So did you have compresses air that the driver could pump or let out? Each driver had a high capacity generator and a rotary joint. You had complete control. If one tire was damaged, we would add pressure to the other one. It would work until we got a chance to fix it.

Were the tires used at all for propulsion in the water? Yes. If the propeller was damaged, they would move the vehicle about two miles per hour. This was better than not moving at all.

Did you start from scratch for all of this? Yes. There was a man who was involved with the Naval Reserves. He wanted us to get involved because the boats made in the past were lousy and not good to begin with. See, if we helped, then at least they work well in the water. I didn't want to design axles, transmission differentials... all that.

So we started with an axle for a regular two and a half-ton, 6 x 6 truck. But first we had to improve the tires.

I was very lucky to have met a man, Dick Kerr, who had been with Aramco for many years. He knew more about tires with 90 pounds of pressure in them. When I drove the first ones down to Fort Bell, I knew we had to improve these tires for sand. We had to be very careful: we wanted to go someplace where the sand was just soft enough. So we moved to a big sand dune near Pontiac. Before going though, we got a truck with a big compressor, and bought every tire we could. Dick Kerr advised that we should try these new single tires instead of high pressure duals. We did: the Duck came up the dunes beautifully. That was the first step forward.

The next thing we worked on was the steering. At first, it took three or four turns from center for it to hard over. These guys thought it wasn't responding like a truck on land would. It took too many turns to get the result we wanted. So I went and rigged a system that would improve this: A dummy piler that went very slowly… as it passed the center it was only two inches behind the center pivot of the rudder. So, even though it went very slowly, it allowed the rudder to pass right over it. This worked great.

We were teaching all this to these guys that weren't boatmen. They needed to get some sort of response or else they thought it was not working.

How long did you work on it from the time that approached to the time it was operational? I worked on it till the end of the war. After that, I got a commission from the Naval Reserves. They told me that since I knew more about these vehicles that anyone else, they wanted me to stay there, working and improving on it. This suited me fine, since I knew what would work and what wouldn't.

You mentioned the pumps before. Did you have all the pumps you needed? Eisenhower and Patton got us all the pumps we needed. See the pump systems were very important. We had to have a systems that would get the water out quickly.

You mean bilge pumps? Yes. And did they swamp? Was there a danger of swamping them? Fortunately, they pretty stable. The center of gravity was down low and if you didn't get too much water in them, you would be all right. Whenever we hit

breaking seas, we would use a 750-gallon per minute one in the main part of the bilge. The water would be out in minutes.

List of Diagrams