

470 MANUAL

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470 Instruction Information

The 470 Instruction Program is an intensive intermediate-advanced level sailing course. While introducing the many facets of the 470, including trapeze, spinnaker, improved upwind skills, and heavy-air performance, we will move into fine tuning the sails, sailing the boat flat, roll tacking, and especially important: team work between skipper and crew. It is expected that students coming into a 470 instruction program know close-hauled sail trim, roll tacking, sailing the lifts,

coming-about on the knocks, right-of-way rules, and sail theory. Practical experience, which means lots of hours in a sailboat practicing, is the only real way to learn how to sail.

SAILING RULES

Two person minimum and maximum limit.

No life jackets are to be stuffed into the spinnaker bags.

Spinnaker poles should be clipped to a hiking strap while not being used.

When raising or lowering the centerboard, the boomvang should be untensioned.

STORAGE

All lines and ropes should be coiled and off the floor of the hull cockpit.

All sails must be rolled neatly and put into the correct bag.

Spinnaker pouches should be pulled inside out.

Inspection ports should be open so the tanks can ventilate.

Never cut or trim off excess line..

Jib sheets are always left on the sail.

All loose shackles and parts should be reported to the dock master, or stowed in an open, clear, plastic pouch.

Breakdowns should be repaired immediately..

Rigging problems should be maintained as soon as possible.

INTRODUCTION

You'll never learn to sail by reading a book. In fact, if you look outside right now and the weather's agreeable, drop what you're doing and go for a sail. The time you spend in any boat will probably help your 470 sailing far more than spending the same time reading any sailing book. On the other hand, if you've had or are about to take your first 470 ride, and have a free evening or rainy day, then you might find some of the tips in this manual worthwhile and enlightening.

For several years, despite strong interest and an active fleet, no 470 manual has been released. Several things have led to this shortsightedness. In the first place, writing such a manual is a time consuming job with little reward. In addition, there are only a few technical aspects of 470 sailing which are distinctive of the boat. Most of the information in this manual can be picked up from any intermediate level sailing book. However, the boat does have its peculiarities, and some ideas that are glossed over elsewhere must be emphasized for sailing a boat like the 470. Some sections get pretty technical and if you don't know your leech from your slot effect, it might get very confusing.

This manual contains few specific rigging diagrams. There are often several ways of accomplishing the same goal in putting a boat together. Things have a way of getting changed around so any rigging diagram might be out of date before this is even published. Instead, a general diagram of the lines that control the shape and trim of the main, jib and spinnaker will be presented. If you are confused about which strings do what on the boat that you are preparing to sail, spend a few minutes on shore pulling things and seeing what happens. This manual will also contain a few specific cure alls to how to sail a 470 (i.e., out haul slacked 2 inches in winds 5-8 knots). Instead, the theory of how your sails should be working and what all the controls do to the shape of the sails, will be presented. It's up to you to figure out how all of this nonsense applies to sailing a real boat on real water.

In as much as the 470 is a racing boat, much of the information contained in this manual pertains to getting the most speed and performance out of the boat. As it will be emphasized, the 470 basically is a fairly easy boat to sail. The trick is getting it to sail well, which is what racing is all about. The techniques are not limited to racing however, as a well sailed 470 really is more fun. Finally, by this point you should be a fairly competent sailor and should realize that perfection of both form and function is a reasonable sailing objective.

It is important to remember that the 470 is a delicate and expensive boat. The upkeep of the fleet is dependent on you. There are far too many things for the maintenance crew to keep in order that come before the minor repairs on the 470. Yet, it is the minor mishaps that detract so much from the sailing of the boats. If you expect to sail 470s for years to come, expect to put in some time for repair and preventative maintenance. If you wish to see changes and improvements in equipment, racing or facilities, its up to you to see that something gets done. Check with the fleet captain to find out what you can do.

ABOUT THE BOAT

The 470 is a two person fiberglass dinghy designed in the late 1960's by André Corneau. Shortly after its introduction, the 470 was accepted as an Olympic class, defeating the Fireball for that distinction. The 470 made its premier Olympic appearance at the 1976 games in Kingston, Ontario.

The 470 is a one-design boat with fairly strict regulations. Although many companies manufacture boats, sails and spars, the shape, weight and materials of the 470 sailing gear is carefully regulated. One of the finest 470s in the world was manufactured by Vanguard Boat Works in Pewaukee, Wisconsin. There are currently over 1700 470s in the U.S. and about 15,000 world wide. In recent years, a number of boats similar in basic nature and requiring similar technique to the 470 have been developed. These include the 505, 420, Laser II and Flying Dutchman. Although each of these boats has its own personality and nuances, they all share the common feature of being light weight, trapeze rigged dinghies.

The 470 is characterized by its very light weight (120 kg fully rigged) and relatively small sail area; herein lies the biggest difference between the 470 and most other high performance sailboats that you are likely to come across. The 470 is fairly easy to learn to sail but requires tremendous skill to sail well. Good form requires "muscling" the boat around, pumping sails and shifting body weight to facilitate steering. The limited power available from the undersized sail

plan must be maximized by careful adjustment of mast bend, leech twist and whatever other strings you have to pull, in all but the heaviest of weather. However, these same characteristics and the inclusion of the trapeze make the 470 a boat that even the smallest of college aged crews can handle when the breeze is up. In fact, the 470 is probably the ultimate boat for strong winds (over 25 knots).

The 470 was designed as a two-person racing boat. Because of its complexity, the jobs of both skipper and crew require a fair degree of skill. Furthermore, in order to sail the boat really well, a high level of team work is required.

Be sure to learn how to sail the boat from the front end as well as from the back. If you start to race, try and sail with the same partner for a while (you may find that switching places every so often is quite helpful). After only a few races, you'll be beating people who may be better racers than you, merely because you are sailing the boat so much better. In later chapters the jobs of the skipper and crew, in terms both of sailing and tactical function, will be spelled out more explicitly. Remember though, if you have a competent crew you have an extra brain and set of eyes and ideas on board.

SETTING UP THE BOAT

A few seconds of inspection of a 470 should impress you with the fact that the boat is both delicate and complicated. Several special precautions should be taken both on and off the water to guarantee safe and enjoyable sailing. Spend a little time looking over the boat on shore. Check the control lines to see what they do and that they are working properly. Make sure that there are no frays in any of the wires or lines on the boat. If you see a problem or a potential problem, fix it before going sailing. For a fully rigged boat you'll need the following:

Main and jib

Three battens (1 long, 2 short)

Rudder and tiller

Trapeze harness

Spinnaker and spinnaker pole

Two life jackets

Rig the main by first attaching the foot to the boom and connecting the tack pin and out haul. Slide in the battens. The two lower (short) battens are quite normal in function. The long upper batten runs from the luff of the sail to its leech. The tension that this compression batten exerts on the sail can be adjusted in order to force shape into the upper sections of the main. In general, in very light and heavy air, the batten should be set in loosely (but not so loose that it will fall out). In moderate winds, the batten should be set quite tightly. The proper tension on this batten is dependent on batten flexibility, sailing style, waves, sail condition, crew weight and a host of other factors. In order to properly adjust it, you must look at your sail. Experiment to see what looks and feels best. As with all sail trim adjustments, if you have questions, ask a local racing hotshot.

The 470 jib contains an internal forestay. When the jib is hoisted, the rig is

supported by this wire and not the permanent forestay seen on other sailing boats. The jib is, therefore, made without the usual forestay clips. After attaching the tack to the stem fitting at the bow, the head to the halyard, and the jib sheets to the clew, you have a choice of three options for the ends of the jib sheets. If they are figure 8 knotted, a six to eight inch tail should be left at the end so that you can grab them should they pull up to the block. Alternatively, the two jib sheet ends can be tied together. This continuous arrangement reduces fumbling by the crew since there is only one sheet to grab when tacking. A third possibility is leading the sheet across the cockpit and tying it up to the trapeze handle. Though this system makes tripping in the boat somewhat more likely, after a few practice sessions it becomes remarkably fast and efficient. You'll amaze your friends when they see how fast you can find the proper sheet and trim in the sail.

Both the main and jib are supported by wire halyards with rope tails. The wire doesn't stretch and so the luffs are not affected by heavy sheet trim or high winds. The rope tails are only so that your hands survive the hoisting of the sails. With this arrangement, the sails are not tied up, but rather, the wire is hooked onto some sort of halyard lock. After the sails are hoisted, and before heading out onto the lake, you'll find that it's a good idea to clean up the rope tails by tucking them into a pocket on one of the spinnaker pouches. Packing the spinnaker is better seen than described (though the procedure is described in detail in a later section).

A few points to remember are to check the halyard to make sure that it's clear aloft. By this, check to make sure it's completely untangled from the rigging, not caught between a spreader and the main sail, and that the chute is packed outside the jib and stays. You'll probably find that the spinnaker packs with fewer problems if it's bent on before the jib.

Before putting the boat in the water, attach the spinnaker pole to see if the topping lift is working and is at approximately the right height. After adjusting the height, stow the pole securely in the boat so that it will not float out and get lost in the event of a capsized.

The trapeze harness is required attire in all but the lightest of winds. With the exception of teaching, generally only one harness is allowed per boat. There are several schools of thought on the wearing of the harness. Most sailors agree that the waist strap should be quite tight. The life jacket may be worn either under the shoulder straps, where it acts as a cushion and improves fit for smaller crews or over the harness to keep the straps from getting over the harness to keep the strap from getting caught under the boom. Some sailors will adjust the shoulder straps for weight distribution and support.

If you are a beginner, keep the strap snug for a feeling of confidence and security. As you become more comfortable on the wire, practice loosening the shoulder strap in heavy air so that you can stretch out farther.

Other clothing should include long pants and a shirt with a collar to prevent cuts and chaffing from the harness straps. Shoes are a must if you intend to keep the same pair of feet for the rest of your life. And, of course, dress for the weather, which, in a 470 when the wind is up, means dress for a continual drenching in water that may be pretty cold.

The delicate nature of the 470 makes it particularly prone to damage at the pier. To minimize the abuse that these poor boats must endure, release the boomvang and raise the centerboard whenever the boat is tied up. Drop the sails and remove the rudder and tiller if the boat will be at the pier for more than a few minutes. The rocking and rolling of the boat may bang the tiller against the boat and break. Most important, never leave your boat unattended at the pier, even with the sails down.

Going Upwind

Close hauled, the 470 is sailed perfectly flat, except in very light air when the boat may be heeled to leeward to fill the sails. The dinghy-shaped 470 is fastest, sideslips least, and is most controllable when sailed level. By sailing the boat flat, you minimize the boat's tendency to turn on its own, which also reduces the need to use the rudder and slow the boat.

Crewing

One of the most important jobs of the 470 crew is maintaining the proper hull trim. In light wind, this requires moving from side to side in the boat. In heavier air, the trapeze becomes a necessity. The objective of good crew weight placement is to keep the skipper sitting comfortably in one place where the jib and water to windward can be watched.

The incorporation of a trapeze on a sailboat allows a yacht designer to increase the sail area and decrease the beam, thus, decrease the drag of the boat. Far more important is the added dimension that this device gives to crewing. On your first few rides, especially in light air, your skipper will do all sorts of weird things to hold you out on the wire. As you gain experience, the skipper should pay less and less attention to your position. Remember, it's the crew's job to keep the boat level.

There are two ways to get out on the trapeze, from inside the boat; the slow easy way and the faster, better way. To get out the easy way, hook up while sitting on the gun-whale and raise the hook until you're suspended just off the deck. Grab the handle with your forward hand and place your forward leg, bent, on the deck. Place your back hand on the edge of the boat just behind you. When you're ready to go out, put your weight on the wire, lean back and push off with your back hand. Straighten out your front leg and bring your back leg up onto the edge of the boat. You should now be out on the trapeze!

The hard, fast way out is easier to describe; grab the handle with your forward hand, jump out and hook up. Waiting until you're out of the boat before hooking up leads to very quick, classy looking tacks that can make you demolishing on a race course.

On your first few trapeze rides, you will probably find it most comfortable to plant your forward foot against the shroud, have the trapeze hook pulled all the way up and have your feet spread for balance.

As you become more proficient, try to improve your form and the performance of your boat. Bring your feet closer together to get your weight as far outboard as possible. For added stability, stay on the balls of your feet and point your front foot ahead to prevent yourself from being thrown forward. Lengthen the wire to

lower your weight and increase the boat's resistance to heeling. Higher hook positions are used most often in lighter air or bouncier waves.

Finally, move away from the shroud. Having your weight that far forward pushes the bow down and kills the performance of the boat. When trapeezing in smooth water, stand about 2 to 3 feet aft of the shroud. As the waves and wind build, move back until you are just in front of the skipper, who should be sitting right at the traveler. As crew, your exact position depends on your weight as well as the weight of the guy in the back of the boat. As a general rule, in lighter air and smoother water look forward to where the bow cuts through the water. The curve of the boat, where bow becomes bottom, should just be kissing the waves. In choppy conditions, the boat should feel like it is rhythmically hobby-horsing through the waves. Whatever the conditions, occasionally move back and forth to see the effect of your weight. Make a mental note to see if the boat tends to plane easier, plows through the waves, feels sluggish, points higher or sends up a funny spray. Ask the person steering if they can detect a difference in the feel of the helm accompanying the shifting of your weight.

The critical aspect of good trepanning is smoothness. All too often beginning, and not so beginning, crews shoot out of the boat when the first gust hits, which causes the boat to rock to windward, then, come flying in as they get their bottom wet. This business of see-sawing from side to side while going upwind is generally considered poor seamanship and not very much fun.

The first requirement for smooth wire work is that you get your eyes out of the boat and look to where the wind is coming from. If you see a large puff coming, you can pop out of the boat pretty fast. On the other hand, if you can see that you'll be hit by a small gust, be ready to ease out slower, and gently get back in as the wind subsides.

If you are already trapezing, and the wind starts to let up a bit, don't spring right into the boat. First, sit up keeping your legs straight and just bend at the waist. If the wind lightens even more, stay on the rail and just "butterball" up by bending your knees to your chest. As the next gust hits, you can then gently reverse the process without having to go through the jarring of getting into and out of the boat. Remember, once there is a moderate breeze, the 470 must be sailed absolutely flat. Pay attention to how much the boat is heeling. A glance back at the transom is a good indication of just how close to flat the boat is.

Marginal trapeze conditions require lots of concentration and patience. Be ready to constantly adjust your weight to keep the boat balanced. It is often a good idea to raise the hook high enough so that it holds you just off the side tank when you're sitting in. This allows you to easily swing out without having to lift your weight with the handle. As the wind increases, keep sitting further outboard while slung in the harness. If your legs are long enough, trapeze right off the centerboard trunk.

Otherwise, hold yourself halfway out by leaning back and pushing off the tank with your back hand. Be ready to put your front foot onto the rail as the gust builds. If necessary, hold onto the handle with your front hand. Once your front foot is up on the edge of the boat, it should be easy to get all the way out by straightening your leg and pushing off with your back hand. Heavy air is pretty easy to handle from the wire and requires much less work than hiking. Try to get

comfortable and "clamped" in. Lower the hook as much as it possibly can, keep the jib sheet nearby for an emergency, relax, and enjoy the ride.

In puffs, you can bounce your weight to get the boat flat. If done in concert with the skipper, bouncing can be an extremely potent tool in heavy air. In addition to jerking the boat down, bouncing causes the tip of the mast to flex, allowing the upper leech of the main to spill wind (more on this later). If the boat goes way over, crack off the jib for a split second then trim it right back in. Do not leave the jib nucleated and flailing; that could lead to your demise. A 470 must be kept driving forward in heavy air. The boat can capsize, even with both sails leafing, if its dead in the water.

Skippering

Steering upwind in a 470, or any other performance boat, is tricky business. It requires concentration, observation, experimentation and lots of practice. When you first start steering the boat, you will spend a lot of time worrying where your crew is and how to hold him out on the wire. For this reason, it is best to try and sail with the same person for awhile until you both get used to the boat. Remember, until the crew is flat out on the wire, its his or her responsibility to keep the boat level and the skipper sitting in a comfortable position. When sailed properly to windward, the 470 tracks in a fairly narrow "groove". Finding this groove requires that you spend a fair amount of time in the boat and concentrate when going upwind. To find the groove, sheet the sails in (more detail on

this later) and steer to keep the telltales on the jib streaming straight back.

The telltales on the jib provide a very accurate gauge as to its trim. The inside (windward) telltale luffs before the sail itself would; the outside telltale flapping, seen in shadow behind the sail, indicates over trim. The jib is at maximum efficiency when both telltales are streaming straight back. Trim in if the inside telltale luffs; ease the sail if the outside one does. If you're doing a good job, the boat will have almost neutral helm. A slight weather helm is OK. This will allow you to steer through the waves with very little tiller motion. Try steering with your eyes closed for a while and you should soon be able to detect the feel of the boat when its on the wind.

The 470 is an easy boat to hold flat but is somewhat tougher to get flat once it heels up. When a gust hits, be prepared to do a lot of work for a short while to get the boat back under you. The basic technique for flattening the boat out is not particularly exotic; ease the main slightly, hike hard and feather up into the wind a bit. When you get the boat flat, trim the main right back in, bear off to the correct course, and you can relax until the next gust. In almost all conditions, the skipper should be sitting right up against the traveler bar. As crew, this puts your weight at the widest part of the boat, allowing you to reach all of the control lines, and give the boat the best turning moments for going over waves and quick steering. There is a big tendency for beginning sailors to slide aft at every possible chance. Just try to keep climbing forward. Remember, keep working the sails to match the changing conditions.

Tacking

There are three different factors to consider when trying to turn a 470; the rudder,

the sails and the hull. Obviously you can pull or push the tiller to get the boat pointed in the right direction. Not as obvious, but just as important to turning the boat is the trim of the hull and sails. On all sailboats, all of the wind forces, and all of the water forces, appear to concentrate at single points on the sails (Center of Effort-CE) and hull (Center of Lateral Resistance-CLR) respectively.

When a boat has a neutral helm, the CE is directly over the CLR and the boat sails in a straight line with no pressure on the tiller. Sailors of 470s and other high-performance boats strive to tune their rigs towards this neutral helm. The reduced amount of wiggling of the tiller not only makes the boat more responsive, it actually makes the boat faster due to the reduction of rudder drag. Although things like sail cut, mast rake, centerboard shape etc., all influence of the position of the CE and CLR, the most dramatic changes that can be made on the water involve sail trim and heel angle. In addition to reducing the amount of tiller motion needed, adjusting boat and sail trim may help you to keep the boat under control in high wind, or during large course changes like mark roundings.

The 470 has a notoriously inefficient rudder shape due to strict class rules. It is not uncommon for the water flow to become separated from the blade. This is a phenomenon known as stall. When this happens, for example, when the rudder is turned too much, steering becomes virtually ineffective. In heavy air, the rudder may shoot up a rooster-tail of water as the boat broaches. In light air, the boat will feel sluggish and without control as it drifts straight to leeward.

Easing the main slightly causes the CE to move forward and the boat will bear off. This happens as the jib provides more of the power and turning force. Conversely, over sheeting the main slightly moves the CE forward and forces the boat to head up.

Heeling the boat changes the position of the CLR. When the boat heels to leeward, as it will during a puff, the CLR also moves to leeward and gives the boat a weather helm. Therefore, when a gust hits and the boat heels up, it is imperative that you ease the main slightly to neutralize the helm and get the boat back under control. Simply turning the rudder is often not enough.

When it becomes necessary to make dramatic changes in direction, such as when tacking, rounding a mark, or maneuvering at a starting line, the sails and heel can be used to make the rudder's job much easier. In general, when bearing off, ease the main out and hike the boat to weather. When rounding up, allow the boat to heel and rapidly sheet in the main. These steering techniques should not be thought of as frills or advanced techniques. Rather, they are essential tools for sailing a 470.

In order to get an appreciation for, and develop a feel for proper sail and weight control, practice is required. On a day when there is a moderate breeze (crew and skipper on the high side but not trepanning), ease your grip on the hiking stick and try to keep the boat going in a straight line. Watch what effect heeling and sail trim have on your control. After doing this for a while let go of the tiller completely! Be sure to do this well away from other boats as you'll probably lose control and sail in circles for a while. After mastering the straight line, pull the rudder off the boat and try sailing around the lake. You will have to raise the centerboard slightly to counteract the effect that removing the rudder has on the CLR. When you feel that you have the boat under control, and after returning the

rudder to its rightful place, try sailing circles around a buoy. Although you're allowed to use the tiller for this drill, you'll find that the more precise your hiking and sheeting, the tighter your circles.

As with most other aspects of 470 sailing, there are two ways to tack the boat—the easy way and a fast way. The easy way, called the flat tack, is not unlike tacking any other boat. Uncleat the main and jib when close hauled, push the tiller across, change sides and trim in the sails as the boat falls off onto the new tack. If the crew is out on the wire, the skipper should say "ready about" and wait until the crew swings in, unhooks and uncleats the jib. It's the skipper's responsibility to wait until the crew is unhooked and ready before putting the helm down.

The flashy method of tacking, the roll tack, involves actively shifting crew weight to force the boat through the eye of the wind. A properly done roll tack actually accelerates the boat. The roll tack is started by allowing the boat to heel up, giving it a strong weather helm. Coupled with the turning of the tiller, this allows the boat to spin very fast. Unlike during the flat tack, the skipper and crew should stay on the (old) weather side after the skipper pushes the tiller over. In fact, they should hike hard to roll the boat through the tack. After coming across the wind, skipper and crew rapidly scurry to the high side and hike the boat flat while trimming in the sails.

A roll tack is slightly more difficult during trepanning conditions. When the skipper says "ready about", the crew unhooks from the trapeze and uncleats the jib while still out of the boat. The crew, when ready, says "ready", and the skipper immediately puts the helm down. With this sort of tack, the crew is responsible for their own well being; if the skipper were forced to check the crew, the crew would have to hang, unhooked, for an extra couple of seconds.

Once the boat begins to tack, the crew should try to wait for an extra second while swinging in to roll the boat through the wind. The new jib sheet should be grabbed as close to the fair lead as possible so that one pull will get the jib almost trimmed. The vast majority of 470 crews tack facing forwards but some face aft during a tack. Give both a try before developing any habits. Either way, as you come across the boat, trim and cleat the jib, grab the handle with what will be your forward hand, pivot around and get your feet out on the rail. By this point, the skipper should be across the boat and trimming the main to balance the boat. The crew should be hooked up and trimming in the jib. All at the same time, the boat races past all the boats who were doing dull old flat tacks.

Obviously, this type of tack requires lots of practice in order to get the timing down. One of the best drills to speed up the crew is sailing without the use of the harness. This forces the crew to learn to get out and come in without being dependent on being hooked up.

Once you can do a smooth roll tack try "double tacking. Do a second tack the instantly after finishing a tack. If your boat has not stopped dead in the water, you're doing OK. If not, keep practicing. The double tack, in addition to being a fine drill, is a useful defense against a tight cover in a race. It is also very effective in impressing other sailors. If you are serious about racing 470's, extend the drill by doing as many consecutive roll tacks as possible. It is important not to sail between tacks, even for a second or two, because this makes it much easier to do them. In theory, you should be able to roll tack your way across the lake. In

practice, if you can consistently do smooth double and triple tacks then you're doing pretty well.

Upwind Sail Trim

Up to this point, nothing has been mentioned about how to adjust the various control lines of the 470. It is impossible to say, for example, that in 12 knots of wind, the cunningham should be pulled down 1-1/4 inches. In many cases, the way the controls are adjusted is dependent on your weight, sail age and cut, the type of mast, and even your particular style of sailing. So, rather than summarize the best ways to adjust your sails, here is some technical information on the "power plant" of the 470. Here are some basic hints on how to tune the sails, but its up to you to go out and experiment to observe what happens. Also, don't be shy about asking more experienced sailors for their opinion on certain trim problems.

Sails have a rather complicated three-dimensional shape which is quite difficult to interpret without several years of sailing experience. In all likelihood, if you've sailed with an experienced sailor, you've been frustrated by his or her constant adjustments of controls and mutterings of "it just didn't look right" in response to queries. Don't fret too much! There are short cuts to developing a good eye. While its difficult to discuss the sail as a whole, there are three areas of the sail which indicate, in general, how the whole sail is working.

The first area is the upper leech. This adjusts for the proper amount of "twist". A sail with little twist has the leech, and the give-away top batten, pointing straight back or hooked slightly to windward. The leech of a sail with lots of twist, falls off "opening up" and depowers the sail.

The second important area of sail trim concerns the location and depth of the deepest part of the sail. The fancy name for this is the point of maximum camber or more simply, the draft.

The third area is the luff of the sail. The amount of fullness, or "entry" of the sail, dramatically influences the flow of air over the rest of the sail. There are several ways to evaluate your sails. First, look at the sails while you are sailing. It might be helpful at times to stick your head under the main to get a good look at the leeward side of the sails. Second, watch other boats sailing near, but faster, than you . Look at the leeches of their sails, the height of the foot of the jib above the splash rail, the location of the boom, and any other clues of what is being done right or wrong. Finally, set a boat up on shore sometime when there is a light breeze. Be sure to do this with enough people around to keep the boat under control. Play with the controls and walk around the boat to see what the sails look like.

As far as 470 sailors are concerned, the wind comes in three basic "flavors." - very light, medium and heavy - each of which requires a fairly different sail set up. In light air, strangely enough, it is necessary to sail with fairly flat sails but very little tension on the sheets. Wind, going all the way around a full sail, tends to become separated from the sail. The loss of the laminar flow from the sail, or the rudder, is called stall. It's important to remember that sails are made of cloth and that changes in wind strength causes them to change shape. For example, increasing wind strength automatically causes the camber to move aft and the

leech to twist off. If a sail is set perfectly in moderate air, what happens in light air is the leech will tend to be too tight and the draft goes too far forward.

In order to open the leech, flatten the sail and move the draft back to its proper position; the mast must be bent in light air. But, the two most important tools for bending the mast, the mainsheet and boom vang, can not be used because excessive tension on these lines will over flatten the main and over tighten its leech. Therefore, the knowledge of prebend is important. The cunningham should not be tightened, because it tends to pull camber forward then flatten the sail. The out haul, on the other hand, can be snug but not tight.

Your best clue for trimming the main is a series of telltales on the leech of the main. If the sail is stalled, these telltales will curl to the leeward side of the sail. In drifting conditions, it is best to have the telltales at the top batten, stalled about 1/3 to 1-1/2 most of the time, and streaming straight back the rest of the time. The most important controls for doing this are the mainsheet and traveler position. If playing with these or the rest of the lines in the boat don't do the job, try lowering the sail and readjusting the tension of the top batten. More tension makes the sail fuller, the leech tighter, and the telltale to be stalled more of the time.

Over the years the traveler system on the 470 has undergone a major evolution. In the early days, all boats were equipped with a conventional, single car traveler. Many sailors then shifted over to a fixed bridle system, which made sail adjustments easier in heavier air. A number of methods were evaluated to make the bridle adjustable for use in lighter air, but it wasn't until the two car system was developed that sailors became satisfied.

In light air with a single car traveler, mainsail leech tension is easily adjusted with a combination of traveler car position, usually to windward of the centerline, and mainsheet tension. When sailing close hauled, the mainsheet no longer acts to move the boom in and out. Instead, most of the sheet's effect is directed down and on the leech twist.

Once the desirable amount of twist has been set with the main, the position of the boom can be set by adjusting the traveler car. With a bridle this sort of adjusting becomes trickier. The sail either has the right amount of leech tension but improper trim if the sheet is eased, or, too tight a leech if the sail is pulled all the way in.

With a two car system, the leeward car can be nucleated in light air converting the bridle to a traveler. This means tacking the cars, so if you're just learning, it will probably pay to leave both cars pinned out. One more thing, if you have a single car traveler, don't bother with it until you are comfortable in the boat.

You might want to prove to yourself that the leeward car does have a dramatic effect on sail shape by looking at a boat set up on shore. Pull both traveler cars out and sheet the main in all the way. If you walk around to the back of the boat and look up at the leech, you'll see that its hooked way to weather. Now, just uncleat the leeward traveler car and look at the difference in the sail. Try altering the position of the boom with the windward car and changing mainsheet tension at the same time. Finally, look at the sail for giveaway clues that tell you if the mainsail is working correctly. Hint: in addition to the behavior of the leech telltales, the angle of the battens in relation to the boom often give you an

accurate picture of the shape of the leech.

Moderate air requires a distinctly different set of sail settings. The sails can be allowed to work to their fullest and there is not a serious threat of stalling. Moderate air conditions exist when the crew is just about sitting on the windward tank to the point when the crew is fully extended on the wire and you can no longer keep the boat flat without easing the main.

To get the most power from your sails, ease the outhaul a bit and sheet the main in hard. Most beginning 470 sailors constantly have their sails under sheeted. The blocks on the boom should be sheeted right down to the blocks of the traveler.

Once the crew is out on the wire, you can begin to put tension on the cunningham. Pay attention to how the cunningham adjusts the shape of the sail. Tension on the luff pulls the draft forward and makes the entry fuller. If your sails are old and blown out, the draft will be blown back and you may have to put on some cunningham before the crew is on the trapeze. The vang can begin to be tensioned after the crew is out on the wire. This will keep the leech tight, especially down low, by preventing the boom from rising in the increased wind. The vang, unfortunately, pushes the boom forward and causes the mast to bend and depowers the sail. In moderate air you want to get as much power as possible from the sail and prevent the mast from bending. This requires "blocking" the mast at the partners, using the mast pull.

When the crew begins to trapeze, the bridle system begins to get the advantage over the traveler. With both cars pulled all the way out, leech tension is maintained strictly by the boom vang. Due to this transfer of function of the main to the vang, this system is sometimes referred to as vang sheeting. The leech should be allowed to go through a gradual transition from stalling 1/3 to 1/2 of the time as indicated by the leech telltale when the crew is just sitting on the tack, to always flowing straight back when the crew is fully extended on the trapeze. As the wind strength increases, it will become necessary to pull all the strings a little tighter to maintain the shape of the sail. In light air the leech will stay tight on its own but as the wind picks up, the sail will twist off more and more. The amount of twist would automatically become excessive unless the vang is used as a control.

The wind is not often steady for more than a couple of seconds at a time. If you use the suggested technique of sheeting the main in very hard, be ready to ease the sail out in the gusts and pump it right back in the lulls. Going upwind it's very important to keeping the boat constantly level as well as having the sails trimmed properly.

When the wind becomes strong enough to warrant depowering, the mast should be allowed to bend by removing any sort of blocks or preventer from the front of the mast. The pushing of the vang and main will cause the mast to bend, flattening the sail and the opening of the leech. The outhaul can be pulled quite snug and lots of cunningham will be needed to pull the draft forward. Remember, it's the strong wind that pulls the camber aft, you just want to hold it in its proper place.

Both traveler cars should be pulled out for vang sheeting. A substantial amount of boom vang tension is needed to control leech tension, flatten the sail and bend the mast. When the main is eased in the gusts, the vang will allow the boat to

keep driving by preventing the leech from twisting off too much.

In heavy air, your sails should always be sheeted for flow. See what happens when you try to stall them. As mentioned before, the 470 is easy to hold flat but hard to get flat. Gusts must be handled by dumping the main and rapidly retrimming to keep the boat moving. It helps to raise the centerboard slightly from its usual position perpendicular to the hull.

When you are fairly comfortable in heavy air, a technique slightly different from the usual feathering style of sailing may be tried. If conditions are right, the 470 may be made to plane to weather. This means the boat is sailed as if it were on a reach. Here's what you need to do:

- *Vang hard and ease the main to balance the heel.*
- *Keep the boat flat*
- *Hike and trapeze hard*
- *Set jib leads aft to open the slot*
- *Ease mast pull for a flat sail and open leech.*
- *When overpowered ease the main and bear off very slightly.*

The last step may result in a swim unless you do all of the other steps right. However, if the wind and your timing are right, the boat will take off.

A final word before going on to jib trim. Wave conditions are as important as wind conditions in influencing sail trim. Large waves require fuller sails than flat water to power through. Sometimes the wind and waves cooperate to make your

decision easy. For example, in heavy air and smooth water, generally an off-shore breeze, the sails should be very flat. Sometimes, conditions are not so favorable to allow for straight, forward choices. One example is when the chop is up but the wind is dying to a drifter. Go out and play around to see how your boat responds. There's no easy suggestion except practice and experience. Trim on the jib basically follows the trim of the main; full for power in moderate air and choppy water, flat in smooth water and in very light and heavy air.

As previously stated, rig tension affects jib shape by controlling luff sag and the shape of the entry. It's difficult to have too much rig tension, no matter what the conditions. On some jibs, the tension of the cloth can be adjusted quite independently of the rig tension with a small lace line at the tack or head of the sail. This line acts like a jib cunningham, though its nearly impossible to adjust while the boat is underway.

The two adjustments that are on hand for jib trim are the lead placement and the sheet tension. Sheet tensions will affect the twist of the leech and the lead will control the fullness of the sail. They are not independent controls and sheeting harder tends both to close the leech and flatten the sail. A word of caution, when it comes to adjusting the lead, the fact that the tracks are 12" long does not mean that a 12" adjustment is ever necessary. Usually, 3" to 4" is the maximum range

of movement that any jib requires. The long track allows for a variety of different cuts of sail. As a guide to jib trim, put two marks with a grease pencil on the splash rail at 14" and 16" from the edge. The foot of the jib will be trimmed between these marks, farther outboard when the jib needs to be full for chop and moderately light air, or when the leech needs to be twisted off for heavy air, and inboard under moderate conditions when most power is needed.

Four sets of tell tails make trimming the jib easier. Three pairs belong along the luff and the fourth high up on the leech as a stall indicator. When you first set up the jib, get down to leeward and sight up the leech. The leech telltale should be trimmed similar to the main telltale, stalled 1/3 to 1/2 the time in a light to moderate breeze, and less at other times. Pulling the sheet tighter closes the leech and makes the telltales stall most of the time. Similarly, sliding the fair lead car forward puts more downward force on the leech and stalls the sail more.

Because they are not independent controls, sheeting harder closes the leech and flattens the sail. Juggle both sheet tension and lead position until you think that fullness and twist are correct. Now, shift your gaze from the leech to the luff and have the skipper head up slightly. All three luff tell tails should flutter at about the same time. If the upper one flaps first it's an indication that the lead is too far aft and not enough sheet tension is transmitted to the top of the sail. Slide the car forward and then retrim the sheet to get the leech tell tail indicating the proper amount of stall. If the bottom telltale luffs, slide the car back and retrim. Once the sail is set correctly, go back up to the windward side of the boat and get an idea where the jib is trimmed in relation to the splash rail so that you can rapidly retrim it after the next tack.

In very light air the slot between the main and jib should be wide open. Light air cannot force its way through a narrow slot. It may, at times, be necessary for the crew, sitting to leeward, to hold the jib sheets outboard and up a bit. In any case, sheet tension should be very light. Moderate conditions demand the most attention to jib trim. As with the main, the jib should not be over tensioned at the lighter end of a moderate breeze. This will cause the sail to be stalled too often. As the wind picks up, the jib can be trimmed in to close the leech for power.

In very strong winds, the jib should be flat and have a twisted off leech. Pulling the lead back and sheeting very hard will accomplish this. Be ready to crack the jib off and rapidly retrim in the event of a sudden gust.

Sailing Off The Wind

A 470 feels very different on reaches and runs than it does close-hauled. Going upwind demands steady and continual hiking, subtle changes in sail trim and little body movement. The boat is a fairly stable platform that is constantly pulling to windward. Off the wind, a 470 tends to be much more squirrely. Sailing the boat requires much more jumping around and dramatic changes in sail trim.

Adjustments off the wind are fairly simple. Under most conditions, the control lines can be eased. The cunningham is easy to slack off but the out haul is often left alone unless you're in a long race or have a quick release lever. The important thing to remember is the readjustment of the boom vang. If there was vang going upwind, and then you bear off onto a reach, be sure to release the vang. If left on tight, the vang will slow the boat, kill the handling, not allow the boom to be

eased out rapidly in gusts and, by pulling the boom way down can cause painful jibes.

The vang should be played as a "throttle". More vang leads to less twist and more power until the sail begins to be over flattened. When reaching, the main should luff evenly, neither the top nor bottom first, and the battens should be aligned if you have the proper vang tension. If overpowered when close reaching, ease the vang and let the leech twist off. Over tightening the vang will make your boat slower while doing little to relieve the excessive heeling forces. Finally, when preparing to jibe, ease the vang off a bit. This will allow the boom to rise and keep the boat from being overpowered and out of control as you come out of the jibe. When you're settled down again, trim the vang in and take off. Until the spinnaker is put up, main and jib sheet trim is the most important consideration when reaching. Both sails should be tightly trimmed so that slight easing would cause a luff. Good main trim requires that the sail occasionally be let out a bit and then retrimmed until the leafing just disappears.

Unlike sailing on the wind, it is not enough to trim and cleat your sails while reaching. A 470 will show fairly major changes in speed off the wind due to surges caused by gusts, waves, planing, and slight changes in course. These changes cause shifts in the apparent wind which must be compensated by changes in sail trim.

Apparent wind is the wind you feel on your face and to which the sails are trimmed, and is affected both by the true wind, as measured on shore, and the wind caused by the motion of the boat. This is exactly the same as if the wind you would feel if you were on a motor boat that was moving at 10 mph. This wind is then added to the true wind, and equals the apparent wind to which you must trim your sails.

Changes in both wind speed and direction as well as boat speed and direction cause changes in the apparent wind. For example, in a sailboat on a reach, when a gust first hits, it feels like the wind shifts aft due to the increased strength of the wind, so the sails are eased slightly. As the boat accelerates the sails must be retrimmed to compensate for the increased effect of the boat's speed.

Much more body motion and steering are needed on the reaches than on the beats. As silly as it sounds, there's an old adage that warns you to "keep the boat under the mast" when reaching. Besides its obvious meaning, this advice provides all the information you'll need to be a capable, off the wind sailor.

If the tip of the mast goes to leeward, such as when a puff hits, bear off until the mast tip is right above the boat. Likewise, when the boat heels to weather in a lull, steer up and get the boat under the mast. This technique, when done smoothly, is not only fast but it also makes the boat the most comfortable and controllable while minimizing the chances of a capsize.

A fair bit of space was devoted to steering with weight and sails in the previous sections. It is even more important to use these techniques off the wind as course changes tend to be more exaggerated. When a gust hits, hike hard to get the boat flat, or even heeled a bit to windward, ease the main, and then bear off. Heading up is best accomplished by allowing the boat to heel slightly and trimming the sail while putting the tiller over. In heavy weather, failing to keep the

boat under the mast, and not using the sails and heel to fall off in the gusts, are the principle causes of capsizes. As mentioned earlier, practice sailing without the rudder to develop a good feel for the boat.

Spinnaker

As you probably know, the spinnaker, or chute, is an auxiliary sail used for off wind work. The addition of a spinnaker into a boat's design allows the boat to be faster down wind. When reaching and running, the spinnaker practically doubles the sail area. This specialization allows the main and jib to be designed most efficiently for sailing on the wind. In addition, the spinnaker gives the crew an important job on the off wind legs of a race. This added responsibility, and the coordination needed while raising, jibing and lowering the chute, demand that the boat be sailed as a team.

The use of a spinnaker greatly increases the number of lines that must be contended with. First is the spinnaker halyard. One end is attached to the head of the spinnaker and the other end led to the skipper. Like all halyards, the spinnaker halyard is used to raise the sail. Unlike other sails however, the spinnaker is only flown off the wind and must be raised and lowered in the course of a day's sailing. A handy addition to the chute halyard is the reverse purchase. Pulling one foot of halyard raises the sail three feet, though it requires three times the strength. In addition to speeding up the hoist, use of a reverse purchase leaves only a third as much line kicking around in the cockpit when the chute is up. The spinnaker also has a sheet which, as always, is used to trim the sail. However, the spinnaker is a symmetrical sail and appears to have two sheets. Once the sail is raised this problem disappears. Only one line acts as a sheet while the other is used to position the spinnaker pole and is called the guy. The pole positions the foot of the spinnaker and is always set out on the side opposite the boom. Note that when you jibe, the pole must be switched from side to side and the old guy becomes the new sheet and vice versa.

The spinnaker pole has three attachment points. One end is hooked to the guy and the other end is attached to the spinnaker ring on the mast. The eye at the center of the pole is attached to the topping lift, a line used to control the height at which the pole is flown. When not in use, the spinnaker is stowed, rigged and ready to go in one of the bags near the mast.

To pack the chute, find both clews while the sail is still in its storage bag and make sure that you can run from one side to the other without any tangles in the foot. Stuff the foot into the spinnaker bag but leave both clews hanging out. continue to stuff the sail making sure that the luff tapes are not twisted. When tying on the halyard, look aloft to make sure that its not tangled and the halyard runs on the same side of the forestay as the sail. Finally, remember that one of the sheets must be led around the forestay before being attached to the spinnaker. You'll probably find that packing the chute before the jib is rigged will minimize some of the tangling problems. Remember, the spinnaker must be rigged outside the jib.

There are two different techniques needed to raise the spinnaker under all conditions. Use of either is dependent on the position of the packed chute before the set. If the sail is in the port bag while the sail is on starboard tack, the spinnaker will be in the lee of the working sails and blow away from the boat

when hoisted. This requires the normal or leeward set. If the chute is in the bag, disaster is possible. The result, a strong possibility of getting blown into the jib.

The technique needed here is called a windward set as the spinnaker will be upwind of the working sails before being hoisted. The leeward set, being easier and less prone to failure, is the first type of spinnaker set you should try. If you are out day sailing and wind up needing a weather set, just jibe to get the chute in proper position.

To hoist the spinnaker, bear off to a reach, ease the vang, and let the main out. The jib should be eased but may be left slightly over trimmed to keep it out of the way. The crew will have trouble in the middle of the boat during the set so it is up to the skipper to balance the boat in a race and keep the boat moving.

Before hoisting, the crew should make sure that the halyard is free to run up. Some sailors like to run the halyard around the chain plate to keep it untangled when not in use. This requires the crew to go down to leeward, unhook the halyard, before the reset. In any case, it's often a good idea to pull the head of the sail a foot or two out of the pouch to help it up.

If your boat has twing lines, make sure that the windward one is cleated and the leeward one free. The crew should make sure that the spinnaker sheet is cleated and onto the guy. Slide the pole from the bilge and hook to one end to the guy. Be sure that the pole is forward of the side stay. Push it out until the topping lift can be attached. Once this is done, the pole can be pushed all the way out and hooked to the spinnaker ring.

Once the pole is set, the crew should yell "hoist" to the skipper, but be ready to balance the boat as the skipper comes in to get the halyard. As the skipper hoists the sail, the crew should pull the guy back and push the pole forward until it meets the corner of the sail. The pole is set by aligning it with the boom, Cleat the guy. This might require turning around to cleat near the traveler. Some boats have guy cleats near the shrouds. Finally ,reach across the boat and pick up the sheet. A good skipper can uncleat and trim the sheet as the crew is fooling with the guy.

Note: Throughout the set, all three corners of the sail are under tension. The head is being pulled up by the halyard, the tack by the guy, and the sheet cleated to keep the clew in. This cuts down the risk of twisting the sail The sheet is nucleated as the sail goes up full and over trimmed. Be prepared to have your sail area doubled in about two seconds. When this happens, the skipper must be able to bear off and the crew needs to hike hard.

A windward set is trickier because the chute can be blown into the jib. During a leeward hoist, the sail will harmlessly be blown away from the boat. Before any spinnaker set, the crew first checks the sail and informs the skipper of the type of set When preparing for a windward set, the crew should uncleat both the guy and the sheet, and give the guy a yank to get some slack in the line. Without this slack, the chute will not be able to get around the jib fast enough.

Next, the pole is attached to the guy but is not put out any further. The entire spinnaker is pulled out of the bag and after yelling "go", is tossed up towards the fore stay. The skipper raises the sail as fast as possible. The throw must be good

enough to get the spinnaker all the way around to the lee side of the boat or you'll have to peel the sail off the jib and toss it again. Once the spinnaker is clear of the forestay, the pole can be fully attached to the topping lift and spinnaker ring and trimmed in a normal fashion.

Its best to try windward sets on low reaches and runs first. These are usually quite tame and easy to do as the spinnaker will tend to blow out in front of the sail and not into the jib. The hardest weather sets are on windy days on high reaches. The spinnaker, like all other sails, is trimmed with the sheet. The sheet is eased until the luff , the edge on the same side as the pole, just begins to curl.

Beware: Spinnakers are tricky beasts and will completely collapse if you take your eye off them for even a second. Should the chute collapse, rapidly trim in until the sail fills, then ease the sheet back out. The pole is set roughly perpendicular to the wind. On a broad reach or run, the pole should be about two-thirds of the way back, while on a close reach, it can be eased as far forward as possible without resting on the forestay. Spinnaker pole position is adjusted with the guy, which may be cleated either near the traveler, or near the forestay.

If cleated near the traveler, the crew will be forced to look away from the sail while adjusting the pole. Using the forward cleats allows the guy to be adjusted while the sheet is being played. The pole height is adjusted with the topping lift. It also controls the shape of the sail and the width of the slot between the spinnaker and working sails. The rules of the 470 class require a spinnaker pole that is smaller than optimal.

Because of this, the luff is frequently choked off and the pole must be flown higher than is common on many other classes of boats. The pole should never be lower than perpendicular to the mast and can be carried as high as perpendicular to the stay. Generally, the pole should be lowest in light air and on broad reaches and runs, and highest on close reaches in heavy air.

A rule of thumb for optimum pole height is the height at which the luff of the spinnaker breaks or curls exactly midway between the head and tack of the sail. The topping lift down haul on a 470 is made of shock cord which is not strong enough to prevent the pole from "skying" in a gust. However, by holding the guy down, the pole can be kept under control. This is done either with small hooks on the chain plate or with a line and cleat system known twings. The guy should be pinned down whenever the boat is reaching and can be pinned on runs except in very light air. If your boat has twings, be sure the leeward twing is cleated at all times. Keeping the sheet down only chokes the spinnaker.

A 470 spinnaker can be pumped to get a surge of power to pop the boat on a plane or surf. Pumping works best on heavy air runs or broad reaches when the waves are up. The chute is pumped by simultaneously and rapid tugging on the guy and sheet and then releasing them to their normal positions. At the same time, the skipper quickly trims the main and hikes to keep the boat flat. This other technique requires lots of practice to be effective. One needs a good feel to know when the boat is ready for a pump. A good way to get a general notion of what's going on is to go for a sail with someone who knows the feel of the boat.

When sailing off the wind, especially in a race, the crew's job is to keep the spinnaker trimmed. The skipper is responsible for tactics and boat balance. This

is almost a complete reversal of the jobs from the beat, when the skipper concentrates on boat speed and the crew calls the shots and keeps the boat level. On the reaches the crew should sit on the windward tank in order to get a full view of the chute. The skipper will usually sit on the leeward tank and thus have a good look upwind for puffs. Some sailors have the skipper sit on the weather tank and the crew on the centerboard trunk. This gives both sailors poor views and concentrates weight in the center making the boat more unstable.

The ultimate thrill in sailing a 470 is trepanning with the chute up. Be prepared to go swimming the first couple of times you try it. The skipper should be ready to jump all over to keep things under control. The crew must be ready to go from flat out on the wire to sitting in the boat, and right back out, while still keeping the spinnaker in trim. The trickiest step is getting from the boat to out on the wire. Unlike going upwind, you'll have to concentrate on keeping a sail trimmed and have one hand full of the sheet. This prevents you from using the trepanning handle. Keeping the ring pulled up will allow you to swing out much easier. You will also find it necessary to keep your legs spread further apart as reaches are bumpier than beats. Remember, as you are trying to swing out, the spinnaker sheet will be trying to pull you in ... good luck!

When flying the chute from the wire, lots of trim adjustments will be necessary. As a gust hits and the apparent wind moves aft; the chute may become over trimmed. Also, the skipper must be able to bear off rapidly to get the boat under control. If the spinnaker is not released, the forces loading up on the rig prevent the skipper from bearing off.

Therefore, as soon as you feel a gust, ease the chute off and extend yourself on the wire to keep the boat flat. Try not to release the sheet too much because a spinnaker collapse will cause you to roll abruptly to weather. When the boat flattens out and starts to plane, the chute will have to be retrimmed. This can be a lot of work and you may find that fast reaching legs will leave you quite breathless. Jibing a 470 is rather easy under most conditions. Flying jibes are the rule. The skipper either grabs the mainsheet parts or the crew grabs the vang, and throws the boom across. Jibing in heavy air with the chute up becomes a bit trickier because it is a very fast maneuver. Be prepared to throw your weight across the boat to keep it stable. Keep control of the tiller and don't allow the boat to round up after the jibe.

There are two ways to jibe with the spinnaker up. First, the normal jibe which is used when jibing on runs or in light air. Second, jibing from reach to reach. The reach to reach fast jibe is a high speed technique for jibing from trapeze to trapeze.

For the normal jibe, the skipper informs the crew of the upcoming maneuver and takes control of the spinnaker sheet. Spinnaker lines on a 470 are run right through the cockpit of the boat. The skipper can reach the sheet right nearby. The crew does not pass an end of the sheet back over the traveler and cause an unnecessary mess. Once the skipper has the sheet, the guy is taken in the same way. The skipper can then straddle the tiller and steer. As the crew jibes the main with the vang, the skipper pulls the spinnaker around and flies it while the crew jibes the pole.

This is done by unclipping the spinnaker pole from the mast, clipping it onto the

new guy, unclipping it from the old guy and rehooking it onto the mast ring. The guy is then cleated, the spinnaker is flying, and the twings are reset. The two trickiest parts of the jibe involve coordinating weight placement between skipper and crew while keeping the chute flying. It helps if the crew, while reattaching the pole to the mast ring, pushes it out towards the front and as close to the proper height as possible. This will assist the skipper in flying the chute continuously through the jibe.

A good drill involves sailing dead downwind and jibing every 10 boat lengths. Also, try flying the chute without the pole as the skipper stands, steers and plays the guy and sheet while jibing back and forth.

The reach to reach jibe is much more demanding and is generally used only once during a race (as you round the jibe mark). If done correctly however, it can result in passing 3 or 4 boats at that mark. Be forewarned that this type of jibe requires quite a bit of practice but is well worth the effort.

The reach to reach jibe begins with the skipper and crew both being fully hiked out and the boat planing on a high reach. The skipper takes the sheet from the crew, hikes very hard and bears off slightly to allow the crew to swing in. The crew unhooks on the way in, pops the jib out of the cleat and if possible, pulls the leeward twing in as much as possible in one tug. The skipper then releases the sheet, leaving the chute flailing, bears off and jibes the main by tossing the boom across the boat with the mainsheet parts. As the boat is jibing., the crew uncleats the (old) windward twing and pulls the chute around the jib by yanking on the old guy. Once the main is jibed, the skipper can begin to trim the mainsheet and reach across the boat for the spinnaker sheet.

Meanwhile, the crew moves to the windward side, trims in the (new) windward twing all the way and cleats the guy (at the shroud cleat) at a predetermined mark that will keep the pole just off the forestay. Finally, the pole is moved to the proper side. As soon as the skipper sees the pole hooked to the mast ring, he trims in the spinnaker sheet. The crew grabs the handle, pops out, hooks onto the trapeze and takes the spinnaker sheet from the skipper. Once things are settled down, the skipper and crew both heave a brief sigh of relief, hike out, the skipper trims the main in properly. The crew re-trims the jib and the boat takes off. That's all there is to it.

Dousing is just the reverse of setting, but easier. The skipper takes the sheet from the crew and trims as the crew takes the pole down. As soon as the pole is off the mast, the sheet can be released. As the pole is removed and being slid into the bilges, the crew grabs the guy. The foot of the sail is gathered and this causes the spinnaker to collapse. The crew then yells to the skipper to lower the halyard. While the crew stuffs the chute into the bag, the skipper should watch as the sail comes down so not to drop it too fast.

Note that the spinnaker is always taken down on the windward side of the boat. In heavy weather, the spinnaker can be made more manageable by pulling in both twings before the douse.

A handy racing tip is to set up your boat for the upcoming beat before taking the spinnaker down. For example, board down, cunningham in, out haul retightened, just to name a few things. Then, after the douse, you can devote your full

attention to doing a good rounding and getting the boat right on the wind while your competitors are flopping around with their heads in their bilges.

CAPSIZE

If you never capsize a 470, you're probably doing something wrong! It might be that you don't drive your boat as hard as you could, or that you don't go out in conditions as rough as you can handle or you are overly cautious and prevent the boat from living up to its full potential. One of the joys of 470 sailing is the boat's manageability after a capsize. Many boats are impossible to pull up or tend to stay swamped after a dump, but a 470 will pop right back up, almost dry as a bone with just a little practice. The first spill is always the roughest and dumping in a blow can be pretty unnerving regardless of how much practice you've had.

The 470 alas, is rather unhappy sitting on its side. It would prefer to be upright or turtled. It is very important, therefore, to move quickly after each capsize if you want to avoid turtling. The surest way to force a dumped 470 to turtle is to sit on the gunwale. In as much as the crew may need some time to unhook, in many cases, he'll be the culprit. Therefore, to reduce the time and effort needed to get sailing again, it is necessary to get the crew off the gunwale immediately. This usually involves dropping into the water on the low side. Before deciding to take the final plunge, the crew should take a quick glance at the skipper, if possible to figure out what he's about to do.

There are those occasions when it pays for the skipper to drop into the drink and the crew to go right for the centerboard. This happens when the skipper is sitting to leeward or off balance as the boat rolls. In most instances however, the crew should go into the water as the skipper goes for the board as fast as possible.

A word of caution: 470's have bailers with extremely sharp edges that have a tendency to rip up legs. Be careful getting onto the board and then close the bailer with the palm of your hand before doing anything else. Once someone is on the board the boat will stabilize and not roll any farther. After hitting the water, the crew should get unhooked, tangled their self from the lines floating around, and climb out of the sail.

It's a good idea to yell out so that you know where each other is. Communication becomes very important when you can't see your partner through the boat.

At this point, the centerboard should be extended to its full down position for maximum leverage. If your board has a friction system it is easy to pull it out from the bottom of the boat. Both skipper and crew needs to remember to uncleat the main, jib, and spinnaker sheets as well as the boom vang as these will all tend to make the boat unmanageable as it is pulled up. The person on the board can back up to its edge and start to pull the boat up. Holding the trapeze handle gives you better stability and leverage as you back up. As the boat comes up, the crew in the water should hook his arm around the traveler bar or under a hiking strap. Once the boat starts to come up, it picks up speed and can roll all the way over unless its stopped. By hanging on to the traveler you can put your weight on the tank as soon as the boat reaches vertical and check its roll (holding onto the trapeze handle works well also). Often the boat will begin to sail before both of you are back in, so it will be important that the person nearest the stern be ready to grab the helm before climbing out of the water.

It doesn't matter which way the boat is lying when being righted. As soon as the head of the sail pulls out of the water, the wind will pivot the boat and flip the boat right up. The person in the water must be very fast since it will be necessary to really pull down hard to keep the boat from rolling over in the other direction.

Should the boat turtle, both skipper and crew may have to get up on the bottom of the boat and pull on the board. If the centerboard has slipped down into the slot, it will be necessary for one of you to swim under the boat and push it out. Once the centerboard is fully extended, both sailors should pull the boat gently by leaning on the board. Bouncing too hard can damage the board as well as the trunk. When the tip of the mast is just lying on the surface of the water, one of you must get in the water and swim to the low side. The person on the board should stabilize the boat until the other person is in position on the low side. After that, it's exactly the same as an ordinary capsize.

Many, if not most capsizes occur when sailing off the wind, when the spinnaker is likely to be up. When this happens, the chute has a tendency to get intricately tangled between the spreaders, shrouds or anything else that's handy. Try to get the chute completely free of the rigging before bringing the boat back up. It may be necessary to detach the chute from its halyard and/or sheets to unravel the mess.

Note: Secure the halyard to something or at least stop knot it to prevent it from pulling into the mast.

A sure way to tear a spinnaker is by yanking at it when it's tangled after righting the boat. If you bring it up and it's not lashing freely, restrain the violent whipping as much as possible while you gently free the snags.

If you capsize in shallow water it's critical that the mast tip be eased out of the mud slowly to avoid bending it. The key is to avoid excessive muscling or bouncing on the board. Be patient and the wind will eventually back the boat out of the mud and allow the boat to be righted with little force. Be especially careful when you capsize near shore. Before you know it, you may find yourself blown into shallow water.

APPENDIX

Even before putting the boat in the water there are numerous decisions that are made by racing sailors in preparing their boats. There is, of course, the selection of the mast, which is based principally on its bend characteristics (both fore and aft and side to side) and weight. At this point you probably have little choice of mast.

Another is the spreaders. Two adjustments can be made with spreaders: length and angle. Neither of these should be messed with until you feel quite certain that you know what you're doing. The fine points of spreader adjustment are beyond the scope of this manual. Nonetheless, there are a couple of basics that you can keep in mind. Long spreaders make the mast stiffer sideways. This makes the rig more powerful and is favored by heavier crews, those that don't sail in oceans where there are large waves to power through, and those that have specially cut flat sails. Spreader angle affects the fore and aft bend characteristics. Pinning the spreader tips further aft increases the amount that the mast is bowed by tension

on the shrouds and the pressure of the mainsheet.

When setting up the mast, there are two things that should be kept in mind: the rig tension and rake. The rake is not the same as bend. Rake influences the position of the Center of Effort and the helm of the boat. Raking the mast back moves the CE back and increases weather helm. Rake also affects mainsail shape by determining the tension on the mainsheet when the boom is pulled all the way in.

Finally, mast rake affects jib trim by changing the width of the slot between the main and jib. Raking the mast aft has the same effect on the jib as moving the jib fairlead aft. It opens up the slot. A lot of experimenting by the experts has been done to determine the best rake. The general consensus is that the mast should be set up so that a tape measure shackled to the main halyard and hoisted the masthead should read 22 feet 2 inches at the transom with the jib hoisted.

Note that this has the mast raked aft of vertical.

In heavier air, the "big boys" have decreed that the mast may be leaned back a bit and the rake measurement reduced to 21 feet, 11 inches in overpowering conditions.

The next decision is the rig tension. Greater tension on the shrouds and forestay keeps the mast from jumping around in a chop, "prebends" the mast by compression, and affects both the entry and amount of jib luff sag. Keeping the rig firmly anchored is clearly an advantage in heavy weather, but the importance of rig tension on the shape of the sails is much more important in all conditions.

Most 470 mains are cut to expect a certain amount of mast bend. This allows them to perform most efficiently under the widest range of wind conditions. In many instances, mast bend is induced by tension on the mainsheet and boom vang, which, by pulling on the mainsail leech, pulls the mast tip back. However, in light air there should be very little tension on the main and the vang should not be used at all. The slight amount of bend caused by the tension of the shrouds is necessary for the sail to set correctly.

Tight shrouds also cause a tight fore stay, which prevents the luff of the jib from sagging off in gusts. Luff sag kills both speed and control as it results in the jib getting fuller in puffs. With a tight fore stay, the jib shape stays constant through puffs and lulls.

Rig tension also affects the entry of the jib. Too little tension causes too full of an entry and the boat feels sluggish. Too much makes the boat very difficult to keep "in the groove". Fortunately, it is almost impossible to over trim a 470 rig. Most competitive sailors find that a super tight rig is extremely fast and equip their boats with a powerful block and tackle system to tension the jib stay.

Rig tension and mast rake are obviously influenced by the same adjustments. It is important to alter both the shroud length and jib halyard to properly tune your rig. Once the shrouds are set, increasing tension on the jib stay does two things: 1) it straightens the rake by pulling the mast forward and 2) it pulls against the shrouds and thus increases rig tension.

Small changes in the halyard have a greater effect on rake than on rig tension.

Changing the length of the shrouds by choosing a new hole on the chain plate has a greater effect on tension than on rake. Therefore, when setting up your boat, its best to think of the jib halyard as a rake adjustment and the shrouds as a tension adjustment.

Remember, for your rig to be set up properly both must be adjusted together. For example, if you find it necessary to drop your mast back, the halyard is the main control but your shrouds must be pinned in a lower hole to take up the "slack" and maintain proper tension. Some of the better racing sailors have quick release pins on their shrouds so that they can retune their rig on the water if necessary.

Sails must have an air foil shape in order to pull a boat upwind. Putting a flat sheet on the mast just won't do the trick. Over the years, sail makers have devised two construction techniques to create and control the shape of the sail. Broad seaming sets the depth and position of the draft in the sail. As the name implies, broad seaming involves overlapping the seams of the panels in the sail.

The second technique, luff curve, allows the fullness of the sail to easily be changed while the boat is underway. Camber is forced into a sail with a curved luff that is placed on a relatively straight mast. By allowing the mast to bend, you cause the sail to become flatter and flatter until the amount of bend equals the amount of curve cut into the luff and luff curve no long contributes to the fullness of the sail. Bending the mast also allows the leach to twist off, further depowering the main. The mast can be bent beyond the luff curve, which causes the sail to invert and large diagonal wrinkles to radiate from the clew to the spreader. Inversion should be avoided in all but the heaviest of wind. Under extreme conditions, an inverted main, though almost completely depowered, still allows the boat to point in and the main not be eased out too far.

Mains of 470's, as well as most other dinghies, have both broad seaming and luff curve in order to create sails that are effective over a wide range of wind and sea condition.

Happy Sailing

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