

General Principles of Working a Ship *The New Practical Navigator (1814)*

A ship is acted upon principally by the rudder and sails. When the rudder is fore-and-aft, that is, on a line with the keel, the water runs by it, and it has no effect upon the ship's direction. When it is changed from a right line to one side or the other, the water strikes against it, and forces the stern in an opposite direction. For instance, if the helm is put to the starboard, the rudder is put off the line of the keel, to port. This sends the stern off to the starboard, and, of course, the ship turning on her centre of gravity, her head goes in an opposite direction, to port. If the helm is put to port, the reverse will follow, and the ship's head will turn off her course to starboard. Therefore the helm is always put in the opposite direction from, that in which the ship's head is to be moved.

Moving the rudder from a right line has the effect of deadening the ship's way more or less, according as it is put at a greater or less angle with the keel. A ship should therefore be so balanced by her sails that a slight change of her helm may answer the purpose.

If a vessel is going astern, and the rudder is turned off from the line of the keel, the water, striking against the back of the rudder, pushes the stern off in the same direction in which the rudder is turned. For instance, if sternway is on her, and the helm is put to the starboard, the rudder turns to port, the water forces the stern in the same direction, and the ship's head goes off to the starboard. Therefore, when sternway is on a vessel, put the helm in the same direction in which the head is to be tuned.

A current or tide running astern, that is, when the ship's head is toward it, will have the same effect on the rudder as if the ship were going ahead; and when it runs forward, it will be the same as though the ship were going astern.

It will now be well to shew how the sails act upon a ship, with reference to her centre of rotation. Suppose a vessel to be rigged with three sails, one in the forward part, one at the centre, and the third at the after part, and her left or larboard side to be presented to the wind, which we will suppose to be abeam, or at right angles with the keel. If the head sail only were set, the effect would be that the wind would send the vessel a little ahead and off to the starboard on her centre of rotation, so as to bring her stern slowly round to the wind. If the after sail only were set, the vessel would shoot ahead a little, her stern would go off to the starboard and her head come up into the wind. If only the centre sail were set, the effect would be the same as if all three of the sails were set, and she would go ahead in a straight line. So far, we have supposed the sails to be set full, that is, with their tacks forward and their sheets aft. If they were all set aback, the vessel would go astern nearly, if the rudder were kept steady, in a straight line. If the head sail only is set and aback, she will go astern and round upon her axis, with her head from the wind, much quicker than if full. So, if the after sail alone were, set and aback, she would go astern, and her head would come suddenly into the wind.

These principles of the wind acting upon the sails, and the water upon the rudder, are the foundation of the whole science of working a ship. In large vessels the sails are numerous, but they may all be reduced to three classes, viz., head sails, or those which are forward of the centre of gravity or rotation, having a tendency to send the ship's head off from the wind, after sails, or those abaft the centre, of rotation, and which send the stern off and the head toward the wind; and lastly, centre sails, which act equally on each side the centre of rotation, and do not turn the ship off her course one way or the other. These

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classes of sails, if set aback, tend to stop the headway and send the ship astern, and also to turn her off her course in the same direction as when set full, but with more rapidity. The further a sail is from centre of rotation, the greater is its tendency to send the ship off from the line of her keel. Accordingly, a jib is the strongest head sail, and a spanker the strongest after sail.

The centre of rotation is not necessarily at the centre of the ship. On the contrary, as vessels are now built, it may not be much abaft that part of the deck to which the main tack is boarded. For the main breadth, or dead-flat, being there, the greatest cavity will also be there, and of course the principal weight of the cargo should centre there, as being the strongest part. Therefore the centre of rotation will depend upon proper stowage. If the ship is much by the stern, the centre of rotation will be carried aft, and if by the head, it will be carried forward. The cause of this is, that when loaded down by the stern, her after sails have but little effect to move her stern against the water, and a very slight action upon the forward sails will send her head off to leeward, as she is there light and high in the air. Accordingly, to keep her in a straight line, the press of sail is required to be further aft, or, in other words, the centre of rotation is further aft. If a ship is loaded down by the head, the opposite results follow, and more head and less after sail is necessary.

A ship should be so stowed, and have her sails so trimmed, that she may be balanced as much as possible, and not be obliged to carry her helm much off the line of her keel, which tends to deaden her way. If a ship is stowed in her best sailing trim, and it is found, when on a wind, that her head tends to windward, obliging her to carry a strong weather helm, it maybe remedied by taking in some after sail, or adding head sail. So, if she carries a lee helm, that is, if her head tends to fly off from the wind, it is remedied by taking in head or adding after sail. Sometimes a ship is made to carry a weather helm by having too much head sail set aloft. For, if she lies much over on a wind, the square sails forward have a tendency to press her downwards and raise her proportionally abaft, so that she meets great resistance, from the water to leeward under her bows, while her stern, being light, is easily carried off; which, of course, requires her to carry a weather helm.

The general rules, then, for turning a ship are these: to bring her head to the wind, put the helm to leeward, and bring the wind to act as much as possible on the after sails, and as little as possible on the head sails. This may be done without taking in any sail, by letting go the head sheets, so that those sails may lose their wind, and by pointing the head yards to the wind, so as to keep the head sails shaking. At the same time keep the after sails full, and flatten in the spanker sheet; or, if this is not sufficient, the after sails may be braced aback, which will send the stern off and the head to windward. But as this makes back sails of them, and tends to send the vessel astern, there should be either head or centre sails enough filled to counteract this and keep headway upon her. On the other hand, to turn the head off from the wind, put the helm to windward, shiver the after sails, and flatten in the head sheets. Brace the head yards aback if necessary, being careful not to let her lose headway if it can be avoided.

The vessel may be assisted very much in going off or coming to, by setting or taking in the jib and spanker; which, if the latter is fitted with brails, are easily handled.

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TACKING

Have the ship so suited with sails that she may steer herself as nearly as possible, and come to with a small helm. Keep her a good full, so that she may have plenty of headway. *Ready, about!* Send all hands to their stations. The chief mate and one, two, or more of the best men, according to the size of the vessel, on the forecastle, to work the head sheets and bowlines and the fore tack; two, or more good men (one usually a petty officer, or an older and trusty seaman) to work the main tack and bowline. The second mate sees the lee fore and main braces clear and ready for letting go, and stands by to let go the lee main braces, which may all be belayed to one pin. Put one hand to let go the weather cross-jack braces, and others to haul in to leeward; the cook works the fore sheet, and the steward the main; station one or more at the spanker sheet and guys; and the rest at the weather main braces.

Ease the helm down gradually; *Helm's a-lee* and let go the jibsheet and fore-sheets. As soon as the wind is parallel with the yards, blowing directly upon the leaches of the square sails, so that all is shaking, *Raise tacks and sheets!* and let go the fore and main tacks and main sheet, keeping the fore and main bowline fast. As soon as her head is within a point or a point and a half of the wind, *Mainsail haul!* let go the lee main and weather cross-jack braces, and swing the after yards round. While she is head to the wind, and the after sails are becalmed by the head sails, get the main tack down and sheet aft, and right your helm, using it afterwards as her coming to or falling off requires. As soon as she passes the direction of the wind, shift your jib sheets over the stays, and when the after sails take full, or when she brings the wind four points on the other bow, and you are sure of paying off sufficiently, *Let go and haul!* brace round the head yards briskly, down fore tack and aft the sheet, brace sharp up and haul your bowlines out, and trim down your head sheets.

It is best to haul the mainsail just before you get the wind right ahead, for then the wind, striking the weather leaches of the after sails, forces them round almost without the braces, and you will have time to brace up and get your tack down and sheet aft, when she has payed off on the other side.

If she falls off too rapidly while swinging your head yards, so as to bring the wind abeam or abaft, *Vast bracing!* Ease off head sheets and put your helm a-lee; and as she comes up, meet her and brace sharp up. If, on the other hand (as sometimes happens with vessels which carry a strong weather helm), she does not fall off after the after sails take, be careful not to haul your head yards until she is fully round; and if she should fly up into the wind, let go the main sheet, and, if necessary, brail up the spanker and shiver the cross-jack yards. In staying, be careful to right your helm before she loses headway.

To TACK WITHOUT FORE-REACHING

As in a narrow channel, when you are afraid to keep head-way. If she comes slowly up to windward, haul down the jib and get your spanker-boom well over to windward. As you raise tacks and sheets, let go the lee, fore topsail brace, being careful to brace up again as soon as she takes aback. Also, hoist the jib, and trim down, if necessary, as soon as she takes on the other side.

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TACKING AGAINST A HEAVY HEAD SEA

You are under short sail, there is a heavy head sea, and you doubt whether she will stay against it. Haul down the fore topmast staysail, ease down the helm, and raise fore sheet. When within about a point of the wind's eye, let go main tack and sheet, lee braces and after bowlines, and *Mainsail haul!* If she loses her headway at this time, shift your helm. As soon as she brings the wind on the other bow, she will fall off rapidly by reason of her sternway, therefore shift your helm again to meet her, and *Let go and haul!* at once. Brace about the head yards, but keep the weather braces in, to moderate her falling off. When she gets headway, right the helm, and as she comes up to the wind, brace up and haul aft.

TACKING BY HAULING OFF ALL

This can be done only in a smooth sea, with a light working breeze, a smart vessel and strong crew. Man all the braces. Let her come up head to the wind, and fall off on the other tack, shifting the helm if she gathers sternway. When you get the wind about five points on the other bow, *Haul off all!* let go all the braces and bowlines and swing all the yards at once. Right the helm, board tacks and haul aft sheets, brace up and haul out.

To TRIM THE YARDS WHEN CLOSE-HAULED

In smooth water, with a little breeze, brace the lower yards sharp up, and trim the upper each a trifle in abaft the one below it. If you have a pretty stiff breeze, brace the topsailyard in about half a point more than the lower yard, and the topgallant-yard half a point more than the topsailyard, and so on. If you have a strong breeze and a topping sea, and especially if reduced to short sail, brace in your lower yards a little, and the others proportionally. This will prevent the vessel going off bodily to leeward; and if she labours heavily, the play of the mast would otherwise carry away the braces and sheets, or spring the yards.

MISSING STAYS

If after getting head to the wind she comes to a stand and begins to fall off before you have hauled your mainyard, flatten in your jibsheets, board foretack, and haul aft foresheet; also ease off spankersheet, or brail up the spanker, if necessary. When she is full again, trim the jib and spankersheets, and when she has recovered sufficient headway, try it again. If, after coming head to the wind, and after the afteryards are swung, she loses headway and refuses to go round, or begins to fall off on the same tack on which ship was before, and you have shifted the helm without effect, haul up the mainsail and spanker, square the after yards, shift your helm again a-lee, so as to assist her in falling off, and brace round the head yards so as to box her off. As she falls on her former tack, brace up the after yards, brace round the head yards, sharp up all, board tacks, haul out and haul aft.

WEARING

Haul up the mainsail and spanker, put the helm up, and, as she goes off, brace in the after yards. If there is a light breeze, the rule is to keep the mizzen-topsail lifting and the maintopsail full. This will keep sufficient headway on her, and at the same time enable her to fall off. But if you have a good breeze and she goes off fast, keep both the main and

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mizzen-topsails lifting. As she goes round, bringing the wind on her quarter and aft, follow the wind with your after yards, keeping the mizzen-topsail lifting, and the main either lifting or full, as is best. After a vessel has fallen off much, the less headway she has the better, provided she has enough to give her steerage. When you have the wind aft, raise fore-tack and sheet, square the headyards, and haul down the jib. As she brings the wind on the other quarter, brace up sharp the after yards, haul out the spanker, and set the mainsail. As she comes to on the other tack, brace up the headyards, keeping the sails full, board fore-tack and aft the sheet, hoist the jib, and meet her with the helm.

To WEAR UNDER COURSES

Square the cross-jack-yards, ease off the main-bowline and tack, and haul up the mainsail. Ease off the mainsheet, and haul up the lee-claw, and the buntlines and leachlines. Square the mainyards and put the helm a-weather. As she falls off, let go the fore-bowline, ease off the foresheet, and brace in the foreyard. When she gets before the wind, board the fore and maintacks on the other side, and haul aft the mainsheet, but keep the weather braces in. As she comes to on the other side, ease the helm, trim down the foresheet, brace up and haul out.

To WEAR UNDER A MAINSAIL

Vessels lying-to under this sail generally wear by hoisting the fore-topmast staysail, or some other head sail. If this cannot be done, brace the cross-jack-yards to the wind, and, if necessary, send down the mizzen-topmast and the cross-jack-yard. Brace the headyards full. Take an opportunity when she has headway, and will fall off, to put the helm up. Ease off the mainsheet, and, as she falls off, brace in the mainyard a little. When the wind is abaft the beam, raise the maintack. When she is dead before it, get the other maintack down as far as possible; and when she has the wind on the other quarter, ease the helm, haul aft the sheet, and brace up.

To WEAR UNDER BARE POLES

Some vessels, which are well down by the stern, will wear in this situation, by merely pointing the after yards to the wind, or sending down the mizzen-topmast and the cross-jack-yard, and filling the headyards; but vessels in good trim will not do this. To assist the vessel, veer a good scope of hawser out of the lee-quarter, with a buoy, or something for a stop-water, attached to the end. As the ship sags off to leeward, the buoy will be to windward, and will tend to bring the stern round to the wind. When she is before it, haul the hawser aboard.

BOX-HAULING

Put the helm down, light up the headsheets and slack the lee-braces, to deaden her way. As she comes to the wind, raise tacks and sheets, and haul up the mainsail and spanker. As soon as she comes head to the wind and loses her headway, square the after-yards, brace the headyards sharp aback, and flatten in the headsheets. The helm, being put down to bring her up, will now pay her off, as she has sternway on. As she goes off, keep the after sails lifting, and square in the headyards. As soon as the sails on the foremast give her headway, shift the helm. When she meets the wind on the other quarter haul down the jib, haul out the spanker, set the mainsail, and brace the after yards sharp up. As she comes to

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on the other tack, brace up the headyards, meet her with the helm.

BOX-HAULING SHORT

(sometimes called wearing short round) Haul up the mainsail and spanker, put the helm hard a-weather, square the afteryards, brace the headyards sharp aback, and flatten in the head sheets. As she gathers sternway, shift the helm. After this, proceed as in box-hauling by the former method. The first mode is preferable when you wish to stop headway as soon as possible; as a vessel under good way will range ahead some distance after the sails are thrown flat aback. Few merchant vessels are strongly enough manned to perform these evolutions; but they are often of service, as they turn a vessel round quicker on her heel, and will stop her from fore-reaching when near in-shore or when close aboard another vessel.

CLUB-HAULING

This method of going about is resorted to when on a lee shore, and the vessel can neither be tacked nor box-hauled. Cock-bill you lee-anchor, get a hawser on it for a spring, and lead it to the lee-quarter; range your cable, and unshackle it abaft the windlass. *Helm a-lee!* and *Raise tacks and sheets!* as for going in stays. The moment she loses headway, let go the anchor and *Mainsail haul!* As soon as the anchor brings her head to the wind, let the chain cable go, holding on to the spring; and when the after sails take full, cast off or cut the spring, and *Let go and haul!*

DRIFTING IN A TIDE-WAY

As a vessel is deeper aft than forward, her stern will always tend to drift faster than her head. If the current is setting out of a river or harbour, and the wind the opposite way, or only partly across the current, you may work out by tacking from shore to shore; or you may let her drift out, broadside to the current; or, keeping her head to the current by sufficient sail, you may let her drift out stern first; or, lastly, you may club her down. If the wind is partly across the current, cast to windward. If you work down by tacking, and the wind is at all across the current, be careful of the lee shore, and stay in season, since, if you miss stays, you may not be able to save yourself by wearing or box-hauling, as you might on the weather shore. If the channel is very narrow, or there are many vessels at anchor, the safest way is to bring her head to the current, brace the yards full, and keep only sail enough to give her steerage, that you may sheer from side, to side. If there is room enough, you will drift more rapidly by bringing her broadside to the current, keeping the topsails shaking, and counteract the force of the current upon the stern by having the spanker full and the helm a-lee. You can at any time shoot her ahead, back her astern, or bring her head to the current, by filling the headyards, taking in the spanker, and setting the jib; filling the after yards, taking in the jib, and setting the spanker; or by bracing all aback.

BACKING AND FILLING IN A TIDE-WAY

Counter-brace your yards as in lying-to, and drift down broadside to the current. Fill away and shoot ahead, or throw all aback and force her astern, as occasion may require. When you approach the shore on either side fill away till she gets sufficient headway, and put her in stays or wear her round.

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CLUBBING IN A TIDE-WAY

Drift down with your anchor under your foot, heaving in or paying out on your cable as you wish to present a broadside to the current. This method is it troublesome and dangerous one and rarely resorted to. An anchor will seldom drag clear through the whole operation.

LYING-TO

The best single sail to lie-to under, is generally thought to be a close-reefed maintopsail. The fore or the main spencer (sails which are used very much now instead of main and mizzen staysails) may be used to advantage, according as a ship requires sail more before or abaft the centre of gravity. If a ship will bear more than one sail, it is thought best to separate the pressure. Then set the fore and main spencers; or (if she carries staysails instead) the main and mizzen staysail; or, if she is easier under lofty sail, the fore and main topsails close-reefed. A close-reefed maintop-sail, with three lower storm staysails; or, with the two spencers, foretopmast staysail, and reefed spanker, is considered a good arrangement for lying-to. If the foretopmast staysail and balance reefed spanker can be added to the two close-reefed topsails, she will keep some way, will go less to leeward, and can be easily wore round. Close-reefed topsails are used much more now for lying-to than the courses. As ships are now built, with the centre of gravity farther forward, and the foremast stepped more aft, they will lie-to under head sail better than formerly. Some vessels, which are well down by the stern, will lie-to under a reefed foresail, as this tends to press her down forward; whereas, if she has much after sail, she would have all the lateral resistance of the water aft, and would come up to the wind. In carrying most head or after sail, you must be determined by trim of the vessel, her tendency to come to or go off, and as to whether the sail you use will act as a lifting or a burying sail.

A topsail has an advantage over a spencer or lower staysail for lying-to, since it steadies the ship better, and counteracts the heavy weather roll, which a vessel will give under low and small fore-and-aft sails.

SCUDDING

The most approved sail for scudding is the closereefed maintopsail, with a reefed foresail. The course alone might get becalmed under the lee of a high sea, and the vessel losing her way, would be overtaken by the sea from aft; whereas the topsail will always give her way enough and lift her. The foresail is of use in case she should be brought by the lee. Many officers recommend that the fore topmast staysail, or fore storm staysail, should always be set in scudding, to pay her off if she should broach-to, and with the sheets hauled flat aft.

It has been thought that with the wind quartering and a heavy sea, a vessel is more under command with a close-reefed foretopmast staysail and maintopmast staysail. The foretopmast staysail may also be hoisted. If the ship flies off and gets by the lee, the foretopmast staysail is soon braced about, and, with the maintopmast staysail sheet shifted to the other side, the headway is not lost.

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To HEAVE-TO AFTER SCUDDING

Secure everything about decks, and watch a smooth time. Suppose her to be scudding under a close-reefed maintopsail and reefed foresail; haul up the foresail, put the helm down, brace up the after yards, and set the mizzen staysail. As she comes-to, set the main staysail, meet her with the helm, brace up the head-yards, and set the fore or foretopmast staysail.

If your vessel labours much, ease the lee braces and the halyards, that everything may work fairly aloft, and let her have plenty of helm, to come-to and fall off freely with the sea. The helmsman will often let the wheel fly off to leeward, taking care to meet her easily and in season. The sails should be so arranged as to require little of the rudder.

TAKEN ABACK

It will frequently happen, when sailing close-hauled, especially in light winds, from a shift of wind, from its dying away, or from inattention, that the ship will come up into the wind, shaking the square sails forward. In this case, it will often be sufficient to put the helm hard up, flatten in the head sheets, or haul their bights to windward, and haul up the spanker. If this will not recover her, and she continues to come-to, box her off. Raise fore tack and sheet, haul up the spanker and mainsail, brace the head-yards aback, haul the jib sheets to windward and haul out the lee-bowlines. When the after sails fill, *Let go and haul!* This manoeuvre of boxing can only be, performed in good weather and light winds as it usually gives a vessel sternway.

If the wind has got round upon the other bow, and it is too late for box-hauling, square the yards fore and aft, keeping your helm so as to pay her off under sternway; and, as the sails fill, keep the after yards shaking, and haul up the spanker and mainsail, squaring the head-yards, and shifting your helm as she gathers headway.

CHAPPELLING

This operation is performed when, instead of coming-to, you are taken aback in light winds. Put the helm up, if she has headway, haul up the mainsail and spanker, and square the after yards. Shift the helm as she gathers sternway, and when the after sails fill, and she gathers headway, shift your helm again. When she brings the wind aft, brace up the after yards, get the main tack down and sheet aft, and haul out the spanker as soon as it will take. The head braces are not touched, but the yards remain braced as before. The former mode of wearing, by squaring the head-yards when the after sails are full, has great advantages over chappelling, as the vessel will go off faster when the wind is abeam and abaft, and will come-to quicker when the wind gets on the other side.

BROACHING-TO

This is when a vessel is scudding, and comes up into the wind and gets aback. For such an accident, the foretopmast staysail is set, which will act as an offsail, so that by keeping the helm up, with the maintopsail (if set) braced into the wind, she will pay-off again without getting sternway. If the close-reefed foretopsail is carried instead of the main, it can be easily filled.

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BROUGHT BY THE LEE

This is when a vessel is scudding with the wind quartering, and falls off so as to bring the wind on the other side, laying the sails aback. This is more likely to occur than broaching-to, especially in a heavy sea. Suppose the vessel to be scudding under a close-reefed maintopsail and reefed foresail, with the wind on her larboard quarter. She falls off suddenly and brings the wind on the starboard quarter, laying all aback. Put your helm hard a-starboard, raise fore tack and sheet, and fill the foresail, shivering the maintopsail. When she brings the wind aft again, meet her with the helm, and trim the yards for her course.

ON BEAM-ENDS

A vessel is usually thrown upon her beam-ends by a sudden squall taking her, when under a press of sail, and shifting the ballast. She must be righted, if possible, without cutting away the masts. For, beside sacrificing them, the object can seldom be accomplished in that way, if the ballast and cargo have shifted. Carry a hawser from the lee-quarter, with spars and other good stop-waters bent to it. As the ship drifts well to leeward, the hawser will bring her stern to the wind; but it may not cast her on the other side. If a spring can be got upon the hawser from the lee bow, and hauled upon, and the stern fast let go, this will bring the wind to act upon the flat part of the deck and pay her stern off, and assist the spring, when the sails may be trimmed to help her in righting. If she can be brought head to the wind, and the sails be taken aback, she may cast on the other tack. When there is anchoring ground, the practice is to let go the lee anchor, which may take the sails aback and cast her. Then the ballast and cargo way be righted.

If there is no anchoring ground, a vessel may still be kept head to the wind, by paying a chain cable out of the lee hawse-hole; or by bending a hawser to a large spar, which may be kept broadside to by a span, to the centre of which the hawser is bent. The same operation may be applied to a vessel overset, and is preferable to wearing by a hawser. Make fast the hawser forward to the lee bow, carry the other end aft to windward and bend it to the spar, and launch the spar overboard. By this means, or by letting go an anchor, though there be no bottom to be reached, a vessel may often be recovered.