

A Brief Introduction to Important Ship Mooring Techniques

*A Quick Reference Resource for
Deck Officers and Crew*



Marine Insight©

“A Brief Introduction to Important Ship Mooring Techniques”

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What is Mooring of Ship?

Mooring is a procedure to make fast the ship with a fixed or a floating object (Jetty, pier, ship, barge, buoy etc.) to held them together for various cargo operations. In other words-securing or confining of vessel in a particular location.

The mooring operation demands a high degree of teamwork both from ship's and port crew. It is of great importance that all crew involved in mooring operation are properly trained and equipped, and must have a clear understanding of the duties of fellow members, as well as their own role and responsibilities.

To be a safe and efficient team on ship, the mooring operations must be properly planned. For large ships on tidal berths, mooring plans are developed and agreed prior to vessel arrival, and roles and responsibilities of each crew and officers are explained .

The complete responsibility for coordinating the mooring operation lies with master of the ship (In case pilot is taking the lead, he will be responsible for the coordination) and not the shore/port mooring party.

The port authority also plays an important role to arrange the berth and equipment for ship to get alongside which also requires moving of cranes away from the area until the ship is along side or clear, or ensure cranes are in the ship's mid length area as the ship maneuvers near to the quayside.

What is Mediterranean Mooring of ship?



Image Courtesy: Sudhai Hazell

What happens when there is not enough space at the wharf for a number of ships or boats to be moored? Or what happens when there is a ramp at the stern of the ship (like a car carrier) that connects it to the hold? The answer is that the ship has to be moored perpendicular to the wharf with its stern transom (surface) lying parallel to the jetty. Such “end on” to the quay berthing is called “Mediterranean Mooring”.

Mediterranean mooring, also known as “med mooring”, is a technique for mooring a vessel to pier at a perpendicular

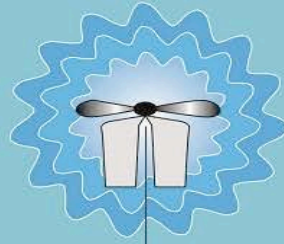
angle. The ship thus occupies less space as it is connected to a fixed length of pier along the width rather than its length. The disadvantage of Mediterranean mooring is that it is more likely to result in collisions and that it is not practical in deep water or in regions with large tides.

Mediterranean mooring can be done in two ways. Now the boats or crafts like yacht can be berthed bow to or stern to with the wharf depending upon the convenience or preference of the crew but in both cases an anchor is dropped from the opposite end of the one that is approaching the jetty in such a way so that that the end remains fixed and the anchor can be hove up and hauled out.

CASE 1: (Berthing Stern to)

At first the place where the ship's stern is to be brought alongside is located. A firsthand knowledge of the shore line is required, like if there is a protrusion or not at the underwater section or the bed is shallow or shoaled.

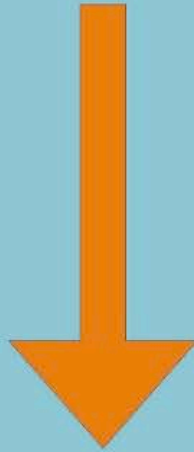
Mooring Stern-To



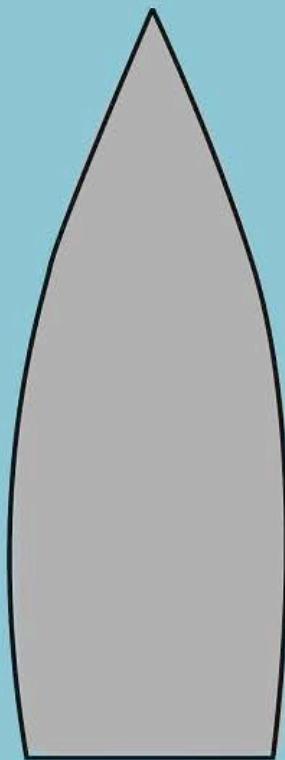
With stern toward dock, drop anchor

Back down, paying out rode but using tension to keep transform square to dock

Scope 7:1



With stern near dock, snub rode



Step ashore with long docklines

Set docklines at wide angles



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In that case the stern first approach is aborted and the bow first approach is tried. For a vessel having normal right handed propeller the wharf is best kept on the port side and the distance is kept more than seven ship's length.

The ship is at first kept parallel to the berth and then it is brought astern. The point of berthing is now generally abeam. All through the astern movement, the rudder is kept to hard over port so as to get the maximum canting effect. As the ship falls astern, the bow will naturally cant to starboard due to transverse thrust. The starboard anchor is dropped in such a way so that the scope (it's the ratio of the length of the anchor rode and the vertical distance from the bow of the vessel to the bottom of the water or the bed) is 7:1 (approx). So if the sea bed is 10 m down from the bow, a distance of 70 m is required. Smaller crafts with shorter anchor chain will try to make this distance as much as practicable.

The chain is let to fall free so that the anchor digs at the sea bed in the first attempt. It is ensured that there is no snag in the rode (it's the length of the anchor line or chain) and that there is enough length of the chain to reach the berth.

The anchor must be dropped away from the other anchor lines or the lazy lines, which are used to retrieve heavy pre embedded bow lines substituting the anchor. Otherwise fouling of the anchor chains or these lines can be quite a cumbersome affair during sailing.

Meanwhile hand fenders are arranged along the sides to protect the hull of the ship/boats on a windy day from colliding with the other crafts that are docked already. The vessel is slowly brought astern keeping in mind that the wind is not on-shore; otherwise the fall cannot be restricted. Offshore winds are of great help as they dampen the stern board movement and the vessel will have a tendency to stop without much use of the ahead movements on the telegraph.

When the wind is athwart, the first line ashore will be the one from the windward side. In this case if the wind pushes the starboard hull the starboard quarter line is to be sent ashore first. Then the other rope from the opposite end is thrown ashore and ensured that both the lines are "doubled up" i.e., the lines are made to take a turn on the shore bollard and are sent on board.

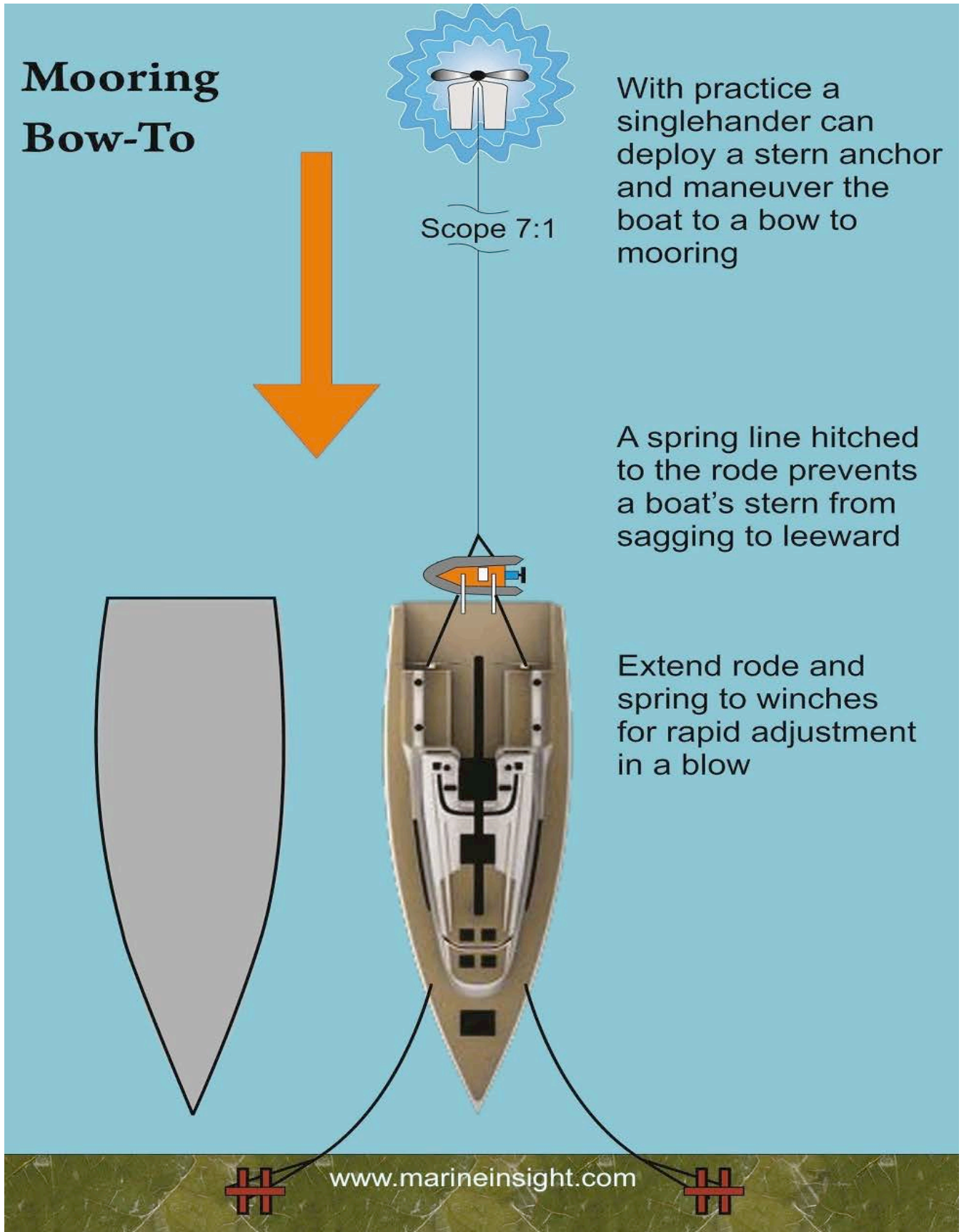
This helps the crew while hauling out as only casting one end of the line from on board the line can be retrieved with the winch without any shore assistance. On a windy day the first shoreline is sent ashore by a small motorboat or a dingy so that the vessel can be warped in with the help of its winches. While hauling in if the bow swings, corrective counter measures are taken with short kicks of forward movements and necessary helm or holding the anchor a bit, as the case may be. The lines ashore are fast in such a way that the angle between them is wide enough to restrict any swing of the stern due to any surge in the wave or wind. It is best to set another pair of lines across the stern to the shore.

The boarding ramp is employed for the crew to step out from the stern. Also cars and trucks loaded in the car carriers can be loaded or unloaded.

CASE 2 (Berthing Bow to):

Docking “Bow to” is much easier though as the pilot or the master has much more control over his ship as he steers in letting his stern anchor far off the berth so as it holds the

stern during the stay.



A line from each quarter is hitched to the chain aft to restrict any side wards play. Two lines are passed ashore from the port and starboard bow at a wide angle as in the previous case so as to make fast the bow to the jetty. This type of bow fast approach is done if there is an underwater shoal below the jetty or there is a protrusion.

In both cases the anchor is snubbed when there is only a boat length difference between the quay and the bow or stern. Engines are also given accordingly so as to avoid any untoward collision.

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What is Baltic Mooring Of Ship?

What happens when there is a strong onshore wind and you have to berth a ship without the assistance of tugs to a pier or jetty that is not strong enough to bear the impact or is not sufficiently ‘fendered’?

In such situations, the master or the pilot takes the recourse of using the ship’s anchor as well as the wires available on board in a specific way to minimize the impact of the fall. This is done by a mooring ship in such a way where a vessel is berthed alongside the quay by employing a stern mooring

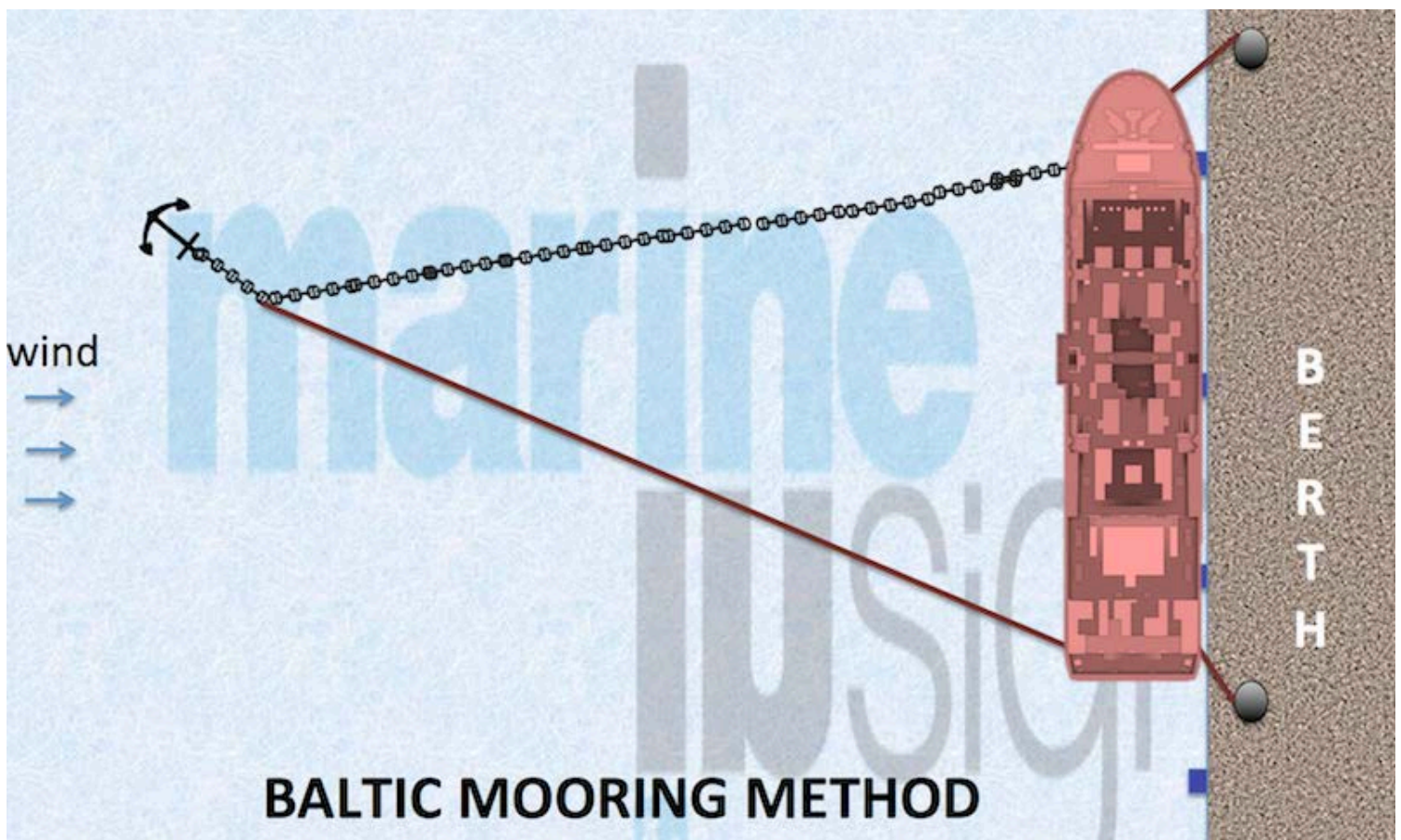
shackled to the offshore anchor cable in the region of the 'ganger length'. When approaching the berth, the offshore anchor is deployed and the weight on the cable and the stern mooring act in unison to hold the vessel just off the quay.

Baltic mooring is a combination mooring of a vessel alongside the berth which employs a stern mooring shackled to the offshore anchor cable in the region of the "ganger length". When approaching the berth, the offshore anchor is deployed and the weight on the cable and the stern mooring act to hold the vessel just off the quay. Baltic mooring is a safe option to berth a ship on a windy day.

Now, there is a preparatory process to be undertaken before venturing for the Baltic moor:

- At first a 30 mm wire is passed from the poop deck on the offshore side from the outside of the hull and clear of any protrusions like the gangway, the pilot ladder etc.
- The anchor is cockbilled, i.e., released a little from the hawse pipe before finally letting it go, and a man is

- lowered with a bosun's chair (a seat suspended from the ship to perform any work outside the ship's hull) to tie up the wire to the anchor with a shackle at about the ganger's length
- The other end of the wire is taken 'on turn' upon a mooring winch through a bight
- When the ship is abreast of the berth and falling on it rapidly, the anchor is dropped keeping trickle headway so that the anchor holds



- When the anchor is snubbed, the wire from the stern that goes in with the anchor, gets taught and effectively holds the fall of the stern
- The anchor chain is then slowly payed off and simultaneously the wire from the stern, while the on-shore wind pushes the vessel horizontally to the berth
- As soon as the vessel is close -springs, head and stern lines are passed ashore with the heaving lines and the scope of the anchor adjusted accordingly so as to bring the ship slowly alongside the berth
- Normally the anchor is dropped 70-100 feet off the berth depending on the wind force and vessel tonnage

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What is Single Point Mooring of Ship?



Image Courtesy: Saiful Pedang

Single point mooring (SPM) is a floating buoy/jetty anchored offshore to allow handling of liquid cargo such as petroleum products for tanker ships.

SPM is mainly used in areas where a dedicated facility for loading or unloading liquid cargo is not available. Located at a distance of several kilometers from the shore-facility and connected using sub-sea and sub-oil pipelines, these single point mooring (SPM) facilities can even handle vessels of massive capacity such as

Single point mooring (SPM) serves as a link between the shore-facilities and the tankers for loading or off-loading liquid and gas cargo. Some of the major benefits of using SPM are:

- Ability to handle extra large vessels
- Doesn't require ships to come to the port and thus save fuel and time
- Ships with high drafts can be moored easily
- Large quantity of cargo can be easily handled

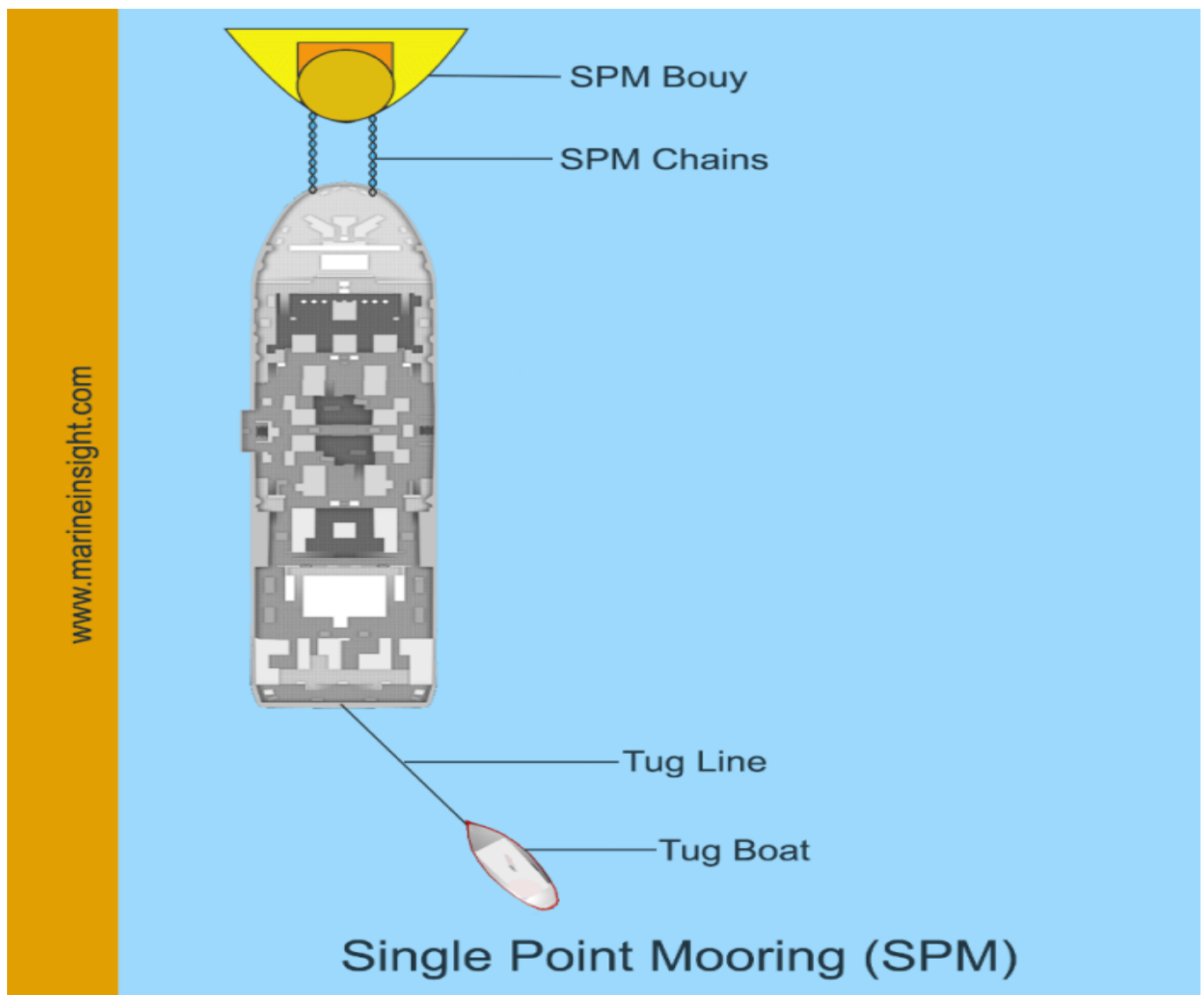
How Single Point Mooring (SPM) Works?

The offshore-anchored loading buoy is divided into different parts having dedicated functionality. Mooring and anchoring system, buoy body and product transfer system are the main parts of the SPM.

The SPM is moored to the seabed using mooring arrangement which includes anchors, anchor chains, chain

stoppers etc. The mooring arrangement is such that it permits the buoy to move freely within defined limits, considering wind, waves, current, and tanker ship conditions.

The buoy is anchored to the seabed using anchor chains (legs) which are attached to the anchor point (gravity based or piled) on the seabed. Chain stoppers are used to connect the chains to the buoy.



The part of the Single Point Mooring System (buoy body) which is floating above the water has a rotating part which connects to the tanker. The rotating part allows the tanker to get stable at its desired position around the buoy.

The tanker is usually moored to the buoy by means of a hawser arrangement, which consists of nylon or polyester ropes shackled to an integrated hook on the buoy deck.



Chafe chains are connected at the tanker end of the hawser to prevent damage from tanker fairlead. The mooring systems used for such offshore operations follow the standards put forth by OCIMF.

The product transfer system is located at the heart of the mooring buoy. The system transfers products to the tanker from the Pipeline End and Manifold (PLEM) (geostatic location) located on the seabed. Flexible hoses known as risers connect the subsea pipelines to the buoy's product transfer system. The buoy is connected to the tankers using floating hose strings, which are provided with breakaway couplings (A special type of coupling with a break point which will break at a pre-determined break load, activating internal valves which will automatically close at both ends and prevent further release of products.) to prevent oil spills.

Single Point Mooring Systems use a swivel system which connects the Pipeline End and Manifold (PLEM) to the buoy. The product swivel system provides flexibility of movement to the tankers during transfer of products. This movable pipe-connection system prevents premature hose failure due to traction or bending stresses.

General overview on how single point mooring (SPM) system works:

- The tanker ship is moored to the buoy for loading or unloading of cargo
- A boat landing space on the the buoy deck provides access to the buoy for setting up the connections and securing the ship



Image Courtesy: Asante-Asare Y Boateng

- Fenders are used to protect the buoy from unexpected movement of the ship due to bad weather
- Lifting and handling equipment on the buoy allows handling of hoses connections and safety tools
- Once the connections are made, valves are operated from the electrical substation
- Necessary alarm systems and navigational aids are provided as safety precautions
- Liquid cargo is transferred from geostatic location (Pipeline End and Manifold (PLEM)) to the tanker using product transfer system of the single point mooring system

The advertisement is for a digital guide titled "The Ultimate Guide to DECK MACHINERY PROCEDURES AND OPERATIONS". The title is in large, bold, yellow-green letters. Below the title, there are four bullet points with checkmarks: "Instant Digital Download", "Guaranteed for 30 days", "Pay by PayPal or Credit Card", and "4 FREE Bonuses". A large, blue, circular badge with a gear-like border contains the text "RECOMMENDED" at the top and bottom, and "TOP SELLER" in the center. To the right of the text are four small images showing various deck machinery and operations on a ship. At the bottom left, there is a blue button with a white download icon and the text "Download it Now!" and "US \$18 \$9.95 ONLY". At the bottom right, there is a blue box with the text "A Ultimate Guide to Deck Machinery Procedures and Operations" and the "marine insight" logo.

What is Multiple Point Mooring of Ship?



Image Courtesy: Depositphoto

In this mooring method the bow of the ship is secured using both her anchors whereas the stern is secured to buoy around it . In the approach firstly vessel approaches the final berthing position from forward at an angle of 90 degrees to her final direction of berthing.

The starboard anchor is then let go first at a pre-decided spot while the ship is making headway. Required amount of cable is paid and the astern propulsion too operated simultaneously to stop the vessel.

Once the vessel is stopped in water, port anchor is let go and thus vessel positions her stern along the centerline bifurcating the buoys. For aligning the vessel along this centerline, port cable is paid out and starboard cable heaved in with astern propulsion.

The helm and engines to be carefully used during this maneuver to ensure the stern is swinging clear of any of the buoys. During un-berthing the anchor cables are heaved in to move the vessel forward and the weight is taken on windward lines while casting off other lines to prevent swinging of the stern into the other buoys.

This maneuver requires skill and efficient operation of ship's crew as well as of the mooring equipment as often weight of the lines can be immense.

This same method can be used with multiple buoys know as the Conventional Buoy Mooring (CBM) system which includes multiple buoys that are fixed to the seabed by means of mooring lines and marine anchors.

Normally there can be three to as many as six buoys which are permanently installed in a rectangular pattern to accomplish safe mooring of a ship which is positioned between the buoys by use of tugs.

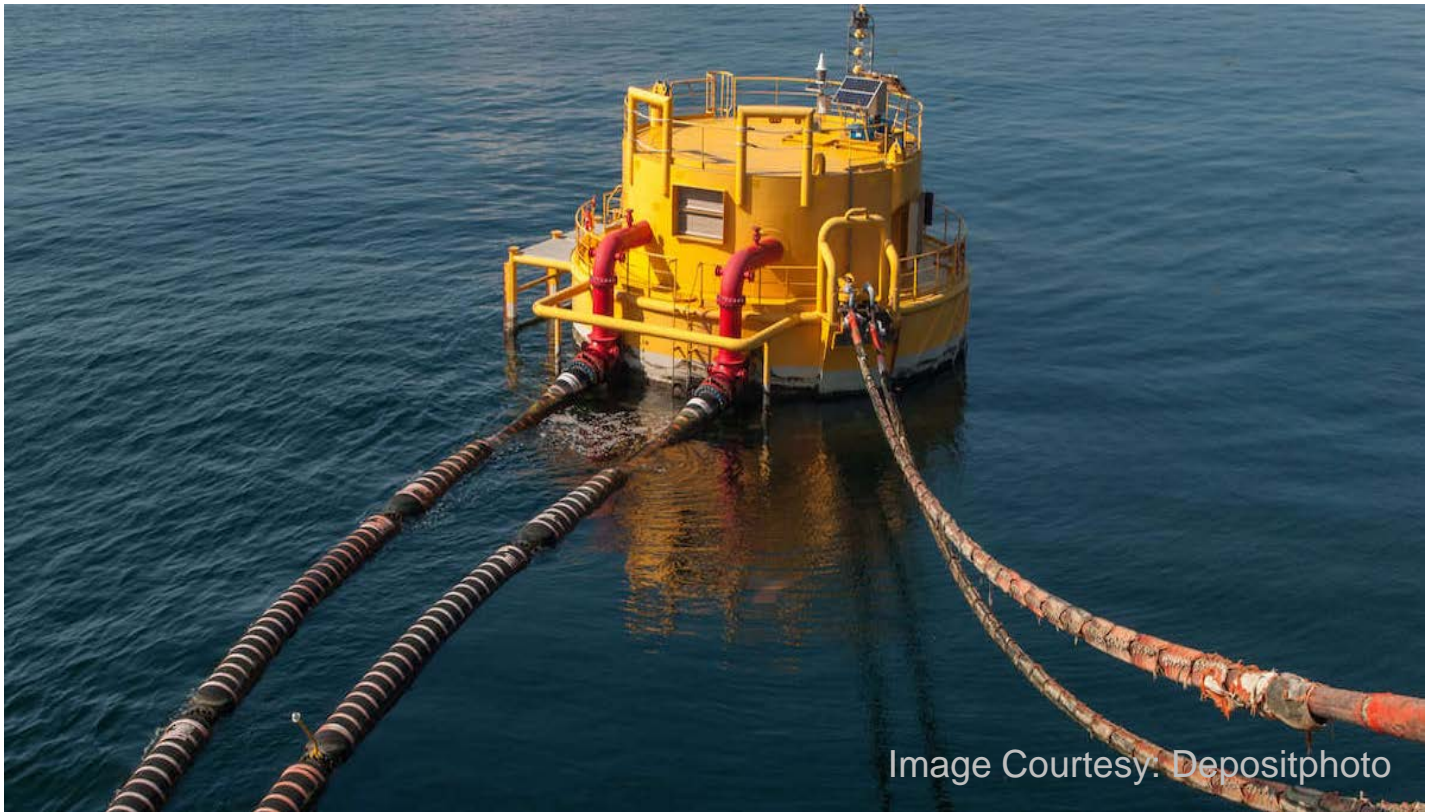


Image Courtesy: Depositphoto

These mooring buoys act as a strong points to attach the vessel's on-board mooring lines (same lines that are also used for mooring the vessel along a quay).

The multiple buoy or CBM system is useful where no quay is available or ship is not able to maneuver/proceed to the quay. It can also be combined with a fluid transfer system that enables connection of (subsea) pipelines to the midship manifold of a conventional tanker.

When no tanker is moored, the submersible hose or hoses are stored on the seabed. For cryogenic fluids, the aerial hose is suspended from a tower to the midship manifold of the liquefied gas carrier.



Some mooring buoys are off-the-shelf products, while others have been specially designed to include features like quick disconnection couplings. The mooring system and layout of the buoys are always specifically designed to match the vessel's requirements and local environmental conditions. Typically these systems are designed for near-shore applications with water depths starting from six meter.

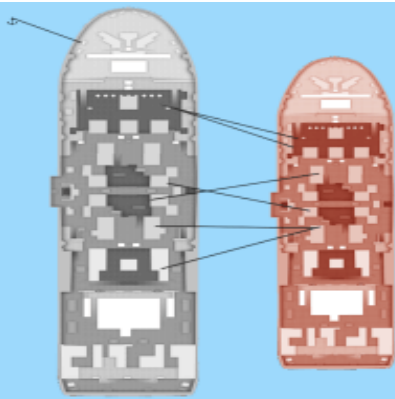


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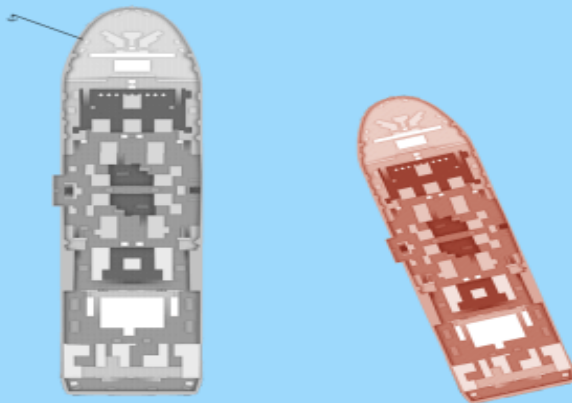
What is Ship to Ship Mooring?

Ship to Ship transfer operation involves mooring alongside of two different or same sized ships for cargo transfer. During this operation either one of the ships is at anchor or both are underway. The mooring arrangement depends on the size of the ships.

A vessel either at anchor or stopped and maintaining a constant heading is approached by the maneuvering ship at an angle of approach as smaller as practicable. The approach is usually abaft the beam of the constant heading and



Bringing Ships Bodily Parallel

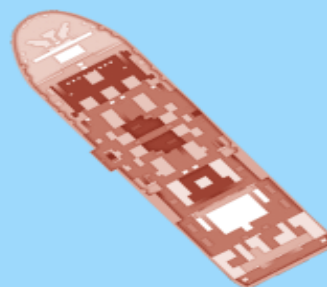


Bringing Ships Closer



A

Approaching slowly from astern



B

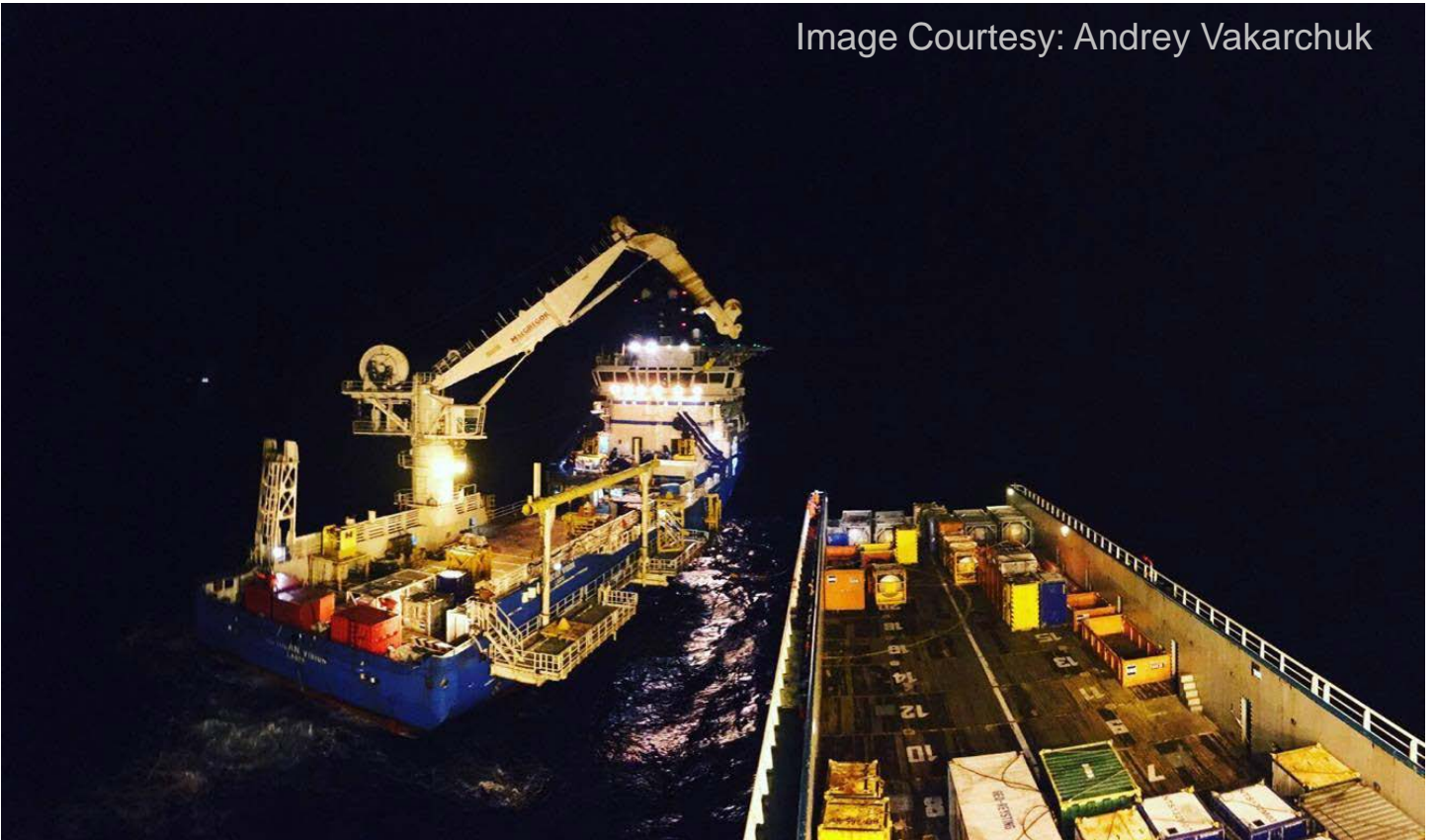
A = Constant heading or Positioned Vessel

B = Manouvering Vessel

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During the approach as the manoeuvring ship comes closer, it steers a course parallel to the heading or course of the other ship and reduces the horizontal distance between ships to less than 100 meters.

Image Courtesy: Andrey Vakarchuk



Once this state is achieved, the manoeuvring ship uses engine and rudder movements and reduces this distance further until the fenders touch each other. The two ships thus then make parallel contact and the lines are passed respectively as per the mooring plan. As a common practice during the approach the wind and sea are preferred to be from ahead or at very small angles to the bow.



7 What is Running and Standing Mooring?

Vessels sometimes also use the seaward anchor in conjunction with mooring lines to haul the vessel out of jetty while casting off or while making fast the vessel alongside use the seaward anchor to assist the control of the rate of lateral movement towards the berth. This manoeuvre can be carried out with or without the assistance of tugs.

Running mooring: The running mooring takes relatively short duration compared to Mediterranean mooring and offers more control of the vessel.

The vessel's starboard anchor is let go at a position approximately four to five shackles from the final position of the bow and around 9 shackles paid out while moving ahead on engines.

Then as she falls astern with the tide the port anchor is let go and the starboard anchor is heaved on to five shackles.



This method restricts the swinging room and reduces the load on windlass.

Standing Mooring : This is practiced during cross winds. As the vessel is stopped the port anchor is let go and with the tide around 9 shackles are paid out. The starboard anchor is let go and simultaneously port anchor heaved on. Thus the port anchor is kept on 4 shackles being generally the flood anchor and starboard on five as it is the ebb anchor. This vessel takes longer duration and provides less control over the vessel . The load on windlass is more as compared to running moor.

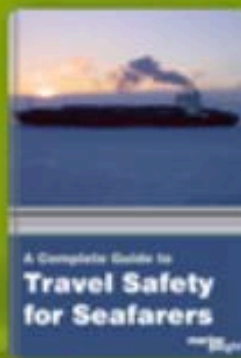
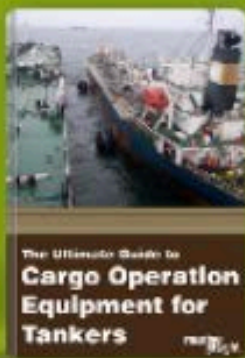
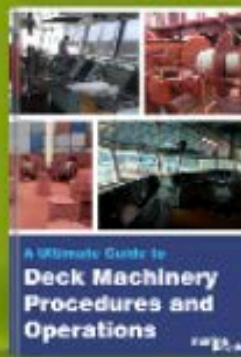
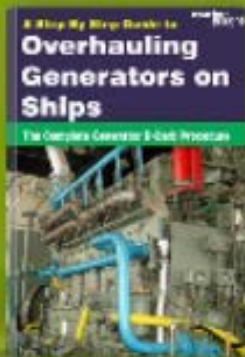
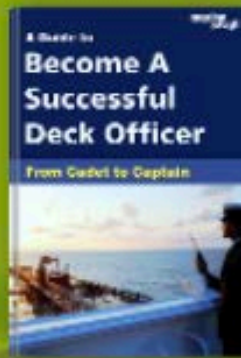
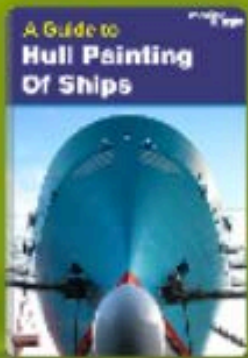


This is not an exhaustive list of mooring methods used for vessels at sea but all important ones that are widely used around the world.

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