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officer: "Stand by to turn." Slightly before the turn bearing is indicated, report to the conning officer: "Mark the turn." Make this report slightly before the bearing is reached because it takes the conning officer a finite amount of time to acknowledge the report and order the helmsman to put over the rudder. Additionally, it takes a finite amount of time for the helmsman to turn the rudder and for the ship to start to turn. If the navigator waits until the turn bearing is indicated to report the turn, the ship will turn too late.

Once the ship is steady on the new course, immediately take another fix to evaluate the vessel's position in relation to the track. If the ship is not on the track after the turn, calculate and recommend a course to the conning officer to regain the track.

1015. Using the Fathometer

Use the fathometer to determine whether the depth of water under the keel is sufficient to prevent the ship from grounding and to check the actual water depth with the charted water depth at the fix position. The navigator must compare the charted sounding at every fix position with the fathometer reading and report to the captain any discrepancies. Taking continuous soundings in restricted waters is mandatory.

See the discussion of calculating the warning and danger soundings in Section 1002. If the warning sounding is received, then slow the ship, fix the ship's position more frequently, and proceed with extreme caution. Ascertain immediately where the ship is in the channel; if the minimum expected sounding was noted correctly, the warning sounding indicates the vessel may be leaving the channel and standing into shoal water. Notify the vessel's captain and conning officer immediately.

If the danger sounding is received, take immediate action to get the vessel back to deep water. Reverse the engines and stop the vessel's forward movement. Turn in the direction of the deepest water before the vessel loses steerageway. Consider dropping the anchor to prevent the ship from drifting aground. The danger sounding indicates that the ship has left the channel and is standing into immediate danger. It requires immediate corrective action by the ship's conning officer, navigator, and captain to avoid disaster.

Many underwater features are poorly surveyed. If a fathometer trace of a distinct underwater feature can be obtained along with accurate position information, send the fathometer trace and related navigational data to NGA for entry into the Digital Bathymetric Data Base.

PILOTING TO AN ANCHORAGE

1016. Choosing an Anchorage

Most U.S. Navy vessels receive instructions in their movement orders regarding the choice of anchorage. Merchant ships are often directed to specific anchorages by harbor authorities. However, lacking specific guidance, the mariner should choose his or her anchoring positions using the following criteria:

- **Depth of Water:** Choose an area that will provide sufficient depth of water through an entire range of tides. Water too shallow will cause the ship to go aground, and water too deep will allow the anchor to drag.
- **Type of Bottom:** Choose the bottom that will best hold the anchor. Avoid rocky bottoms and select sandy or muddy bottoms if they are available.
- **Proximity to navigational Hazards:** Choose an anchorage as far away as possible from known navigational hazards.
- **Proximity to Adjacent Ships:** Anchor well away from adjacent vessels; ensure that another vessel will not swing over your own anchor on a current or wind shift.
- **Proximity to Harbor Traffic Lanes:** Anchor clear of traffic lanes and ensure that the vessel will not swing into the channel on a current or wind shift.
- **Weather:** Choose an area with the weakest winds and currents.
- **Availability of NAVAIDS:** Choose an anchorage with several NAVAIDS available for monitoring the ship's position when anchored.

1017. Navigational Preparations for Anchoring

It is usually best to follow an established procedure to ensure an accurate positioning of the anchor, even when anchoring in an open roadstead. The following procedure is representative. See Figure 1017.

Locate the selected anchoring position on the chart. Consider limitations of land, current, shoals, and other vessels when determining the direction of approach. Where conditions permit, make the approach heading into the current. Close observation of any other anchored vessels will provide clues as to which way the ship will lie to her anchor. If wind and current are strong and from different directions, ships will lie to their anchors according to the balance between these two forces and the draft and trim of each ship. Different ships may lie at different headings in the same anchorage depending on the balance of forces affecting them.

Approach from a direction with a prominent NAVAID, preferably a range, available dead ahead to serve as a steering guide. If practicable, use a straight approach of at least 1200 yards to permit the vessel to steady on the required

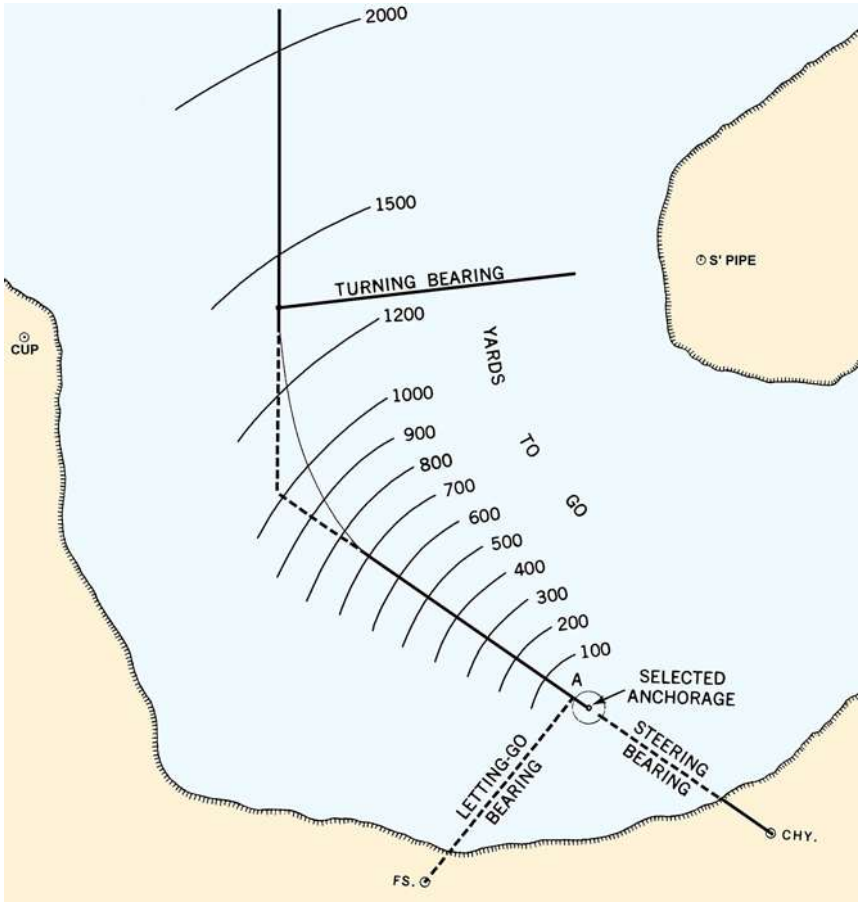

Figure 1017. Anchoring.

course. Draw in the approach track, allowing for advance and transfer during any turns. In Figure 1017, the chimney was selected as this steering bearing. A turn range may also be used if a radar-prominent object can be found directly ahead or astern.

Next, draw a circle with the selected position of the anchor as the center, and with a radius equal to the distance between the hawsepipe and pelorus, alidade, or periscope used for measuring bearings. This circle is marked "A" in Figure 1017. The intersection of this circle and the approach track is the position of the vessel's bearing-measuring instrument at the moment of letting the anchor go. Select a NAVAID which will be on the beam when the vessel is at the point of letting go the anchor. This NAVAID is marked "FS" in Figure 1017. Determine what the bearing to that object will be when the ship is at the drop point and measure this bearing to the nearest 0.1°T. Label this bearing as the letting go bearing.

During the approach to the anchorage, plot fixes at frequent intervals. The navigator must advise the conning officer of any tendency of the vessel to drift from the desired track. The navigator must frequently report to the conning officer the distance to go, permitting adjustment of the speed so that the vessel will be dead in the water or have very slight sternway when the anchor is let go. To aid in determining the distance to the drop point, draw and label a number of range arcs as shown in Figure 1017 representing distances to go to the drop point.

At the moment of letting the anchor go, take a fix and plot the vessel's exact position on the chart. This is important in the construction of the swing and drag circles discussed below. To draw these circles accurately, determine the position of the vessel at the time of letting go the anchor as accurately as possible.

Veer the anchor chain to a length equal to five to seven times the depth of water at the anchorage. The exact amount to veer is a function of both vessel type and severity of weather expected at the anchorage. When calculating the scope of anchor chain to veer, take into account the maximum height of tide.

Once the ship is anchored, construct two separate circles around the ship's position when the anchor was dropped. These circles are called the **swing circle** and the **drag circle**. Use the swing circle to check for navigational hazards and use the drag circle to ensure the anchor is holding.

The swing circle's radius is equal to the sum of the ship's length and the scope of the anchor chain released.

Polar regions have relatively few shoals, but in some areas, notably along the Labrador coast, a number of pinnacles and ledges rise abruptly from the bottom. These constitute a real danger to vessels, since they are generally not surrounded by any apparent shoaling. In such an area, or when entering an unknown harbor or any area of questionable safety, it is good practice to send one or more small craft ahead with portable sounding gear.

In very deep water, of the order of 1,000 meters or more, the echo returned from the bottom is sometimes confused by the sound of ice coming in contact with the hull, but this is generally not a problem when the bottom is close enough to be menacing.

If a ship becomes **beset** by ice, so that steerage way is lost and the vessel drifts with the ice, it may be in danger of grounding as the ice moves over a shoal. Hence, it is important that soundings be continued even when beset. If necessary, a hole should be made in the ice and a hand lead used. A vessel with limited means for freeing itself may prudently save such means for use only when there is danger of grounding.

Useful information on the depth of water in the vicinity of a ship can sometimes be obtained by watching the ice. A stream of ice moving faster than surrounding ice, or a stretch of open water in loose pack ice often marks the main channel through shoal water. A patch of stationary ice in the midst of moving ice often marks a shoal.

Knowledge of earth formations may also prove helpful. The slope of land is often an indication of the underwater gradient. Shoal water is often found off low islands, spits, etc., but seldom near a steep shore. Where glaciation has occurred, the moraine deposits are likely to have formed a bar some distance offshore. Submerged rocks and pinnacles are more likely to be encountered off a rugged shore than near a low, sandy beach.

3330. Anchorage

Because good anchorages are not plentiful in high latitudes, there is an understandable temptation to be less demanding in their selection. This is dangerous practice, for in polar regions some of the requirements are accentuated. The factors to be considered are:

1. *Holding quality of the bottom.* In polar regions a rocky bottom or one with only fair to poor holding qualities is not uncommon. Sometimes the bottom is steep or irregular. Since the nature of the bottom is seldom adequately shown on charts, a wise precaution is to sample the bottom, and sound in the vicinity before anchoring.
2. *Adequate room for swing.* Because high winds are frequent along polar shores, sometimes with little or no warning, a long scope of anchor chain is customarily used. Some harbors are otherwise suitable, but allow inadequate room for swing of the vessel at anchor, or even for its yaw in a high wind. If a vessel is to anchor in an unsurveyed area, the area should first be adequately covered by small boats with portable sounding gear to detect any obstructions.
3. *Protection from wind and sea.* In polar regions protection from wind is probably the most difficult requirement to meet. Generally, high land is accompanied by strong wind blowing directly down the side of the mountains. Polar winds are extremely variable, both in direction and speed. Shifts of 180° accompanied by an increase in speed of more than 50 knots in a few minutes have been reported. It is important that ground tackle be in good condition and that maximum-weight anchors be used. All available weather reports should be obtained and a continuous watch kept on the local weather. Whenever a heavy blow might reasonably be anticipated, the main engines should be kept in an operating condition and on a standby status. Heavy seas are seldom a problem.
4. *Availability of suitable exit in event of extreme weather.* In ice areas it is important that a continuous watch be kept to prevent blocking of the entrance by ice, or actual damage to the vessel by floating ice. However, in an unsurveyed area it may be dangerous to shift anchorage without first sounding the area. It is a wise precaution to do this in advance. Unless the vessel is immediately endangered by ice, it is generally safer to remain at anchor with optimum ground tackle and use of engines to assist in preventing dragging, than to proceed to sea in a high wind, especially in the presence of icebergs and growlers, and particularly during darkness.
5. *Availability of objects for position determination.* The familiar polar problem of establishing a position by inaccurately charted or inadequately surveyed landmarks is accentuated when an accurate position is desired to establish the position of an anchor. Sometimes a trial and error method is needed, and it may be necessary to add landmarks located by radar or visual observation. Because of chart inadequacy, the suitability of an anchorage, from the standpoint of availability of suitable landmarks, cannot always be adequately predicted before arrival.

An unsurveyed harbor should be entered with caution at slow speed, with both the pilot house and engine room watch-standers alerted to possible radical changes in speed or course with little or no warning. The anchor should be kept ready for letting go on short notice and should be adequately attended. An engine combination providing full backing power should be maintained.