THE NAUTICAL INSTITUTE

BRIDGE WATCHKEEPING

A PRACTICAL GUIDE

BRIDGE WATCHKEEPING

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This book has been prepared to address the subject of bridge watchkeeping. This should not, however, be taken to mean that this document deals comprehensively with all of the concerns which will need to be addressed or even, where a particular matter is addressed, that this document sets out the only definitive view for all situations.

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BRIDGE WATCHKEEPING

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The need to improve standards of bridge watchkeeping was identified by members of The Nautical Institute responding to a questionnaire sent out by Captain P.Boyle FNI, President, in 1991.

Resulting from this the Institute has developed a Bridge Operations Programme involving the book Bridge Team Management, three videos on Bridge Watchkeeping, Passage Planning and The Master Pilot Relationship, two Briefing documents contained in this volume and ultimately this practical guide to Bridge Watchkeeping.
At each stage the Institute has sought to involve seagoing members in the development of the programme and Council is grateful to the Isle of Man Branch for monitoring the progress of this volume and maintaining the right balance for its purpose. The assistance of the advisory group, listed separately, was both necessary and much appreciated.
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C.J.Parker
T.C.Rooney

BRIDGE WATCHKEEPING

A message from the Secretary General of the IMO introducing The Nautical Institute Bridge Operations Programme

"Whenever a ship puts to sea, the Master and navigating officers have a duty both in public and commercial law to navigate competently at all times. Upon their actions depend the successful outcome of the voyage, safety at sea and protection of the marine environment.

"Watchkeeping officers, through their diligence and professionalism, provide a highly valued service to society. This contribution is recognised by the IMO and I wish to pay tribute to the world's seafarers and those organisations which are working with us to enhance safe ship operations."

W. A. O'Neil

BRIDGE WATCHKEEPING

FOREWORD

by Captain L.A.Holder, ExC MPhil FNI President,
The Nautical Institute

Competence in navigation and seamanship is based upon a sound knowledge of principles and rules, experience at sea and proficiency in carrying out duties diligently. This applies particularly to watchkeeping, which requires all these elements to be brought together on the bridge of a ship. The officer of the watch has to have personal qualities — being self-reliant, not too proud to ask for assistance and always being willing to work as part of a team.

It is surprising that there are so few books on watchkeeping. Part of the reason is the expectation that all the skills will be learnt on the job, without the need for written support. However, studies undertaken by The Nautical Institute and information provided in our confidential marine accident reporting scheme (MARS), indicate that training can no longer be taken for granted and that practical assistance is needed to convey the attributes and skills necessary to become a competent watchkeeper.

Bridge Watchkeeping is part of a programme of videos and training guides which The Nautical Institute is helping to produce with the aim of improving and updating navigational and watchkeeping skills. Further details are given in Annex 7.

This study guide has brought together a team of experienced masters and officers to pass on the experience they have gained over many years of seafaring. The guide will help trainees and junior officers to improve bridge watchkeeping performance. I wish all those following the course of study success in becoming well organised, confident and efficient watchkeepers.

BRIDGE WATCHKEEPING

INTRODUCTION

Welcome to this study guide on Bridge Watchkeeping. It has been prepared in response to a demand for practical guidance for the officer of the watch (OOW).

It is designed to pass on practical advice by senior officers in the hope that their guidance will help to prevent many of the mistakes which they have had to leam from bitter experience.

This guide is designed for self-study. The aim and objectives are listed below. By working carefully and methodically through this guide OOWs should have a better appreciation of their watchkeeping duties and how they can support the Master and become an efficient and responsible member of the bridge team.

Aim of the Guide

The aim of this self-study guide is to enhance standards of bridge watchkeeping through a self-assessment programme which covers bridge operations with respect to:-
Different stages of the passage
The tasks to be performed
The correct use of equipment
Application of reliable procedures
Support for the bridge team

Objectives

On successful completion of the guide the OOW should be able to describe, state or list the duties of a watchkeeping officer and the practices necessary to:-
Conduct a safe navigational watch
Hand over and accept a watch
Carry out the tasks required during each stage of a sea passage
Monitor the equipment which should be available for use during each stage of a passage
Prevent the errors which can occur when carrying out tasks or using equipment
Implement reliable methods of error checking
Support the Master, and the pilot when carried
Call for assistance
Work as a member of the bridge team

It should be possible, with further watchkeeping experience/ for the OOW who follows the guidance in this book, to be able to carry out those duties safely and confidently.

Assumptions

This self-study guide assumes that OOWs have undertaken basic training in chart work and in the use of radar and navigation equipment. It is also assumed that they have studied and understand the provisions of the International Regulations for Preventing Collisions at Sea (COLREGS).

Guide to studying

Each chapter contains some element of the overall objectives and details of the tasks that combine to ensure a safe navigational watch. This is in the context of the guidance provided by the International Maritime Organization (IMO) Resolutions (see Annex 2) and the International Chamber of Shipping (ICS) **Bridge Procedure Guide.**

Self-Assessment Questions (SAQs)

Self-assessment questions should be completed as they appear in the text and should not be omitted. Without the SAQs this guide would be just another text book. By all means discuss the answers to the SAQs with other officers. However, this is an individual course of study, and readers should persevere with each chapter, answering the SAQs to the best of their ability.

Use the space provided in the text to write the answers to the SAQs in your hand writing. When it comes to revision, the answers will form part of the learning process. Do not store the answers mentally but write them down and then check with the text in case some important details have been overlooked. Writing the answers in the space provided reinforces the lessons to be learned.

In the text the SAQs are not numbered in sequence because when checking the answer to one question the answer to the next question could be seen. In the pages at the back of the book the answers are, however, in sequential order. Some of the questions require information which can only be found on board the ship.

An example of a self-assessment question

SAQ 1—1. From which sources do you obtain information about your watchkeeping duties?
1. Из какого источника можно получить информацию об
обязанностях вахтенного помощника.

BRIDGE WATCHKEEPING

Chapter 1 — PREPARING FOR SEA

Purpose

On completion of this chapter you will be aware of the reasons for testing the gear and checking that it is tested properly. You will be introduced to the concept of 'error chains' and the need to understand shipboard operations, in order to communicate effectively both onboard and with the shore. A final section reminds you of your role in updating navigational information.

The ship in port

When a ship is in port, officers will supervise the loading and/or discharge of cargo; ballasting or deballasting; the maintenance of the ship; the maintenance of the machinery; the mooring arrangements which are affected by the internal loading of the ship and the external rise and fall of the tide; the security and the gangway and safe access to the ship.

Supplementary activities might include the loading of stores, security, crew changes, shore gangs carrying out maintenance, surveyors carrying out classification or statutory surveys and specialists servicing equipment.

The need for systematic testing

When so many activities are taking place and the ship's officers are working either in watches or on individual items of maintenance, it is not possible to be absolutely sure that everything has been put back in perfect working order. Indeed, experience shows that this is often not the case. The only way to find out if all the equipment is functional is to test it.

The need for seamanship

Before taking a ship to sea the Master must satisfy himself that the ship is seaworthy. He will need to know, amongst other things, that:

-The cargo is stowed safely;
-The ship is properly battened down;
-All moveable objects are secured;
-Bridge equipment tested and operational;
-The main engine, auxiliaries and the steering gear are fully operational;
-Personnel are back on board, properly rested and ready to perform their duties.

The command structure

The Master has the ultimate responsibility for the safe and efficient operation of the ship. The Master delegates authority to the OOW through:
-Standing orders
-The routine of the ship Night orders
-Direct orders and discussion

An example of an extract from Master's Standing Orders is given on pages 11 to 13. The OOW has a duty to carry out these orders to the best of his or her ability. The OOW must comply with the Master's orders to ensure that the Master can properly direct the activities to be carried out on board.

The responsibility of the OOW

The international standards for bridge watchkeeping are given in the Convention on Standards of Training Certification and Watchkeeping 1978 as listed in Annex 2. Specifically, the primary responsibility of the OOW is stated as follows:-

"The officer of the watch is the Master's representative and his primary responsibility at all times is the safe navigation of the ship. He should at all times comply with the applicable regulations for preventing collisions at sea."

Testing the gear

The Master's standing orders will usually delegate the testing of ship's navigational equipment to the junior OOW, who must ensure its operational readiness prior to sailing.

Failure to ensure that all equipment is tested and in working order can lead to critical situations. For example, on one occasion a failure to test the whistle prevented a pilot from communicating urgently, to another vessel in a fairway, that he was turning to starboard. On another occasion, the omission to put out the binoculars in the wheelhouse prevented an important landmark from being identified.

Most errors can be corrected in time, but the aim of good watchkeeping practice must be to ensure that the cause of an error chain is avoided (see Chapter 12).

Most ships require check lists to be used. Standing Orders generally state that the designated officer will verify each item and sign the list before handing it to the Master prior to sailing.

Alternatively, a two-person system may be used whereby one person reads out the item to be inspected and the other verifies its status. A typical check list is provided on page 14.

Preparations in the engine room and engine control room

The OOW should, of course, be aware that as the ship prepares for sea, preparation in the engine room and engine control room is also taking place.

(text continued on page 15)

MASTER'S STANDING ORDERS
M.V. Golden Rule

For the whole period of his watch the OOW is responsible for the safety of the Ship until such time as he is formally relieved by another officer or the Master, and until that time he shall remain at his place of duty. The OOW shall be guided by the contents of international regulations and guidelines, but paying particular attention to the following: -

PARAMOUNT CLAUSE —
THE SAFETY OF THE SHIP AND ITS PERSONNEL IS ALWAYS TO BE THE PRIME CONSIDERATION, TAKING PRECEDENCE OVER ANY OTHER. NO CONSIDERATION OF PROGRAMME, CONVENIENCE OR PREVIOUS INSTRUCTIONS JUSTIFIES TAKING ANY RISK WHICH MAY PLACE THE SHIP IN DANGER.

1 The first and foremost duty of the OOW is the keeping of a GOOD LOOKOUT, using all means available, visual, audible and electronic.

2 The International Regulations for Preventing Collisions at Sea are to be strictly observed. Do not hesitate to use the whistle or engine in obeying these Regulations. When altering course for another vessel do so boldly and in sufficient time to let any other vessel be in no doubt as to your intentions.

3 If you are in doubt as to another vessel's intentions, or if the bearing of any vessel on the port side is steady, call the Master, preferably when the range still exceeds five miles.

4 In reduced visibility immediately comply with international regulations. Do not hesitate to use the whistle or slow down if necessary. Commence plotting all targets forward of the beam, operate VHF on Channel 16, and inform the Master and Chief Engineer. For the purpose of these orders reduced visibility is anything less than four miles.

5 If severe line squalls or freak meteorological phenomena such as waterspouts are observed, immediately alert any crew members on deck by sounding one prolonged blast on the whistle, alter course to keep clear if possible, and call the Master.

6 Watchkeepers are to use all means and opportunities in order to establish the ship's position. All stellar positions obtained are to be entered in the Deck Log Book, also the times of crossing significant depth contours, e.g. the 200m line. The positions of all course alterations are to be logged. Officers are to familiarise themselves with the full operations, scope and limitations of bridge navigational equipment, especially electronic. This means studying the manufacturer's

operational manuals provided.

7 Only one chart at a time is to be on the chart table/ this being the largest scale available for the area being navigated. Time spent in the chartroom is to be limited to essential navigational duties.

8 At sea, gyro and magnetic compasses are to be compared frequently and an azimuth bearing is to be taken after every major course alteration, or at least once per watch.

9 All incoming radio or VHF warnings are to be drawn to the attention of the Master (navigational, weather forecasts, etc.).

10 Officers are to read the Company Regulations and carry out the duties prescribed therein. Officers are also to comply with all State regulations and are to be conversant with all current 'M' Notices, Statutory Instruments and Coast Guard requirements.

11 All OOWs are to familiarise themselves with the section on tropical storms contained in the Mariners Handbook (pages 95-99) and to call the Master immediately if any of the precursory signs of a tropical depression are observed. In any event, the Master is to be notified immediately of any fall in barometric pressure of 3mb or more in any period of less than four hours. The practice of logging weather details at the end of each watch is to be continued in port.

12 UNDER PILOTAGE. An accurate record of the ship's passage (passing breakwaters, buoys, etc.) is to be kept in the Movement Book, together with details of all whistle signals and speed reductions whilst passing other vessels, moorings or shore installations.

13 AT ANCHORAGE. Use any or all of the navigational aids to monitor the vessel's position and the relative positions of other ships. Shore transit bearings are to be used whenever possible as the quickest means of detecting a dragging anchor.

14 Most anchorages, however sheltered, can become untenable in a very short space of time in sudden bad weather. It is therefore of the utmost importance that at the first signs of deteriorating weather the main engine is put on immediate notice and the Master and Bosun called.

15 IN PORT. For the whole period of his watch the OOW is responsible for the safety of the ship and the correct stowage and operation of cargo work, in that order, and he should ensure that:-

a) Gangways are fitted with a properly rigged safety net, well lit, and a Shore Leave Board fitted. The Master/Chief Officer are to be consulted for expiration of shore leave. No deck officer or crew member is to go

ashore without first informing the Chief Officer, or in his absence, the Master.

b) Prior to operation, the ship's cranes are to be thoroughly inspected by the OOW to ensure that all securing devices have been released and that the crane rails are free of obstructions.

c) During bunkering all scuppers are to be plugged, appropriate signals displayed and sawdust, an empty oil drum and a foam fire extinguisher placed near to the bunker connection. A deck officer must always be up and about whenever bunkers are taken, even if cargo work is finished or not taking place and the ship's Oil Contingency Plan complied with.

d) Any hydraulic spills are to be cleaned up immediately.

e) Any deviation from the agreed loading procedure is to be brought to the Chief Officer's or Master's attention immediately.

f) Any damage to the ship, ship's equipment or cargo, caused by stevedores, is to be drawn immediately to the attention of the Gang Foreman or Supervisor and the Chief Officer or Master be informed immediately.

g) Moorings or and gangways are to be checked regularly, especially in ports where swell surges are experienced.

h) Any delay in cargo work of five minutes or more is to be reported to the Master prior to sailing from that port. No Log Book entries concerning the delay are to be made until the Master or Chief Officer is consulted.

i) The Chief Officer is to be notified immediately in the event of any damaged cargo or holed containers are loaded.

j) A stowaway search is to be carried out prior to departure. The duty Engineer is to be kept informed of all current ETS and gear tested one hour prior to departure.

k) Any crane defects, especially involving possible override use, are to be reported to the Chief Officer immediately.

A good officer, when faced with any unusual circumstance, will apply COMMON SENSE AND THE GOOD PRACTICE OF SEAMEN to the situation and act accordingly. If you find yourself thinking about calling the Master then the time has clearly come to do so.

All officers are to sign and date these orders at the commencement of each voyage.

R.U.Sure
Master

Chief Officer Second Officer Third Officer

Date..... Date..... Date.....

PRE-DEPARTURE CHECK LIST BRIDGE AND NAVIGATIONAL EQUIPMENT M.V Golden Rule

checked and verified

1. Gyro and repeaters switched on and synchronized □
2. Magnetic compass and gyro repeater headings checked □
3. Echo sounder checked □
4. Speed/distance recorder checked □
5. Electronic navigation aids checked □
6. Clocks synchronized (including engine room) □
7. Plotter recorder ready for use □
8. Engine revolution indicator checked □
9. Primary and emergency navigation lights tested and checked □
10. Propeller and rudder checked clear of obstruction □
11. "Not under command" and anchor lights and shapes checked □
12. Steering gear tested both in primary and secondary systems (both motors to be running when manoeuvring) □
13. Auto-pilot and change-over arrangements tested (SOLAS Chapter V, Regulation 19-2) □
14. Main engines ready and telegraphs tested □
15. Bridge communications equipment (internal, external and portable) tested □
16. Signalling lamps tested □
17. Whistle tested (if allowed by the Port's Regulations) □
18. Bridge window wipers/clear view screens tested □
19. Deck power available □
20. Arrangements for pilot embarkation/disembarkation inc. overside lighting, heaving line, pilot ladder, lifebuoy, etc checked □
21. Binoculars available □
22. Charts and navigational publications, i.e. Notices to Mariners, etc., corrected up to date and courses plotted on the chart □
23. Latest weather reports and navigational warnings received and available □
24. Passage plan prepared. Almanac, Tide Tables, etc., confirmed available on board □
25. Engine movement recorder checked □
26. Anchors cleared away and ready for use □
27. Mooring winches and capstans in good working order □
28. Crew checked on board □
29. Crew at their stations for leaving harbour □
30. Documents, Certificates and Log Book checked □
31. Security checked, stowaways and unauthorised personnel searched for □

On completion of the pre-departure checks this form is to be signed by the responsible officer and handed to the Master.

Port ..... Signed.....

Date .....

The OOW should receive a report from the engine room that various checks have been carried out. These will include:

The engines are ready for manoeuvring

Power is available for deck machinery such as winches, windlass and the gangway motor

Auxiliaries for generating extra power are made ready

Air is opened to the whistle

Water is made available on deck

Control systems are tested

Communications are tested

Steering gear, telegraphs and control systems checked with the bridge

When appropriate, the controllable pitch propeller control system is verified and the thrusters operational.

Positive reporting

The risk of an error or omission increases as more people become involved in the line of command. As a general rule the more threatening the situation the shorter should be the line of command — for two reasons.

1. With fewer people involved, corrective action can be taken more quickly.

2. There is less chance of an error in communication, particularly if people are tense or anxious.

Because the proper working of the ship's equipment is vital to the safe navigation of the ship the designated officer must verify that the ship's gear has actually been tested personally. That officer can then give a positive verbal report to the Master.

What happens if a fault is found?

The purpose of testing gear is to identify any possible faults before the ship puts to sea. If a fault is found this must be reported to the Master immediately, preferably with a recommended solution. However, it is the Master who will decide what action to take.

Communications

The OOW has a key role to play on the bridge carrying out communications. At busy periods the hand-held phone, the Very High Frequency radio (VHF) and the internal telephones may all be in use. Whenever possible, the IMO Standard Marine Navigational Vocabulary (listed in Annex 3) should be used.

As a general rule, keep bridge communications as short as possible. Postpone non-essential communications until after the ship has finished manoeuvring. When using hand-held phones in congested areas always precede a message by stating the name of the ship. This will avoid any errors which might arise from messages received and acted upon from outside by mistake. Prepare, or have available, telephone numbers or VHF channels before departure. Ensure that all hand-held phones are properly charged and operational when the gear is tested.

Communications are a significant part of bridge operations

From the video "Bridge Watchkeeping", courtesy Videotel

Checking the passage plan

From the video "Bridge Watchkeeping", courtesy Videotel

The OOW will usually be required to supervise the ship's flags/ which will involve the ship's national flag, company flag and courtesy flags and the international signal flags typically/ P — I am about to sail, to be taken down on sailing, G — I require a pilot, H — I have a pilot on board, to be used appropriately.

The OOW must be aware of the **vital** need to keep the Master informed of critical operations, e.g.

When ropes are clear of propellers and thrusters
The distance off the quay or next ship
The letting go of the anchor
The quantity of starting air available (if getting critical)
The state of the gangway
Where the tugs are situated and if made fast or not
Other vessels or objects close to the ship

The passage plan

Prior to sailing the navigating officer, usually the second officer, will have prepared a passage plan which will have been verified by the Master. The plan should be laid out from berth to berth and will need to be updated with the latest information at sailing time. All watchkeeping officers should be familiar with the plan prior to sailing, (see also Annex 4)

The Master will expect to find, on the bridge prior to sailing, the latest weather information and navigational warnings. Any adverse weather which is forecast — fog, rain, winds and sea state should be brought to his attention. The time of departure will be used to assess:-

The height of the tide
Tidal currents
The need to ensure that the navigational lights and shapes required by the Regulations are being complied with
The estimated times for operations such as when the pilot is due to arrive or leave

The OOW should therefore satisfy himself that he has all the required information to modify the passage plan, if necessary, in accordance with changing times.

The OOW must ensure that paper recorders have an adequate supply of paper and that all record books are in place with pens or pencils ready to be used. Binoculars should be made available, compass errors checked, azimuth mirrors placed on the repeaters and repeaters aligned correctly to the master compass. The bridge must be in every sense ready for the intended voyage. The chart area should also be checked to ensure that the charts are in sequence, that navigational instruments are to hand and that the bridge lighting is appropriate to day, dusk or night conditions.

At no time should cups of coffee, tea or any other liquid be put on the chart table or near any electronic equipment keyboards or switches.

The OOW should switch on all relevant navigational equipment, calibrate instruments/ set up radars and check that all items are working properly. The OOW can then fill in the pilot boarding card which will include:-
Port and date
The dimensions of the ship
Type of propulsion and manoeuvring speeds
Turning data
Draught
Any equipment or machinery defects
The latest compass error

The manoeuvring data relating to the ship should be prominently displayed on the bridge.

Prior to sailing it is usually necessary to contact the harbour Vessel Traffic Service (VTS) on VHF. The VTS will need to know the anticipated sailing time at least 30 minutes before sailing so that they can advise inbound or passing traffic to keep clear whilst the ship is manoeuvring off its berth. The pilot will usually seek clearance to proceed at the time of sailing and the ship must not "let go" until verification has been received that the ship will not cause a hazard due to the movements of other ships in the channel or in the vicinity.

Summary

The OOW has an essential role to play in ensuring that, from a navigational point of view, the ship is in all respects ready to proceed to sea and should:-

- □ Check that all equipment is operational
- □ Verify that all equipment is properly tuned, calibrated and checked
- □ Record all defects
- □ Prepare all recording systems and ensure that books and logs are to hand with adequate resources of paper
- □ Update the passage plan with respect to time dependent factors
- □ Ensure up-to-date weather information is available
- □ Ensure latest navigational warnings are available
- □ Obtain all relevant VHF working channels to be used during the planned departure
- □ Ensure the watertight integrity of the ship can be controlled
- □ Contact the shore VTS sufficiently in advance of the sailing time to enable them to manage the traffic safely
- □ Ensure all communication equipment is functional
- □ Ensure the gangway is taken in and stowed securely
- □ Complete the pilot boarding card to the Master's satisfaction
- □ Ensure the ship is flying the correct flags
- □ Ensure the ship is generally ready for sea. Any unusual items should be reported to the Master immediately, such as an unclosed hatch, lighters and barges still attached alongside, a gangway net still in place, any loose items on deck, pipes, wires or telephones still connected to the shore, or any other item which might be affected by the movement of the ship.

NOTE THE RANDOM SAQ NUMBERS ARE DESIGNED TO AVOID READ OVER IN THE ANSWERS

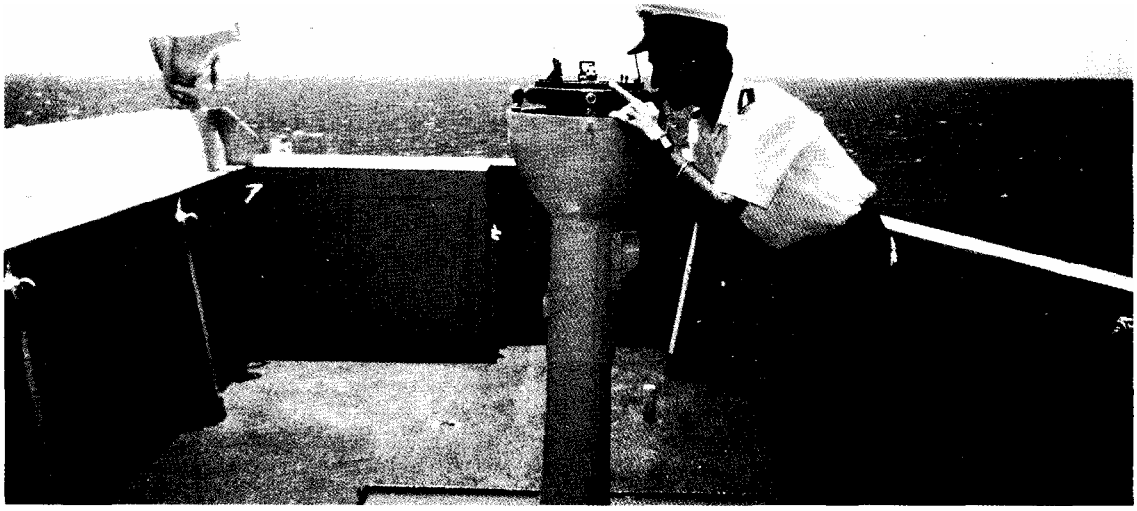
Chapter 1 — SAQs

SAQ 20. From which sources do you obtain information about your OOW duties?

SAQ 73. What is positive reporting and why is it necessary for the testing of equipment before the ship sails?

SAQ 41. What must the Navigating Officer do to ensure that the ship's passage plan is updated prior to sailing?

SAQ 92. What reports are expected from the engine room to the bridge prior to sailing?



Learning how to take compass bearings — an essential bridge watchkeeping skill

Photo , Courtesy V.Ships

BRIDGE WATCHKEEPING

Chapter 2 — WATCHKEEPING IN PILOTAGE WATERS

Purpose

On completion of this chapter you will be aware of your responsibilities when navigating with a pilot on board. You will read how to monitor the progress of the ship and the status of the bridge equipment. The concept of 'situational awareness' will be introduced and you will recognise that in order to monitor progress it is necessary to plan ahead.

Information the pilot needs to know about the ship

When the pilot boards he will want to know essential information about the ship. This will include the draught, in case of depth restrictions in the port approach, and the effects of 'squat'. He will also want to know the revolutions and speeds at standard telegraph settings, the number of propellers, type of engines, rudder configuration, thruster availability and so on.

It is important that you are able to complete and update the pilot card accurately. A typical pilot card is shown on page 22.

The manoeuvring data should be prominently displayed on the bridge. This gives turning circles, stopping distances and other information in different load conditions.

Unmooring

Many activities will be taking place and the OOW must make sure that the duties that are assigned to him or her are carried out. These will usually be:-

Assisting with communications
Handling the telegraph
Operating the bridge engine controls
Recording key information in the 'bell book' or 'manoeuvring book'
Switching on the appropriate navigation lights
Switching off deck lights
Monitoring helm orders
Monitoring engine movements and rudder angles

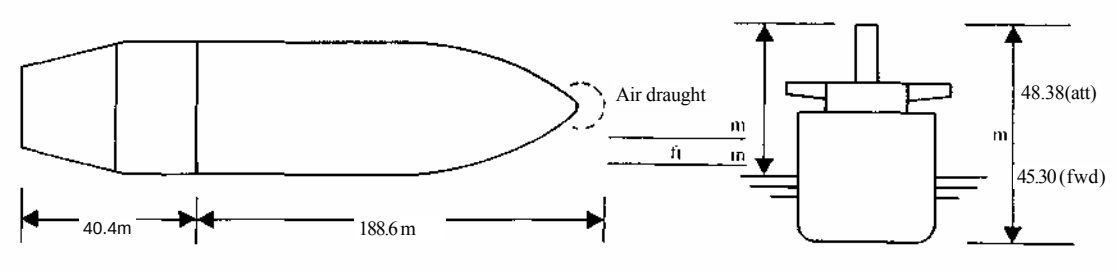
If the OOW has been assigned to the telegraph it is essential to stand near the telegraph until critical manoeuvres are completed. The OOW must be attentive to the orders of the pilot and always repeat the order and confirm the engines are responding properly. In this way the pilot knows his order is understood.

PILOT BOARDING CARD

Ship's name: M.V Golden Rule Date:.....
Call sign: W X Y Z Year built: 1985
Draught: Aft..... m/..... ft..... in Forward ..... m/..... ft..... in
Deadweight: 63,000 tonnes Displacement:..... tonnes

SHIP'S PARTICULARS

Length overall: 215 m Breadth: 32 m
Anchor chain: Port 11 shackles Starboard 12 shackles
Bulbous bow: Yes / No (1 shackle = 27.5 m / 15 fathoms)
Bow Thruster: Yes / No Stern Thruster: Yes / No
Power:..... Power:.....



Type of engine: Mitsui B+ W -7
Maximum power: 9,500 kW (12,990 HP)

Manoeuvring engine order	Rpm/pitch	Speed (knots) Loaded	Ballast
Full sea speed	100	13-0	14-0
Full ahead	80	10-6	11-0
Half ahead	70	9-3	10-0
Slow ahead	50	6-6	7-0
Dead slow ahead	40	5-3	5-5
Dead slow astern	40		
Slow astern	50		
Half astern	70		
Full astern	80		

Full ahead to full astern: 230 s **Astern power:** = 50 % ahead
Maximum number of consecutive starts: 21
Minimum RPM: 30 = 4 knots
Any temporary defects affecting the manoeuvring and control of the ship:

Many serious manoeuvring accidents are caused by a wrong engine response. By checking the engine revolutions gauge each time the OOW will be preventing an 'error chain' starting.

What is meant by monitoring?

Monitoring is making sure that an activity is having the desired effect. For example, when the pilot orders "Port 15°", the rudder indicator should be watched to make sure that the rudder turns 15° to port. This seems elementary. But what would happen if the helmsman, instead of putting on 15° of port helm brought the ship's head 15° to port? Without monitoring this manoeuvre carefully, a serious mistake could occur.

The main and valuable role of the OOW during pilotage is to monitor the instruments and progress of the vessel and provide backup to the Master and/or pilot.

To monitor progress it is necessary to plot the ship's position frequently. During pilotage the OOW should know where the ship is and where it will be at predetermined intervals.

By monitoring the courses steered, the helm movements, and noting the passing of buoys or position off conspicuous points of land, the OOW will be able to assess if a mistake is made by the pilot. Buoys and floating beacons can be out of place and the ship's position should be verified independently whenever possible.

Useful advice is given in the IMO convention resolution Annex 2:-

"If the* OOW is *in any doubt as to the pilot's actions or intentions, he should seek clarification from the pilot; if doubt still exists/he should notify the Master immediately and take whatever action is necessary before the Master arrives".

Master/pilot relationship

Pilots are engaged for a variety of reasons, depending upon circumstances, which include pilotage based upon local knowledge, liaison with shore authorities, ship handling and bridge support.

The duty of the pilot is to direct the navigation of the ship. The pilot liaises with the VTS and other vessels in the vicinity, and advises on the use of tugs, of anchors, moorings and towing lines.

The International Convention, Annex 1, states:-

Despite the duties and obligations of a pilot, his presence on board does not relieve the Master or officer in charge of the watch from their duties and obligations for the safety of the ship. The Master and pilot shall exchange information regarding navigation procedures, local conditions and the ship's

characteristics. The Master and officer of the watch shall co-operate closely with the pilot and maintain an accurate check of the ship's position and movement.

Situational awareness

Closely linked to monitoring is the concept of 'situational awareness'. This is the ability to know where the ship is in relation to the fairway, land and dangers to navigation, and the proximity of other traffic. This awareness is most easily acquired by looking outside and comparing what is seen with the chart or the radar.

It is often felt, particularly by inexperienced officers, that the radar picture gives the best situational awareness, and that the radar can be compared with the chart without looking outside. The danger with this practice is that the radar picture may be disorientated, the range scale mistaken, and small targets undetected.

Situational awareness, from which the progress of the vessel can be assessed, requires three monitoring activities:-

Examination of the chart
Recognition of conspicuous lights or marks by looking out and conducting personal visual identification
Verification of distances and collision risk by monitoring the radar

Planning ahead

The pilot will have a clear understanding of the time it will take to reach the pilot boat depending upon speed, current, visibility, availability and so on. He will have discussed his plan with the Master and the Master or pilot should brief the OOW on details of the intended passage.

Many other people on board will also want to know the ship's navigational plan:-
The engineers will want to plan for "Full Away"
The Officer forward will want to secure anchors
The Master will want to make the approach to the pilot boat and plan the next course
The appropriate crew members will want to know when and on which side to to rig the pilot ladder

The OOW will be expected to make certain that those who need to know are kept informed of progress. To do this it is necessary to plan ahead:-
Distances to the pilot boat should be noted on the chart
At key points the distance to the pilot boat can be verified
The estimated time of arrival can then be updated

Once the progress of the ship is assessed against the Estimated Time of Arrival (ETA) at the pilot boat, arrangements can be made to call extra hands, if needed, to rig the pilot ladder. The Master should be advised as required.

The need for added vigilance in pilotage waters

The difference between navigating deep sea and in pilotage waters is the shortage of time in confined areas to correct a navigational error.

The OOW has an essential role to play in monitoring progress in such a way that any error is detected in time to prevent an incident.

Summary

- □ Have the pilot boarding card ready
- □ Have the sequence of charts in order
- □ Verify the pilots instructions
- □ Monitor the ship's manoeuvring
- □ Check the compasses regularly and on each significant change of heading
- □ Record essential information
- □ Do not wander about the bridge if ordered to work the telegraph until manoeuvring is completed
- □ Be attentive
- □ Monitor the steering
- □ Monitor under keel clearance
- □ Monitor the weather
- □ Keep tidal information up to date
- □ Develop situational awareness
- □ Positively identify significant navigational marks and features by eye
- □ Use the radar intelligently
- □ Fix the ship regularly to monitor the pilot in coastal waters
- □ Assess risk of collision and advise the pilot
- □ If doubts about intentions exist call the Master
- □ Keep ETA at the pilot boat updated
- □ Call the Master and other hands as appropriate
- □ Be particularly vigilant in confined waters
- □ Keep the VTS informed of progress as required
- □ Ensure the correct lights, flags and shapes are being displayed.

Chapter 2 — SAQs

SAQ 33. List the main items to be updated on the pilot card.

SAQ 84. Why is it necessary to contact the port VTS station prior to sailing?

SAQ 19. How would you monitor the navigation of the pilot?

SAQ 67. How would you, conveniently, check the compass error in pilotage waters?

SAQ 50. How would you know what VHF channels to monitor when leaving port?

NAVIGATIONAL AWARENESS EXERCISE

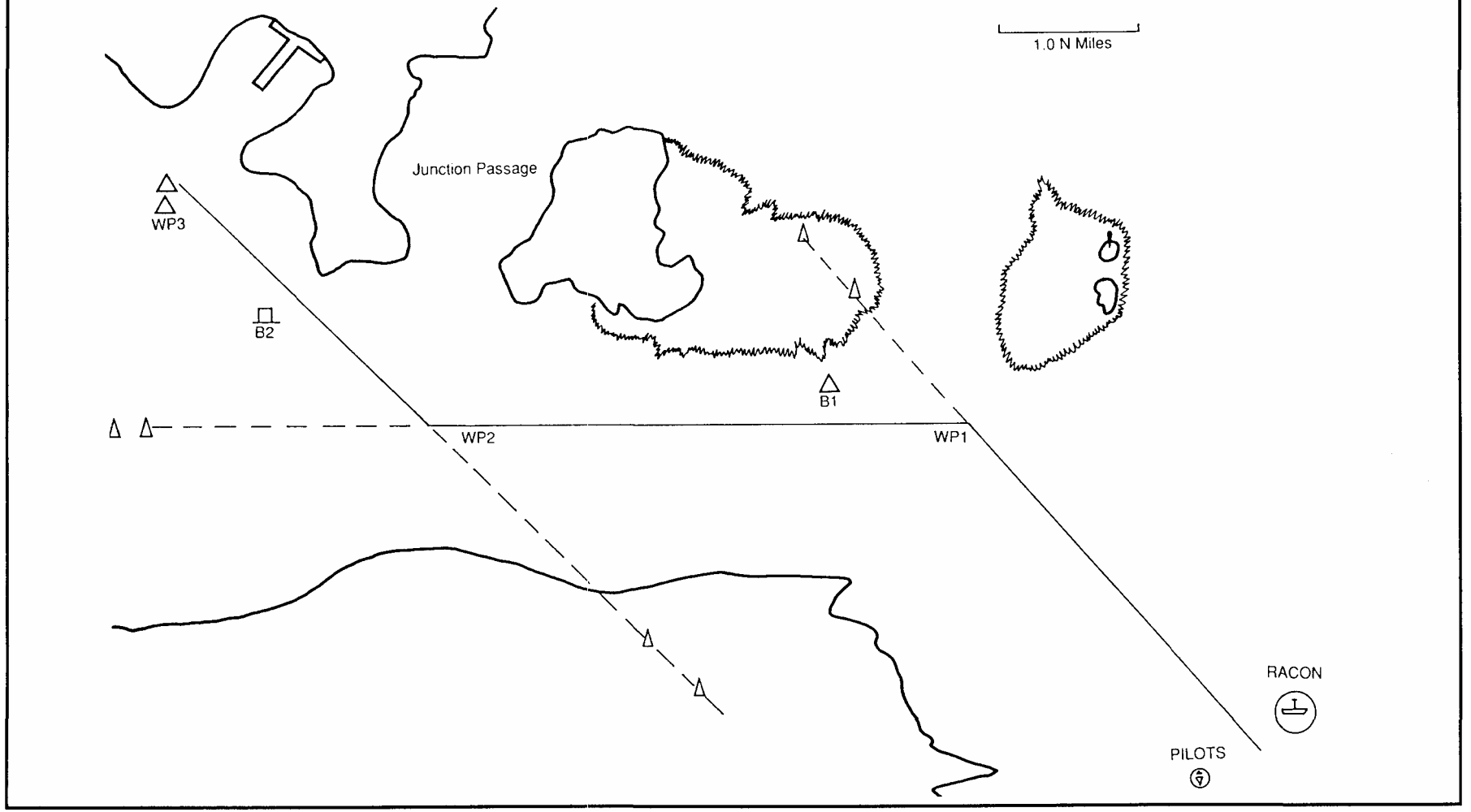
Tracks are drawn on a chart area and you are asked to bring the ship in from sea.

Purpose

The aim of the exercise is to make you aware of situations which can develop and which, if left unattended, may quickly deteriorate into critical situations.

The exercise emphasises the need to plan ahead, to be vigilant, to apply good seamanship and to be able to respond in such a way that the passage is completed safely.

EXERCISE: Watchkeeping in Pilotage Waters: What tasks should the OOW have performed?



EXERCISE: WATCHKEEPING IN PILOTAGE WATERS. WHAT TASKS SHOULD THE OOW HAVE PERFORMED?
Start conditions:- Day; Wind — South West Force 3; Tide — Half an hour before High Water; Visibility —1.0 mile

A location in pilotage waters	An event in pilotage waters	A possible incident?	A possible cause(s) of the incident?	Incident could have been avoided by:
Q 18. Three miles from the pilot station	Rendezvous with pilot cutter to embark pilot	Unable to distinguish light vessel from cutter	Racon temporarily extinguished	
Q 43. Two miles from the pilot station	Too late or too early at the pilot station	Pilot cutter not available	Pilot cutter not given ETA	
Q77. At the pilot station	Ship going ahead at 4 knots, heading 270°	Pilot cutter closing on opposite side to pilot ladder	Pilot cutter not advised of heading and speed for disembarking	
Q29. At the pilot station	Embarking the pilot	Injury to pilot	Pilot ladder improperly rigged	
Q53. Between the pilot station and WP1	Turning to 270°T	Vessel overshoots turn and is in danger of running aground	1. Helmsman not accustomed to steering 2. Turn not planned 3. Gyro wander	

A location in pilotage waters	An event in pilotage waters	A possible incident?	A possible cause(s) of the incident?	Incident could have been avoided by:
Q35. Alter course at WP1	Passing close to light vessel	Set down on light vessel	Ship at slow speed in tidal stream	
Q88. Between WP1 and WP2	Abeam of Bl	Very close to Bl	1. Bl out of position 2. Ship drifted to right of track	
Q61. Between WP1 and WP2	A vessel injunction Passage approaches from before the starboard beam	Collision risk ignored	1. Target presence undetected 2. Target movement not determined	
Q 6. Between WP2 and WP3	Approaching WP3	Closing WP3 very quickly	1. Engine speed too fast 2. Flood tide rate increases	
Q97. Between WP2 and WP3	Searching for on radar	WP3 lost	1. Sea clutter 2. Fall off in radar performance	
Q71. Between WP3 and the berth	Securing bow and stern tugs	Crew not available to secure tugs	Crew not warned in time	

BRIDGE WATCHKEEPING

Chapter 3 — PILOT BOARDING AND DISCHARGE

Purpose

On studying this case study you will be aware of the dangers and risks to human life which can occur if the pilot ladder is rigged incorrectly. Information and guidance is given to demonstrate the correct way of supervising the required boarding arrangements for pilots.

Introduction

The following case study is taken from the confidential Marine Accident Reporting Scheme (MARS) carried out by The Nautical Institute and published monthly in the Institute's Journal SEAWAYS. Annex 5 contains practical guidance on boarding arrangements for pilots.

CASE STUDY

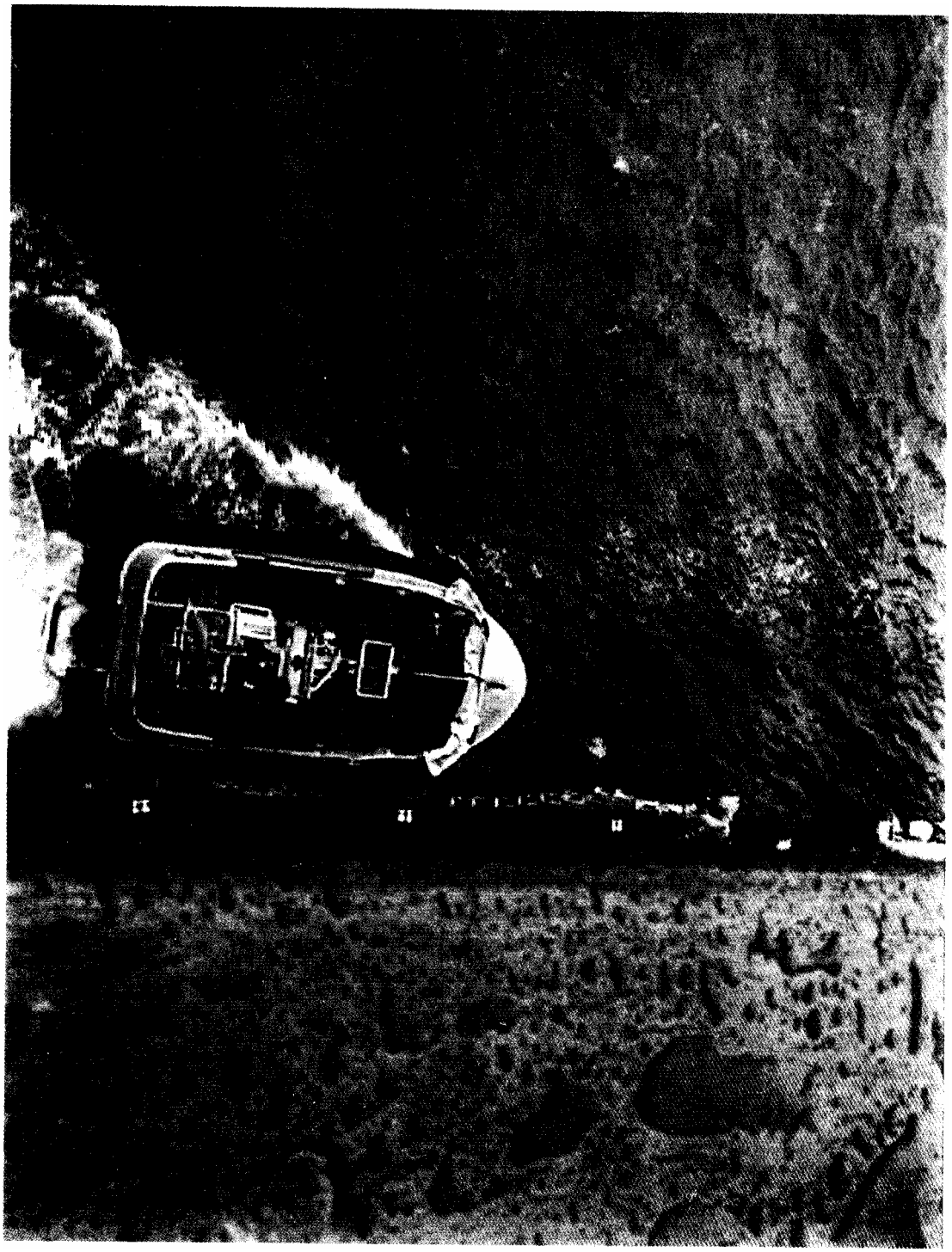
MARS 93041 Pilot Ladder Accident

New Zealand. Night time. SW25/30 knots. Raining.

Whilst disembarking from an outward bound vessel a pilot fell from the pilot ladder and spent eight minutes in the sea before he could be rescued by the pilot launch. The evidence from the pilot and crew of the launch suggests the fall was caused by slackness in the ladder taking up when the pilot's weight on the ladder became effective.

After leaving the berth the Third Mate (3/O) left the bridge to supervise rigging the pilot ladder on the starboard side. The crew were busy securing containers on deck, so the 3/O rigged the ladder on his own. He said that, after rigging the ladder, he tested it by putting his weight on it; he was, however, of light build. He did not know where the manropes for the starboard ladder were stowed and he did not get the manropes from the port side.

When he later escorted the pilot from the bridge the 3/O did not take a torch or a hand-held VHF radio to communicate with the bridge. The pilot did not have a torch either. Illumination of the ladder was provided by a gangway light facing forward and a searchlight from the bridge, although the ship's side was very well lit, the deck area was partly shadowed by the adjacent stow of containers. The pilot did not make a thorough security check of the ladder due to the inadequate lighting on deck. He requested manropes and was offered a totally inadequate heaving line which he refused. He was wearing a lifejacket of old design which did not have an automatic light.



Pilot boarding is a hazardous operation which must be properly supervised at all times.

From the video "Bridge Watchkeeping", courtesy Videotel

When the Master saw the pilot fall he immediately ordered 'stop engine' and 'hard a starboard', he also called the pilot launch but they were too busy to answer until they had retrieved the pilot; the Master then offered any assistance that he could provide. The 3/O did not watch the pilot go down the ladder and only heard the splash. He ran to the bridge shouting "man overboard" as he could not make himself heard against the noise of the wind and rain. He did not throw the life buoy and marker stowed alongside the pilot ladder, a set was thrown from the bridge.

The inboard end of the ladder was permanently secured with shackles through thimbles on the end of each set of side ropes. Rope lashings were then used to seize the side ropes in order to adjust the ladder length. Access over the side was through an opening in the bulwark set inboard 400/500 mm from the sheer strake. The opening in the bulwark was not full depth but stopped 200/300 mm above deck level. The ladder, when hanging over the side, passed from the securing eye pads on the deck up over the lip of the bulwark opening, then down at approximately 45° to the point where it crossed the sheer strake and then vertically down the ship's side.

There were three places at which the ladder treads could foul:-
On the underside of the bulwark plating immediately above the securing lashings
On the top lip in the bulwark access
On the inboard side and top of the sheer strake

In an area of poor lighting, these points could easily be overlooked. It would need more than a cursory glance to see if they were holding back quite a large amount of slack in the ladder, this can be a common fault and has been noted on several occasions. The pressure of a lightweight person testing the ladder may not be sufficient to take up the slack.

The investigators concluded that, for whatever reason, there was slack somewhere inboard of the point where the ladder passed over the sheer strake. As the pilot's weight, and movement of the ladder caused by his descent, shook the fouled ladder free, the combination of a falling ladder followed by a sudden jerk loosened his hand hold sufficiently to throw him clear.

Several factors would have made a contribution to this accident-

Poor lighting to the deck area at the top of the ladder possibly prevented the correct lashing of the ladder when it was adjusted for length at the initial rigging. It also prevented proper inspection of the ladder prior to disembarkation
Neither the 3/O nor the pilot carried a torch to supplement the ship's fixed illumination
No man ropes were used, these would have provided additional support when the ladder slipped

If the pilot had not been wearing a lifejacket he would almost certainly have spent longer in the water. It allowed the crew of the pilot launch to see him, in spite of the lifejacket not being fitted with a light. The retrieval was achieved with considerable difficulty due to inadequate emergency lighting aboard the pilot launch and the fact that the life buoy and light from the ship were dropped too far from the man in the water to be of any use and the bad weather prevailing at the time of the accident.

Chapter 3 — SAQs

SAQ 82. List the correct way of rigging a pilot ladder (see Annex 5).

SAQ 56. Who should be in attendance when a pilot is on the ladder, and why?

SAQ 87. What safety equipment must be provided at the pilot ladder?

SAQ 44. What provision must the OOW make for boarding and disembarking pilots in the dark?

SAQ 64. Why must the pilot ladder be rigged so that it does not touch the water?

SAQ 37. Approaching the pilot vessel in fog, the Master of the pilot vessel says "I can see you on the radar now 135° at 2 miles". Where would you look to find the pilot vessel and why?

Chapter 4 — WATCHKEEPING IN COASTAL WATERS

Purpose

On completion of this chapter you should be able to understand how to organise yourself effectively. You will be shown how to take charge of a watch. The concept of control is introduced. Your responsibilities for safe navigation and collision avoidance are discussed so that you will understand how to set your priorities and how to manage your time. The need to maintain a proper lookout is examined and a final section will remind you that at times, when there is a potentially dangerous situation arising, you should call for assistance.

Setting course after the pilot has left

Often it is necessary to alter the ship's head in order to create a lee from the prevailing wind and waves whilst the ship is slowed or stopped to enable the pilot to leave. Once the pilot boat is away and clear, the Master will work up the speed to Full Away and manoeuvre to regain the track towards the next way point. When the ship is steady and the Master is satisfied that no danger exists he will hand over the charge of the ship to the OOW.

Taking over the watch

Having assisted the Master to check the ship's position, the OOW has a duty to be prepared to take over the watch and must:-

Confirm where the ship is going by examining the chart, working out the time to the next alter course and the approximate estimated position at the end of the watch

Check the radar is working properly, operate the log and confirm its reading and input

Verify the track, compass errors, course to be steered and mark them on the course board

Be familiar with the weather forecast and tidal stream

Be familiar with conspicuous buoys and land marks for use in navigation

Note significant changes in depth for comparison with the depth recorder

Look over the side to check that the pilot ladder is in and that there are no other loose items attached to the ship in the water

Look out to see if there is any threat from traffic in the area

Verify that items likely to be wanted are available, including sunglasses, illumination at night (bulbs working), tea, cocoa or coffee and so on

Know the names of the bridge team and where they are located

Be aware of the activities of the crew for example on deck stowing mooring ropes, securing cargo, etc.

Obtain a positive report that the anchors are secured

Obtain a positive report that any side openings used for pilot access have been securely closed

The key elements to a successful handover are planning and being prepared.

Master's instructions or Night Orders

When the Master formally hands over the watch he should confirm that the OOW is happy with the situation and say "You now have the watch". The OOW should then repeat "I have the watch".

Before going below he will either write down his instructions in the night order book or in day time tell the OOW when he expects to be called unless there is a need for his presence on the bridge.

Typically, for an inexperienced junior OOW, the Master may require calling if any ship has a closest point of approach (CPA) of less than 2 miles, and half an hour before the next alteration of course.

For an OOW with some experience this might be for a CPA of less than 1 mile and 15 minutes before an alter course.

For an experienced OOW the Master may simply request to be informed of any difficulties and when the ship has altered course in accordance with the plan.

It takes time for the Master to know the capabilities of his officers and it is up to the OOW to demonstrate competence to him.

Keeping the situation under control

Chapter 1 demonstrated the importance of **checking** the gear prior to sailing. Chapter 2 described how to **monitor** instruments and the pilot's navigation. This chapter introduces a third concept which is **control.**

The principle of control can be explained as follows:-
A ship steers a straight course
External forces such as currents or winds cause the ship to deviate from the track
The navigator discovers that the ship has deviated from the track on the chart by taking a fix
The navigator corrects the course to bring the ship back on track.

The elements of control can be described as:- steady state, deviation, feedback, correction and steady state.

The same principle exists within the steering system of the ship. Similarly, the Master keeps control on board by setting a standard through his orders. ***If he finds they have not been complied with he will want to know why and correct the situation***.

What has control go to do with watchkeeping? When in charge of a watch there are two equally important functions which must be controlled:-

The safe navigation of the ship at all times

Collision avoidance

In navigation, the ship is being controlled against the intended track. In collision avoidance the ship is being controlled in response to other traffic in accordance with the collision regulations (COLREGS).

How should the OOW organise the navigation of the ship? The international convention states:-

"The largest scale chart on board, suitable for the area and corrected with the latest available information, should be used. Fixes should be taken at frequent intervals; whenever circumstances allow, fixing should be carried out by more than one method. The OOW should identify positively all relevant navigation marks."

The OOW should always aim to fix the ship at regular intervals. It is then easy to project the previous fix interval forward on the chart with dividers to establish the estimated position where the ship **should** be when recording the fix next time.

The need to fix the ship at "frequent intervals" requires further explanation. A fix should be taken whenever the vessel alters course and at regular intervals thereafter.

The fix interval should be such that the vessel can not be set appreciably off track or into danger by the anticipated effects of tidal stream, wind or currents in the period between successive fixes.

Typically, having discharged the pilot in an estuary, the fix interval may be 15 minutes or less. When the ship reaches open water the fix interval may increase to half an hour.

How should the OOW organise collision avoidance?

There is a conflict between the two demands of maintaining a given track and altering course to avoid a collision. This conflict becomes more critical in narrow waters. Also, navigation requires position over the ground, whereas collision avoidance is concerned with the position of the ships in the water relative to each other. **Circumstances demand that the OOW must take appropriate action to avoid collision first, and then seek to resume the track.**

A number of critical situations can arise such as having to avoid a fleet of fishing vessels or the ship may have to alter course to starboard for a succession of ships which means that there is a risk of running aground in shallow water.

If situations like these develop:-
Call the Master
Consider slowing down or stopping the ship

Managing time on watch

Experience shows that traffic makes irregular demands on attention whereas navigational fixing should be carried out regularly. It is therefore essential to plan watchkeeping around the demands of the need to maintain a lookout to identify other vessels. The ship is not put at undue risk if there is a variation in the fix interval. **However, the ship is put at risk if the OOW is preoccupied with navigation when there is a risk of collision.**

As vessels approach one another on a collision course, there are three phases which can be identified: an early period when the target is detected but when action to avoid collision can be deferred; a **critical period** when action must be taken; and a **terminal period** when it is too late to prevent impact.

The beginning and end of each period relate to a range of the values which are determined by the relative speed of approach of the two vessels concerned. The table below shows some typical relative speeds and the times to their collision point.

Distance nml	**Time (minutes) to Potential Collision Point** Combined Approaching Speed (knots)							
	10	**15**	**20**	**25**	**30**	**35**	**40**	**45**
5	30-0	20-0	15-0	12-0	10-0	8-6	7-5	6-7
4	24-0	16-0	12-0	9-6	8-0	6-9	6-0	5-3
3	18-0	12-0	9-0	7-2	6-0	5-1	4-5	4-0
2	12-0	8-0	6-0	4-8	4-0	3-4	3-0	2-7
1	6-0	4-0	3-0	2-4	2-0	1-7	1-5	1-3
0.5	3-0	2-0	1-5	1-2	1-0	0-9	0-8	0-7

For example, if a merchant ship first detects a fisherman at four miles and their relative approaching speed is 20 knots, then the time of collision, if no action is taken, will be 12 minutes later.

If, however, there is a terminal period of one mile and a relative approach speed of 20 knots, then the critical period for the same fishing vessel first identified at 4 miles will be 12 minutes — 3 minutes = 9 minutes.

It is possible for ships to draw up their own limits to the terminal period which will be based upon their ability to manoeuvre. The limitation of the critical period will depend on such factors as obstructed vision and blind arcs, but above all the ability to detect a small vessel in reasonable time.

Review

An OOW in coastal waters can become very busy. If the work load increases and there is a worry that a dangerous situation might develop — **call the Master**.

It is a fact that "the more busy we become the less we tend to plan ahead." This means that in dense traffic the OOW may become so preoccupied solving immediate problems on the bridge that situational awareness is lost or the OOW may fail to notice a new collision risk developing.

Learning to recognise this point of overload takes time and that is why, initially, the Master sets out to control the behaviour of inexperienced personnel by requiring to be told about any ship within a specified CPA.

With experience the Master will leave you to make your own decisions on watch.

There are of course other routines which have to be carried out on watch such as record keeping, taking compass errors and testing the automatic pilot. These will be dealt with in the next chapter.

Summary

- □ Plan ahead before taking over the watch
- □ Check the track, compass errors and courses
- □ Check the compass error at least once a watch
- □ Make keeping a lookout the priority
- □ Assess risk of collision and take action if necessary
- □ Fix the ship at regular intervals, if practicable
- □ Fix more frequently in confined waters
- □ Call the Master before a potentially dangerous situation becomes critical
- □ Observe changes in the weather
- □ Study the chart and expect to find new landmarks before they are seen
- □ Maintain situational awareness, particularly if the ship has to deviate widely to avoid traffic
- □ Be prepared to use the engines, if necessary, to ensure adequate sea room
- □ Be prepared to call a lookout to the bridge if necessary
- □ Be prepared to call a helmsman to the bridge if necessary

"The* OOW *must ensure that at all times the ship is never put into a situation of uncontrollable risk."

SAQ 25. When examining the chart, prior to taking over the watch, what will you be looking for?

SAQ 13. You are aiming to make good a track of 090°T. The ship is allowing 7° drift to port for a current from the starboard bow, and a Leeway Angle of 3° for a wind on the port side. The Gyro Error is 2° low and the Compass Error 4° W. What is the Gyro Course and Compass Course to steer?

SAQ 47. a) What do you mean by a fix interval, b) Your ship is doing 12 knots. There is a current across the track of three knots towards the danger and a wind blowing in the same direction adding 1 knot of drift. The track is parallel to a sand bank at 1 mile. What should be the fix interval?

SAQ 76. Which should take priority — navigation or collision avoidance? Why?

SAQ 90. You are OOW on a 20 knot container ship and you detect a small target at 4 miles approaching at 5 knots with a terminal period of 1 mile. Calculate the critical period .

SAQ 51. Why would you not trust the radar to give you warning of small vessels in coastal waters?

SAQ 79. Give some examples of when you would call the Master for assistance.

SAQ 96. A steering system is a control system. How does it work?

BRIDGE WATCHKEEPING

Chapter 5 — WATCHKEEPING DURING OCEAN PASSAGES

Purpose

On completion of this chapter you will be aware that routine activities on the bridge must be secondary to keeping a vigilant look out. Out of sight of land, navigational accuracy depends upon instruments and you must ensure that monitoring them deep sea has a higher priority. The value of maintaining traditional celestial navigation is discussed and you are encouraged to use spare time to practise this skill and to prepare for more busy coastal passages.

To every threat there must be an adequate response

In the last chapter it was demonstrated that the combined closing speed of two ships travelling at twenty knots means that in 15 minutes they will have approached 10 miles closer to each other. This emphasises the need to detect approaching vessels early and the essential requirement to keep an efficient lookout.

Out of sight of land the principal threat to a ship at sea is the risk of collision from other ships. For this reason the watch must be organised around the need to maintain a vigilant look out. All other duties will be secondary.

The international regulations for preventing collisions at sea state:-

"Every vessel shall at all times maintain a proper look out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and the risk of collision".

What is a proper look out? An analysis of reports received by The Nautical Institute over the past 20 years indicates that in open waters the predominant cause of collision was failure to maintain a proper lookout. In some cases the ships, fishing vessels or yachts were not seen or even *detected* at all and in other cases they were detected too late to avoid a close-quarters situation.

Watchkeeping demands a balanced assessment between keeping a visual lookout, monitoring the radar and referring to the chart.

Experienced watchkeepers are constantly seeking to verify the situation, and part of the reason for this is that it is not possible to predict, with certainty, what other vessels are going to do based upon past observations.

When conducting a visual lookout, the eye is most likely to detect new targets when they break the line of the horizon. Targets can also be obscured

in blind arcs caused by window frames and cargo gear. The OOW will need **to move position on the bridge frequently to obtain a clear view of the surrounding sea.**

The following table provides a comparison between the merits of visual and radar observation which can be used when deciding lookout priorities. It must not be forgotten that the OOW also has to be vigilant concerning activities onboard and the effect of weather on the ship, crew and equipment.

Table

ADVANTAGES OF THE EYE	*ADVANTAGES OF RADAR*
Reliable	Generally reliable
Sensitive to colour	Does not get tired
Can assess heading	Accurate range information
Can identify small targets	Stable bearing platform
Can see light configurations	Simplifies the overview
Can assess ship types	Can penetrate fog
Can identify conspicuous marks	Better penetration in rain and snow
Can identify flashing lights	Useful for predictive collision avoidance
Has better discrimination	Predictive navigation (parallel index)
Can see changing weather patterns	Can have longer range (height of aerial)
Can see effect of sea on vessel	Can have low down port approach aerial to minimise clutter
Not affected by blind arcs (if observer moves)	
LIMITATIONS OF THE EYE	*LIMITATIONS OF RADAR*
Poor at assessing distance (worse at night)	Misses small targets
Subject to night adaptation	Can miss substantial targets in clutter
Degradation through glare (worse with age)	Can de-tune
Gets tired searching	Prone to inherent and input errors
Binoculars needed for early identification (particularly on high speed vessels)	Targets need transponders for positive identification
	Is prone to interference
	Cannot discriminate as well as the eye
	Cannot identify ship types or operations
	Cannot assess aspect immediately
	Bearings less accurate than compass

Do lookout priorities vary?

In clear weather a visual search of the sea area around the ship is the quickest and most certain way of keeping a look out. Having detected a ship it is useful to verify its distance on the radar.

In restricted visibility the reverse process is more effective where the target will be identified first on radar and then looked for by eye to check its heading and collision threat.

Why over-reliance on radar should be avoided

There are obvious reasons and less obvious reasons for not relying implicitly on just a single instrument for the safety of the ship.

Firstly, if the radar is faulty or there has been an error setting it up, the whole ship might be put at risk without the OOW realising.

Secondly, it is easy to focus on specific echoes and miss other potentially hazardous echoes on another part of the screen.

Thirdly, the radar itself, particularly in rain, may not be able to detect significant targets.

To minimise the risk of error, the OOW should check the radar with the visual scene regularly.

The value of a good lookout

Most ships, during the hours of darkness and in poor visibility, require a crew member to be posted as a lookout, generally on the bridge.

Such crew members should have good eyesight and be able to communicate with the OOW. Sometimes they have eyesight problems and this should be quietly tested by noting when lights are seen.

The OOW must ensure that the safety of the ship is not put at risk through the inability of the lookout to keep a vigilant watch.

The effectiveness of the lookout will be considerably increased if he or she is properly briefed about what to expect and when ships and lights should be detected.

Lookouts should be encouraged to relate what they see to the radar. On many ships lookouts are encouraged to keep a visual and radar watch.

Whenever the lookout is sent below for any reason like calling the watch or calling hands to stations, the OOW must ensure that a visual watch is maintained.

Priorities when navigating out of sight of land

When out of sight of land the ship has to be navigated by instruments. It is, therefore, vital that the instruments are properly calibrated and checked regularly and the ship's progress monitored.

Direction is provided by the compass and special attention must be given to monitoring the courses steered and checking the compass errors.

The course will be checked at each watch change and during each watch. After any significant course alteration the OOW must check the compass error. The gyro must be checked against the magnetic compass regularly and a compass error obtained by external observation. The error must be properly recorded.

Position will generally be obtained from the Global Positioning System (GPS) which has proved to be very reliable. Because of this officers tend to trust it implicitly and that can lead to problems because:-

Future waypoints may have been wrongly put into the processor, e.g. in error by 10° or 10'.

The level of integration varies, but a fault may develop in any of the connecting circuits

The set itself may be faulty or break down

Each watch, the principal instruments directing the navigation should be checked against an estimated position so that if a deviation is detected the situation can be controlled.

The value of celestial navigation

The ability to be able to take sights and calculate the ships position independently of navigational aids ensures that in the event of failure the prudent navigator can rely on his or her ability to navigate the ship and all those on board safely to harbour.

Masters and officers brought up using more traditional methods of navigation are confident in their own self reliance. There have been many occasions when this knowledge has been invaluable.

Many companies whose ships are fitted with Satellite Navigation (SatNav) have a statement in their instructions that watch keeping officers must take at least one sight per day.

At noon it is reassuring to check the SatNav with the latitude obtained from celestial observation.

Routines and time on watch

If the OOW was fully occupied navigating and manoeuvring to avoid collision in coastal waters, then there will be time deep sea to do other bridge duties.

For any major project which requires undisturbed concentration — like calculating sights or planning a passage — the OOW must ask for an additional lookout to be posted to the bridge. It is, however, the responsibility of the OOW to make sure that undue reliance is not placed upon an inexperienced lookout.

The OOW must learn to carry out other bridge duties without becoming distracted from the main purpose of maintaining an effective lookout.

On no account must the OOW ever leave the bridge without a relief.

Other duties must be so organised so as not to interfere with the keeping of a proper lookout.

The use of television and radio entertainment on the bridge must be strongly discouraged in spite of the excuse that they are being used to obtain weather forecasts. The fact is that a number of serious accidents involving loss of life have occurred for this reason.

Similarly, radar guard rings may not always be actuated by other vessels and must not be relied upon to the detriment of keeping a proper lookout.

The use of radio communications

Mostly, the OOW is monitoring and receiving incoming radio messages, but equally important is the use of radio for warning other vessels of hazards to navigation.

There is a requirement to monitor VHP Channel 16 and the digital selective calling channel 70. Similarly, the ship must monitor NAVTEX on 518 kHz and the distress frequency of 2187.5 kHz and the radio telephony frequency of 2182 kHz.

Distress messages may be broadcast on a variety of frequencies and the GMDSS receiver is likely to be situated on the bridge if fitted. The OOW must be familiar with the systems for receiving and transmitting urgent messages and should inform the Master in the event of any such communications.

Summary

- □ When on ocean passages keeping a look out must have priority
- □ Check the instruments being used to navigate the ship regularly and monitor the position each watch
- □ Practice celestial navigation regularly
- □ Monitor radio communications for routine messages and ensure that emergency channels are operational and being monitored
- □ Use any spare time productively to plan ahead for the next phase of the voyage
- □ Always post a look out if a bridge task is likely to preoccupy your time
- □ Learn to break off tasks at frequent intervals so that it becomes a habit
- □ Avoid entertainment on the bridge. It may provide a fatal distraction
- □ Monitor changes in the weather and regularly observe the barometer
- □ Keep records up to date

Chapter 5 — SAQs

SAQ 15. List the items to be checked and monitored each watch.

SAQ 32. What advantages does the eye have over the radar?

SAQ 59. When would you instruct a lookout to assist you on the bridge?

SAQ 81. How would you brief a lookout?

SAQ 62. List the ways of obtaining a compass error out of sight of land.

SAQ 22. When would you call the Master, out of sight of land?

SAQ 75. List the information required by the Master at noon each day.

Chapter 6 — MAKING A LANDFALL AND PREPARING FOR ARRIVAL

Purpose

On completion of this chapter you will be aware of the need to identify the coastline positively when making a landfall. At this time there is, invariably, an element of doubt and the risk of placing the ship in danger if predictions are wrong. As the ship approaches port there will be other duties to perform which emphasise the value of planning.

Approaching land

All Masters will expect to be called prior to making a landfall. It is important that they are present on the bridge as they are probably the most experienced navigators onboard and will therefore be best able to assess the situation correctly.

The OOW will also have to be more aware of traffic and the possibility of fishing vessels operating in the area. There is a need to keep a particularly good lookout for small vessels during this phase of navigation.

In poor visibility, approaching land can be hazardous and the radar(s) will be the principal navigational instrument to confirm the ship's position. A lookout should be posted.

The land never lies

After a long ocean passage in poor weather it is quite possible for a ship without electronic fixing aids onboard to be fifty miles away from its estimated position when making a landfall.

Usually ships do obtain sights and at least one position line will have been established, for example the latitude at noon. The estimated position will usually be within twenty miles of the ship's actual position.

GPS will ensure that the ship has an accurate position and landfall should be a matter of routine. The fact remains that the instrument may have an error or the OOW may misread it. It is not until there is a positive confirmation of the land that the Master will feel comfortable.

Why is making a landfall so critical?

Until the land is positively identified it is not possible to know if the ship is likely to approach:-

Sandbanks and shoals offshore
Rocks
Other obstructions

If, for example, a mountain is wrongly identified or a promontory is mistaken on the radar and the ship turns in the wrong direction, a grounding may occur.

A landfall is critical because in the first instance it is usually only possible to obtain one bearing. If that bearing is wrong the ship may be at risk.

So there are two uncertainties when making a landfall. Firstly, the ship's position, and secondly the identification of the land. It is to reduce these uncertainties that good navigational practices must be developed.

Prudent navigation

The OOW should try always to obtain a fix in the ocean and monitor the GPS. Nobody knows for certain when the last fix will be taken prior to making a landfall, particularly in bad weather.

Useful information can be obtained from the depth contour on the chart. The depth recorder should be on and checked against the chart. If there is a significant difference from that anticipated, inform the Master immediately.

Extra care should be taken to identify any light by its exact characteristics and to verify the ship's position on the position line by calculating the distance at the time it appears.

Radar identification of headlands is less certain and it is still prudent to sight lights and lighthouses visually whenever possible. In most landfall locations they have been conveniently provided.

This may seem old-fashioned, but on making a radar landfall the OOW cannot be certain initially whether the echo is the coastline or a ridge inland. Doubt will remain until the ship is close enough to verify the shoreline.

Rising and dipping distances

These are obtained from the height of a light and the distance the light travels until it reaches the horizon and the height of eye enabling the observer to see it from the ship. The information can be found in navigational tables available on the bridge.

Example

The extract overleaf is taken from Nories Tables.

To find out the distance at which a light can be seen for the first time, two entries are needed.

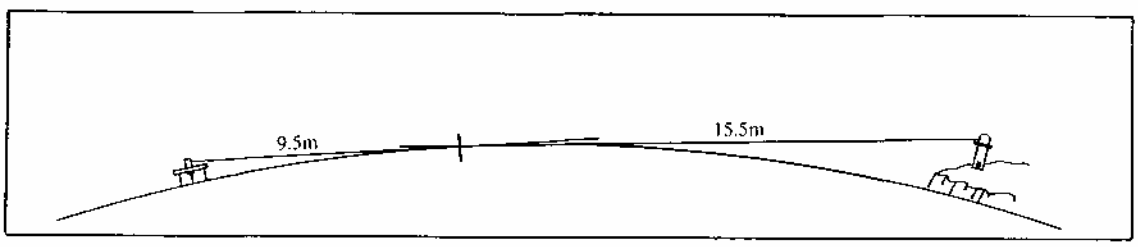
First, find the height of the light. Secondly, note down your own height of eye.

For example, the height of the light, taken from the chart, is 56 metres. Your height of eye is 21 metres.

Distance light to horizon	=	15.6 miles
Distance observer to horizon	=	9.5 miles
Distance to first sighting	=	25.1 miles

TABLE FOR FINDING THE DISTANCE OF TERRESTRIAL OBJECTS AT SEA

Distance of horizon for various heights of eyes								
Height of eye:		Horizon distance n. miles	Height of eye:		Horizon distance n. miles	Height of eye:		Horizon distance n. miles
metres	feet		metres	feet		metres	feet	
1	3.3	2.1	21	68.9	9.5	41	134.5	13.3
2	6.6	2.9	22	72.2	9.8	42	137.8	13.5
3	9.8	3.6	23	75.5	10.0	43	141.1	13.7
4	13.1	4.1	24	78.7	10.2	44	144.4	13.8
5	16.4	4.7	25	82.0	10.4	45	147.6	14.0
6	19.7	5.1	26	85.3	10.6	46	150.9	14.1
7	23.0	5.5	27	88.6	10.8	47	154.2	14.3
8	26.2	5.9	28	91.9	11.0	48	157.5	14.4
9	29.6	6.2	29	95.1	11.2	49	160.8	14.6
10	32.8	6.6	30	98.4	11.4	50	164.0	14.7
11	36.1	6.9	31	101.7	11.6	51	167.3	14.9
12	39.4	7.2	32	105.0	11.8	52	170.6	15.0
13	42.7	7.5	33	108.3	12.0	53	173.9	15.2
14	45.9	7.8	34	111.6	12.1	54	177.2	15.3
15	49.2	8.1	35	114.8	12.3	55	180.4	15.4
16	52.5	8.3	36	118.1	12.5	56	183.7	15.5
17	55.8	8.6	37	121.4	12.7	57	187.0	15.7
18	59.1	8.8	38	124.7	12.8	58	190.3	15.9
19	62.3	9.1	39	128.0	13.0	59	193.6	16.0
20	65.6	9.3	40	131.2	13.2	60	196.9	16.1



Finding the dipping distance of a light

GPS accuracy

When using GPS it must be remembered that different continents and land areas were surveyed from different datums. The latitude and longitude of the land may not, therefore, match the reading on the GPS and the GPS may need to be re-set.

In some areas differences of 5 to 10 miles exist. Under these circumstances it is the chart datum which is presenting misleading information, because the land never lies.

Summary — making a landfall

- □ Always try to fix the ship's position and be as up to date as possible on ocean passages
- □ Call the Master in accordance with his instructions. If land is seen early, call the Master immediately
- □ Use the depth recorder and ensure it is set to the correct scale
- □ Positively identify lights, lighthouses and the coastline
- □ Use the rising distance to improve the accuracy of the first land based position
- □ Having positively identified the ship's position relative to the land, adjust course if appropriate
- □ Re-calibrate electronic navigational aids if necessary

Preparing for arrival

Once landfall has been made the ETA can be worked in more detail, allowing for currents.

Pre-planning should provide details of the VHF radio channels for calling the pilot station, the port coast radio station and the port control centre.

A number of activities will need to be completed before arrival and the OOW must ensure that all officers and crew are called in time to carry out these tasks.

The Chief Engineer will need notice to prepare the engines for manoeuvring and to make sure the necessary auxiliaries are available and working.

The Officer forward will need to prepare the anchors and ensure that the mooring ropes and wires are on deck and the mooring drums operational.

The pilot ladder and gangway will need to be prepared. The Master will need to be informed in time to take charge of the ship when approaching the pilot.

On many ships, preparation for cargo work will also be taking place.

Prior to taking on board the pilot the OOW should complete the pilot boarding card, using the corrected draught worked out by the Chief Officer which will vary from the departure draught due to:-

Consumption of bunkers
Consumption of water
Redistribution of oil and water in the tanks
Ballasting and de-ballasting

It is important for pilots to know the trim of the vessel because it affects the manoeuvring characteristics.

Summary — preparing for arrival

- □ Having made the landfall, work out an accurate ETA
- □ Whilst the watch is still 'quiet', confirm a list of VHF calling channels for reporting, obtaining the pilot and port entry
- □ Recognise that a number of activities will be undertaken prior to arrival
- □ Follow the Master's instructions
- □ Be prepared to:-
  - Call the engine room / chief engineer / control room
  - Have the pilot ladder rigged
  - Find out which side to have the gangway rigged and moorings ready for berthing
  - Call the appropriate Officers to break out anchors and moorings
  - Pass on information about cargo work

Chapter 6 — SAQs
SAQ 27. Why is making a landfall so critical?
SAQ 86. What should you tell the Master when he comes to the bridge, prior to making a landfall at night?
SAQ 17. What preparations would you take when making a landfall in poor visibility?
SAQ 69. What activities need to be undertaken prior to arrival?
SAQ 55. Why is it important to establish correctly in advance which "side to" when berthing?

SAQ 31. Where would you expect to find VHF calling channels for a pilot station and a port VTS?

BRIDGE WATCHKEEPING

Chapter 7 — ANCHORING AND WATCHKEEPING AT ANCHOR

Purpose

On completion of this chapter you will know how to support the Master when approaching an anchorage and whilst anchoring the ship. Once the ship is 'brought up' on the anchor cable you will almost certainly be left on the bridge to keep an anchor watch. The final section will make you aware of hazardous situations which can occur and how to respond.

Anchoring

There are four main approaches to anchoring which require different planning in each case. They are:-

A request to anchor in a designated position
A need to anchor in a waiting area
A need to anchor in the shelter of land
The need to anchor in a river which may be tidal

Anchoring in a designated position

The Master's aim will be to have the ship's head stopped over the ground over the centre of the designated anchorage.

Taking note of the increased effect of tidal currents as the ship slows down the Master will control the speed of the ship and its progress along the track. This can be very difficult if there is a strong cross wind and the ship is in ballast.

Where possible the Master will approach the anchorage head to the prevailing forces of wind and/or tide, as this provides the best method of control and assists in slowing down the ship.

The approach to an anchorage will usually be planned in advance. Where possible the approach to the anchoring position will be along a carefully selected transit. Such an approach, used in conjunction with a parallel index, will provide an accurate check to alert the OOW and the Master if the ship deviates from the track. At night, greater reliance may have to be placed upon the use of radar.

The Master will need to be kept informed of the distance to the anchorage so the points at which speed reductions are to be made should be marked on the chart. Pre-determined cross bearings and radar ranges will help the OOW to determine exactly when the critical points in the approach are reached so that the OOW can keep the Master fully informed of progress.

The OOW has an essential role in assisting the Master with his planned approach, giving the course and distance to go to the anchoring position using information from the chart, the compass and radar. The OOW may work the telegraph or remote engine controls and may be given the task of navigating the vessel in accordance with the plan.

Supporting and monitoring the Master requires the OOW:-

To discuss the approach with the Master

To monitor the depth recorder, the helmsman and the autopilot

To control and monitor the engines
To check the ship's speed either by noting the log or measuring it from the chart
Responding to the Master's request for information
To be aware of which anchor is being used and the shackles to be let go

At the appropriate point the order will be given to let go. The OOW must verify the position independently with bearings of other navigational marks to fix the position of the ship in case it is accidentally out of position or the anchor is lost. From this position the swinging circle can be drawn on the chart, depending upon the number of shackles used.

When the ship is brought up and the anchor bars put in place, the Master will decide the level of readiness for the engines and pass on this instruction before going below. The OOW must then fix the ship again to verify that the anchor is holding, that there is room to swing and to ensure that the ship is within the swinging circle.

Anchoring in a waiting area

In this situation it is often not possible to plan the exact anchoring position in advance. The Master will satisfy himself that it is safe to anchor the ship in the chosen area. He will then slow the ship down well in advance and search visually or on radar for a suitable anchorage position with sufficient room for the vessel to swing.

He should always approach the 'hole' coming up astern of other vessels and in a tight anchorage will have to over-run the position he wishes to occupy so that when he lets go of the anchor and comes back on the chain he ends up where he wants to be.

Instead of aligning the ship to the shore the Master will choose his anchorage in relation to the other ships, from which he will ask the officer of the watch for bearings and distances.

Once the anchor has been let go the OOW must fix the ship in relation to the shore for the reasons given above.

The approach in a crowded anchorage can be critical and the OOW can be of great assistance if he keeps a vigilant lookout to see if any other ships are moving and to tell the Master immediately, as well as monitoring the courses and engine movements.

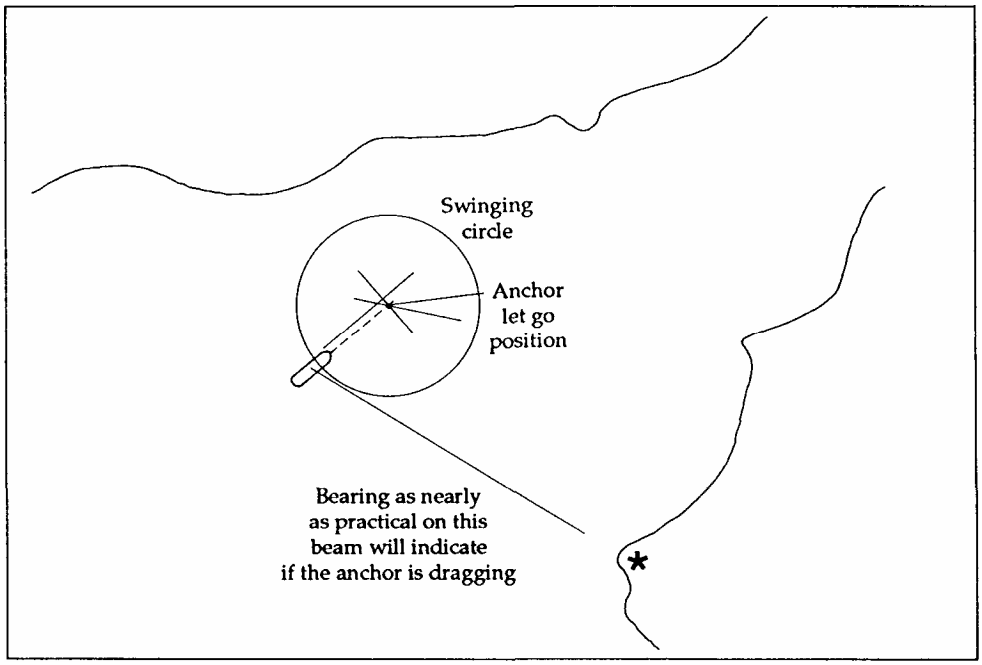
Anchoring in the shelter of land

Particularly on small low-powered vessels, this is a regular occurrence in rough weather.

When choosing an anchorage the Master will be aware of how the direction of the wind will veer or back and will select an anchor so that if a second anchor has to be let go it will not cause a foul hawse.

The distance off land is the critical factor when letting go in these situations and the OOW should monitor this carefully.

In stormy weather the engines will be kept in readiness in case the anchor(s) drags. The Engineers must be told the severity of the situation so that they do not start some maintenance which will prevent the engines from being used in an emergency.



For a vessel at anchor, fix the ship at the time of letting go and inscribe the swinging circle on the chart. Then monitor the anchor bearings either by radar ranges ahead or astern or by beam bearings

The anchor watch must be so organised as to monitor any drag which might occur before the ship gains momentum.

If drag does occur call the Master at once. Consider laying out more cable, using the engines or letting go a second anchor.

Anchoring in a tidal river

When anchoring in a strong current and narrow channel the critical time is when the ship stops in the water, as it is then without steerage and a 'kick ahead' on the engines may cause a sheer.

It is most important, therefore, that the anchors are lowered to the water in advance so that when the brake is released the anchor cable will run free at very short notice.

Frequently, in rivers, there is not enough room for the ship to turn on a long anchor chain when, for example, the tide changes and it has to be held short. To compensate for this the engines may be needed at certain critical times to prevent too much drag on the anchor.

As the current reaches its faster ebbs and flows it may be necessary for the OOW to use the engines.

Accurate position fixing and the use of a cross bearing to ascertain if there is any drag is essential.

What should the OOW look out for whilst at anchor?

As with all previous approaches to keeping a lookout, the first requirement is to assess the level of threat, and this varies according to circumstances.

There are four types of threat which can all have damaging consequences:-

Dragging due to wind and current

Another vessel bearing down on the ship at anchor

Own ship turning one way and a neighbouring ship turning the other way as the tide changes creating a possibility of contact between the vessels

Own ship turning in such a way as to run aground

However, anchor bearings should be checked at least every hour and more frequently in conditions of strong currents, wind and waves.

A useful technique is to use the radar range ring on a conspicuous point ahead or astern of the vessel and this should be checked at similar intervals.

If the ship appears to be dragging her anchors call the Master immediately.

When in an anchorage where other vessels may be in close proximity there is little time available if something does go wrong.

During an anchor watch vigilance is still important and the aim is to detect any threat early. All vessels are moving slowly and are less able to

manoeuvre. This can give rise to a classic misjudgement, for example by Masters wanting to cut across the bow of an anchored ship.

Under these circumstances the other ship cannot move fast enough and is carried down on the current.

At an anchorage ships can usually be identified by name. Early signs of a problem can often be overcome by communicating on the VHF. The OOW must realise that talking may be insufficient to prevent an incident and must be ready to take action.

If the engines are on "stand by" be prepared to use them to manoeuvre even with the anchor down, and call the Master.

If the OOW suspects that a collision might happen he should sound at least 5 short and rapid blasts on the whistle, flash the aldis and call an officer to go forward urgently to pay out more cable.

In a river situation it is possible to give the ship a considerable sheer just by applying helm and this manoeuvre should be considered.

Be prepared to monitor the activities of the crew if they are working over the side.

Other routines

The OOW must ensure that the ship is properly lit at night, that she exhibits the correct lights and sounds signals in fog.

Often the ship will be waiting for orders or working cargo. Attentive monitoring of the VHF or Satellite Communications (SatComs) will be required.

In many places piracy and illicit boarding is a major problem. The monitoring of all approaching craft and a vigilant inspection of the ship's side is the primary protection the ship has against this threat. Precautions for securing the accommodation should be taken.

If unauthorised persons are seen boarding it is suggested that the OOW sounds the general alarm, blows the whistle and takes precautions to lock out the boarders.

Summary

- □ Anchoring demands teamwork
- □ Verify the plan with the Master
- □ Support the Master during the approach with bearings or distances
- □ Monitor the speed of approach

- □ Monitor the course and approach bearings
- □ Keep a lookout for other vessels moving
- □ Fix the ship when the anchor is let go and continue to monitor the position
- □ Maintain a vigilant anchor watch
- □ Check anchor bearings and/or radar distances regularly
- □ Assess any threat early
- □ Be prepared to use the engines to prevent dragging
- □ Be prepared to warn other vessels
- □ Be prepared to apply evasive manoeuvres
- □ Monitor shore based communications
- □ Monitor the movement of small boats
- □ Protect the security of the vessel
- □ Call the Master as soon as a potentially dangerous situation is identified
- □ Monitor the situation of the crew, particularly if they are working over the side

Chapter 7 — SAQs

SAQ 10. How many miles does it take your vessel to stop from a manoeuvring speed of 12 knots/ fully loaded, (i) with no astern power (ii) with maximum astern power?

SAQ 68. How can the OOW best assist the Master when approaching an anchorage?

SAQ 34. What is the purpose of lowering the anchor out of the hawse pipe when approaching an anchoring position?

SAQ 48. What is the maximum speed through the water that your ship can anchor without risking breaking the cable?

SAQ 93. What various options are available to a ship at anchor when faced with a threat of collision from an oncoming ship?

SAQ 65. Apart from navigational safety/ what else should you do on anchor watch?

SAQ 12. List the duties of the OOW at anchor, as laid down in the International Convention Resolution, Annex 2, Article 27.

BRIDGE WATCHKEEPING

Chapter 8 — WATCHKEEPING IN REDUCED VISIBILITY AT SEA

Purpose

On completion of this chapter you will be aware that in reduced visibility at sea there is a need to monitor the radar carefully and that a lookout should be posted to keep a visual lookout and to monitor any sounds. The need to call the Master is emphasised and the use of engines discussed.

Calling the Master

Masters invariably require to be called whenever there is reduced visibility due to fog, rain, snow, sandstorms, squalls or any other condition which makes it difficult to see how the other vessel is heading. Master's standing orders should specify the limits of poor visibility. This may vary with ship type and location.

Assessing the threat

In reduced visibility, the best way to assess the threat of collision is by monitoring the radar display. However, as was demonstrated in Chapter 5, the radar has limitations. A lookout should be posted, therefore, to keep a visual watch and to listen for any sound signals.

The International Resolution requires a number of conditions to be fulfilled. They are as follows:-

"When restricted visibility is encountered or expected, the first responsibility of the officer of the watch is to comply with the relevant rules of the applicable regulations for preventing collisions at sea, with particular regard to the sounding of fog signals, proceeding at a safe speed and having engines ready for immediate manoeuvres. In addition he should;

(a) inform the master;

(b) post a proper lookout and helmsman and, in congested waters, revert to hand steering immediately;

(c) exhibit navigation lights;

(d) operate and use the radar.

It is important that the officer of the watch should know the handling characteristics of his ship, including its stopping distance, and should appreciate that other ships may have different handling characteristics."

In addition the OOW should be prepared to close watertight doors in accordance with regulations and company instructions.

Assessing the collision risk

As soon as the ship enters fog or other conditions of restricted visibility the applicable collision regulations change and any evasive manoeuvres are undertaken under the principles of Rule 19. See also Chapter 13 & Annex 6.

There is more uncertainty about the movements of target vessels in fog. For example, they may be vessels fishing or not under command. It is, therefore, very important that the OOW takes **EARLY** action to avoid a close quarters situation.

Rain and snow are two conditions which not only reduce visibility but significantly reduce the ability of the radar to detect targets. If two radars are fitted the S band radar should be operational as well as the X band radar,

Masters need to know in advance about the onset of any condition which is likely to reduce visibility. This is to avoid being confronted with a "hidden target" at short range as the ship enters rain, fog, snow or even a sand storm. The OOW therefore has a duty to keep a vigilant lookout for fog and to scan the radar at long range for deteriorating weather conditions. If any changes are observed, call the Master.

The Master will use his judgement in accordance with the COLREGS to proceed at a safe speed and will usually want to be on the bridge in reduced visibility. However, everybody needs rest after prolonged periods and the OOW should ensure that in these circumstances approaching vessels are given a wide berth.

It should be remembered that stopping the engines in an emergency has little immediate effect and that it takes time to reduce speed even when the engines are going astern. The OOW should be ready to use the engines but must be aware well in advance what effect this will have on the manoeuvrability of the ship and the limited effect that can be expected in a close quarters situation.

Vessels such as ferries and naval craft are much more manoeuvrable than many vessels and respond more immediately to engine and helm movements. However, for most fully laden vessels this is not so.

Summary

- □ Observe the weather and call the Master when visibility deteriorates
- □ Monitor traffic in the area, and comply with the provisions of Rule 19
- □ Observe the other provisions of the COLREGS
- □ Post a lookout
- □ Put the engines to standby — inform the engineers if appropriate
- □ Be prepared to use a helmsman if a critical situation is developing
- □ Work the automatic plotting aids (ARPA) systematically
- □ If no automatic plotting facility exists, prepare to plot selected targets manually
- □ Be prepared to close watertight doors I
- □ Be prepared to reduce speed, stop, or turn out of danger
- □ If possible, consult the Master before any critical evasive manoeuvres are required

Chapter 8 — SAQs

SAQ 83. What is a safe speed?

SAQ 9. Why is it important to sound fog signals?

SAQ 46. If the Master and yourself are using the same ARPA what should you check?

SAQ 38. Besides the collision risk, what else should you be monitoring on watch in reduced visibility?

BRIDGE WATCHKEEPING

Chapter 9 — TAKING OVER THE WATCH

Purpose

On completion of this chapter you will appreciate the need, when changing the watch, to verify that the ship is proceeding according to plan, that all risks have been recognised and that the equipment is functioning normally.

Changing the watch — the need to provide continuity

The ship is operational throughout the day and night and the Master therefore has to lay down procedures to be followed to ensure continuity of operation when the watch changes. This is an effective time to check the navigation and status of the ship's equipment and can be used to prevent error chains developing (see Chapter 12).

The ship is navigated to meet the requirements of the passage plan, avoid other traffic and follow as closely as possible the track laid down on the chart. The Master will require to be informed of progress and his instructions are recorded in the Night Order book, annotation on the chart or passed on verbally during the day.

If the OOW receives verbal instructions to call the Master at a given time, which may go over into another officer's watch, it is good practice to make a note of the call time at the appropriate position on the track on the chart to remind the next OOW.

Calling the relief

On some ships this is done by the standby man, on other ships by the internal telephone. It is good practice, particularly with heavy sleepers, to make a follow-up call.

What should this relief do when coming to the bridge?

So many accidents have occurred during the change of a watch because of talking in the wheelhouse, failure to check the course, and failure to look out and establish any collision risk, that the International Convention states:-

"The relieving officer of the watch should ensure that members of his watch are fully capable of performing their duties, particularly as regards their adjustment to night vision.

The relieving officer of the watch should not take over the watch until his vision is fully adjusted to the light conditions and he has personally satisfied himself regarding:

(a) standing orders and other special instructions of the Master relating to navigation of the ship;
(b) position, course, speed and draught of the ship;
(c) prevailing and predicted tides, current, weather, visibility and the effect of these factors upon course and speed;
(d) navigational situation, including but not limited to the following:
(i) operational condition of all navigational and safety equipment being used or likely to be used during the watch;
(ii) errors of gyro and magnetic compasses;
(iii) presence and movement of ships in sight or known to be in the vicinity;
(iv) conditions and hazards likely to be encountered during his watch;
(v) possible effects of heel, trim, water density and squat on the underkeel clearance.

If at the time the officer of the watch is to be relieved a manoeuvre or other action to avoid any hazard is taking place, the relief of the officer should be deferred until such action has been completed."

Handing over the watch

Once the relieving officer has stated "I now have the watch" the watchkeeper coming off watch should then make sure that all the log book entries are complete, there is an accurate position or a dead reckoning position on the chart and that the course boards are written up.

It is against these standards that the incoming officer can check the watch arrangements.

The relieved officer should ensure that fire and security rounds of the ship are carried out to inspect for fire or anything unsafe like loose cargo on deck, equipment not stored away deadlights that are not closed at night and anything unusual which might require attention.

Summary

- □ Always be fit for bridge duty
- □ Arrive early and in time to adjust to the bridge situation
- □ Read, understand and sign the Master's night orders
- □ Never sign orders you do not fully understand — always seek advice
- □ Do not take over the watch until your eyes have become adjusted to night vision
- □ Never take over a watch until all manoeuvring has been completed and the ship is safely on course
- □ Check on the watch complement and make sure the lookout is posted and a helmsman is near and ready if required

Chapter 9 — SAQs

SAQ 21. What conditions must be satisfied by the OOW before taking over a bridge watch?

SAQ 78. As the relieving OOW/ there is an instruction in the bridge orders you do not fully understand. What should you do?

SAQ 95. As the relieving OOW should you sign the Master's bridge orders before fully understanding the instructions?

SAQ 30. At the time of relief, a bridge manoeuvre is taking place. What is the action of the relieving officer in these circumstances?

SAQ 58. What does the Nautical Briefing Annex 1 state on fitness for duty?

SAQ 5. The Master has left instructions for an alteration of course at the time of the watch change-over. Traffic in the area prevents this course alteration from taking place. What action should the relieving officer take?

NOTES:

BRIDGE WATCHKEEPING

Chapter 10 — CALLING THE MASTER

Purpose

On completion of this chapter you will know when you must call the Master, the reasons for keeping the Master informed, and. why you should seek his advice before dangerous situations arise.

Calling the Master to the Bridge

Junior officers are often concerned that they might be inconveniencing the Master by calling him to the bridge. However, Masters need to be called as soon as possible if a difficult situation is developing, as he is most likely to be able to help the OOW resolve the problem.

Masters have more confidence in OOWs who demonstrate their willingness to call the Master than those OOWs who allow dangerous situations to develop.

The OOW, by calling the Master early, will be able to learn from the experience of the Master when he comes to the bridge. The OOW has a duty to call the Master early and this must be the guiding principle at all times.

The Master's responsibility

The Master has the ultimate responsibility for the safe and efficient operation of the ship. He is likely to be the most experienced navigator on the ship and will probably have dealt with most situations before.

The OOW therefore has a duty to comply with his orders and to keep the Master **informed** of progress. The OOW should ask the Master about any unusual or potentially dangerous occurrences.

If the Master has to be called in an emergency he will arrive on the bridge in a hurry and will need some time to assess the situation. The OOW must be ready to brief the Master immediately he arrives, starting with the most threatening situation and then informing him of the general scene, i.e. other ships in the area, what they are doing and proximity to land.

Some examples of situations where the Master will expect to be called are listed below, but each Master will define his own requirements:-

A give way vessel standing on

The ship found to be unexpectedly heading for land

The presence of a fishing fleet

Difficult multi-ship encounters
Situations where the work load on the bridge has become excessive
Making a landfall

Significant alter course positions
Times of reduced visibility
When there is a change in the sea state
When revolutions decrease by more than 15%
Any unusual occurrences such as changes in the weather, unusual ship Movements, sickness, accidents, and difficulty maintaining course and speed

The Master will always prefer to be called early, before the ship is in a dangerous situation. This often requires judgement on behalf of the OOW and to help resolve this issue the Master will often request to be called whenever a vessel is to approach within a specified CPA.

What the international regulations require

There are specific regulations about calling the Master, because the Master has the ultimate responsibility for ship safety. The OOW must keep him informed of threatening situations. The international resolution states:-

"The officer of the watch should notify the Master immediately in the following circumstances:-

(a) if restricted visibility is encountered or expected;
(b) if the traffic conditions or the movements of other ships are causing concern;
(c) if difficulty is experienced in maintaining course;
(d) on failure to sight land, a navigation mark or to obtain soundings by the expected time;
(e) if, unexpectedly, land or a navigation mark is sighted or change in soundings occurs;
(f) on the breakdown of the engines, steering gear or any essential navigational equipment;
(g) in heavy weather, if in any doubt about the possibility of weather damage;
(h) if the ship meets any hazard to navigation, such as ice or derelicts;
(i) in any other emergency or situation in which he is in any doubt.

Despite the requirement to notify the Master immediately in the foregoing circumstances, the OOW should, in addition, not hesitate to take immediate action for the safety of the ship, where circumstances so require."

Who is in charge on the bridge?

The Master's appearance on the bridge does not relieve the OOW of his responsibilities. The OOW is still in charge of the watch until the Master formally takes charge. It must be made clear immediately who is in charge of the watch. The Nautical Briefing in Annex 1 deals with this subject in detail.

To *avoid any confusion the OOW must assume he is in charge of the watch unless formally relieved by the Master.*

If the call is made during the hours of darkness, the Master will require a little time to become accustomed to the conditions. The OOW must take this into account and allow for this period when deciding to call the Master. It may be necessary to obtain the services of the helmsman and additional lookouts. These watchkeeping tasks should be completed by the OOW immediately they are required. The OOW should not delay or await the arrival of the Master on the bridge. Under no circumstances is the OOW allowed to leave the bridge.

Rough weather

The ship, in rough weather, is exposed to considerable danger and the OOW must keep a seaman like eye on crew working on deck, enforcing prohibition if it is too dangerous to go on deck, advising the Master accordingly. It is important to check deck cargo and their lashings, the security of fixtures and fittings, and the general safety of the vessel with respect to sea damage and water ingress.

Large ships in heavy seas have, on occasions, had their bow plates badly damaged without anybody being aware of it.

The Master should be informed of significant changes of sea state. On small ships, of course, he will feel it. As a general rule, if the revolutions drop by more than 15% call the Master and be prepared to slow down the engines to reduce the possibility of damage, or alter course to reduce the possibility of damage

When doing rounds after a watch, never go on an exposed deck alone in rough weather. At night, take a torch to assess any possible damage. Use the aldis and deck lights to check hatches and equipment forward from the bridge.

Summary

The Master will expect the OOW to:-

- □ Comply with his orders
- □ Inform him about progress
- □ Call him when any unusual situation arises
- □ Call him in accordance with instructions
- □ Call him whenever critical situations arise
- □ Call him as early as possible
- □ Be prepared to brief him on his arrival by pointing out the most critical situations first

IF IN DOUBT WHETHER OR NOT TO CALL THE MASTER — CALL HIM

SAQ 26. What are the circumstances/ contained in the IMO Resolution, calling on the OOW to notify the Master immediately?

SAQ 74. What is stated in the Nautical Briefing Annex 1 relating to the issuing of standing orders by the Master of every ship?

SAQ 36. The Nautical Briefing, Annex 1, mentions a frequent difficulty experienced by Masters. What is this difficulty?

SAQ 11. The OOW has decided to call the Master. What will be in the mind of the OOW prior to communicating with the Master?

SAQ 52. What should the Master expect from the OOW on arriving on the bridge?

BRIDGE WATCHKEEPING

Chapter 11 — RESPONDING TO EMERGENCIES

Purpose

On completion of this chapter you will understand the difference between a problem and an emergency, and what action each requires. You will learn about your part, as OOW, *in the ship's emergency organisation and the responses required to various situations. The special case of Man Overboard is considered.*

Introduction

The difference between a problem and an emergency is the level of urgency required to take action. An emergency requires immediate action:-

To save life or prevent injury
To avoid damage to the ship and cargo
To avoid pollution
To assist another vessel in distress

A problem on the other hand is an incident or occur ence which requires the attention of the OOW, but is not urgent and can be solved during the normal working of the watch.

With unmanned machinery spaces, the bridge may be the only manned centre on board at night and although work will be carried out in the engine room during the day, the command and control centres are probably not being used.

The OOW is likely to be the first person to know when something has gone wrong. The OOW must therefore know what to do to anticipate and respond to emergencies and know who is the duty engineer and how he can be contacted.

No two emergencies are the same. For example, a scavenge fire in a generator which leads to a blackout in the ocean is an emergency for the engineers and the ship's fire fighting team.

If the blackout occurs in a narrow channel with other traffic in the vicinity the first requirement is to raise the alarm internally, call the Master, then to signal to other ships that you are "Not under command". If necessary, call an anchor party to safeguard the ship from running aground. Not only was there a fire in the engine room, but the whole ship was at risk.

The OOW as part of the ship's emergency organisation

Every ship should have an emergency organisation. Many do not, and on others it may take some weeks to develop a team after a crew change.

If there is no well established emergency organisation the OOW, when faced with an emergency, must:-

Initiate action to minimise danger
Call for assistance

A ship with an emergency organisation will have a tried and tested response to emergencies which makes the best use of resources on board. The emergency organisation will consist of:-

A chain of command
Selected crew members for specific response
Special duties for selected personnel
Equipment availability
Type of response
Flexibility through training and drills

Within this framework the OOW will have a key role to play:-
Being the first point of contact to raise the alarm
Keeping a vigilant lookout to ensure the ship does not get into difficulties whilst the command function is preoccupied with the emergency
Communicating i.e. relaying telephone and walkie-talkie messages as appropriate
Ensuring the ship carries the correct lights and signals to describe its condition

When the ship's crew is fully engaged in responding to the emergency the OOW must keep an undistracted lookout to ensure the ship itself does not get into danger.

Officer of the Watch response

The OOW must be capable of initiating an appropriate response to an emergency. Because the situation may be dangerous and critical it is likely that the OOW will experience a sense of alarm and a sudden increase in their heartbeat accompanied by rapid breathing and a tendency to over-react or freeze.

An emergency calls for immediate response and the sense of alarm must be directed into purposeful action. This can best be done if the OOW is properly **prepared.**

Being prepared means training/ experience and pre-planning.

The best way to prepare for emergencies is to practice them through drills and exercises. Having experienced what to do there is considerably less chance that the OOW will feel panic.

Having become aware of this fact, through studying this section of the book, the OOW can use time on watch to imagine what to do in specific emergency situations.

When considering what action to take an OOW should be guided by the following:-
Take appropriate remedial action
Verify that it is having the desired effect
Call for assistance
Notify all those who need to know
Inform "the outside world" through lights, signals/ flags and VHF as appropriate
Ensure any changeover procedure is properly carried out and that any alternative system is tested and verified
Make certain proper communications enable actions to be verified and monitored
Support the emergency organisation when it is working
Keep a vigilant lookout to ensure the ship is not put at risk whilst the emergency is being solved
Keep accurate records

Man overboard

"It must be emphasised that in the event of a man overboard, the actions taken by the OOW are likely to make the difference between life and death."

Appropriate action must therefore include:-
Immediate release of the bridge wing smoke marker floats
Sound the general alarm — don't waste time telephoning or using the whistle to call assistance.
Try to ensure the man stays in sight by posting lookouts
Turn the vessel to facilitate recovery
Log the time and note the position of the ship in case a search is needed
Mark the waypoint on the SatNav if fitted
Put the engines on stand by
Be ready to brief the Master when he comes on the bridge
Broadcast a MAYDAY MAYDAY MAYDAY message
Sound three long blasts "O" to warn other ships if they are in the vicinity

Conclusions

The OOW has a duty to be prepared for emergencies. To initiate appropriate action, call for assistance, monitor the safety of the ship and take the decisions which will enable the most effective recovery of a man overboard.

The knowledge and ability to respond come from training, practice, and preparedness. No two ships will be the same and every OOW must be fully familiar with their own ship.

Summary

The OOW must know:-

□ How to sound the general alarm

- □ The dimensions of the ship
- □ How to show appropriate lights and signals
- □ How to illuminate all parts of the bridge
- □ How to use the communication equipment
- □ How to control the engines
- □ How to close watertight doors
- □ How to transfer the steering gear into manual
- □ How to seek assistance
- □ How to log times
- □ How to record the ships position at a moments notice
- □ How to think through critical situations in advance and to ask "What would I do if a particular emergency occurred?"

Chapter 11 — SAQs

SAQ 40. What would you do if the third engineer phoned the bridge to say that a fitter had fallen and broken his leg?

SAQ 85. What would you do if you were observing a ship on radar on a collision course when the gyro compass failure alarm sounded?

SAQ 23. You are approaching an alter course position in the company of several ships and suddenly the steering gear fails and the ship starts swinging to port. What would you do?

SAQ 66. You are alone on the bridge at night with a pilot in an estuary and the ship has a blackout. What would you do?

SAQ 2. You are told by the pilot to stop the engines from slow ahead when manoeuvring in a basin. The engine does not stop. What are you going to do?

SAQ 94. What would you do if you heard MAYDAY MAYDAY MAYDAY or PAN PAN PAN on the VHF?

SAQ 57. What effect will the general alarm have on all the crew?

SAQ 14. When would you sound the general alarm?

SAQ 70. What action would you take in the event of a man overboard?

BRIDGE WATCHKEEPING

Chapter 12 — ERROR MANAGEMENT

Purpose

On completion of this chapter you will be aware of errors which can occur and, which if they go undetected, could lead to a serious incident. You will also understand more about human errors and how you should conduct your activities on watch to minimise the effect of mistakes. Finally you will understand that good watchkeeping requires good habits which should be practised at all times.

What can go wrong?

There are three main components of a ship which involve movement. They are the engines; the steering system and the guidance or navigational systems. A fault or failure in any of these, if not detected, could lead to an uncontrolled situation.

Similarly it is possible that an operator may make a mistake. This might be the helmsman who steers the wrong course, the pilot who gives a wrong order or the OOW who mistakes the range on the radar or who sets up the electronic navigation system wrongly.

There are thus many combinations and ways in which errors can occur, both technical and human.

Typical types of equipment error

In general terms these will occur as:-
Total or intermittent failure
Malfunction of safety systems and alarms
Misleading information from uncalibrated instruments
Undetected targets due to an untuned radar
Out of date information on charts and reference books

Typical types of human error

Human beings are not machines. Humans are good at assessing the situation, applying knowledge and solving problems. Humans are bad at sustaining long repetitive tasks, concentrating hard for long periods without a break, are subject to tiredness and fatigue and the dulling effects of boredom.

It is common for experienced officers to make 'slips and lapses'. They often occur during routine automatic activities due to:-

Distraction and preoccupation
Changes to normal expected circumstances
Stress and fatigue

Similarly, it is possible to make **'rule-based mistakes'** by:-
Making a quick decision without considering the rules
Not noticing when a rule does not work
Misapplying an established rule
Tending to shortcut rules
Making errors from ambiguous information
Suffering from stress and fatigue

'Knowledge-based mistakes' can be attributed to ignorance but an OOW will never know if he is ignorant unless this is pointed out — hence mistakes occur due to:-

Real weakness due to ignorance
Over confidence due to ignorance
A mistaken understanding of the principles involved

Cultural conditioning which is effective in ensuring stability of society ashore can cause embarrassment in the command structure found on board ships. Some cultures reinforce an acceptance of authority so that it is very difficult to question senior officers without feeling uncomfortable. Other cultural influences include possible misunderstandings of intentions and a willingness to comply without question.

Seafarers do not intend to make mistakes, but **'violations'** of good practices frequently occur and these can be for a variety of reasons:-

Apathy leading to laziness rather than compliance
Experimentation
A desire to push limits rather than comply
Motivational and behavioral problems individually and in the bridge team

Common forms of error

Combining the possibility of mechanical and systems errors with human mistakes or omissions gives rise to a wide range of possible errors which need to be managed on board.

It must be remembered that a ship is moving and needs to be controlled with respect to navigation and collision avoidance. Typical errors and faults can arise through the following omissions:-

Failure to complete a task when required
Ignorance of the ship's dimensions and behavior
Failure to maintain the sequence of the passage plan, contingency plan or subsequent updates
Undetected differences between intended track and track made good
Not monitoring manual or auto helm wander, rudder indicators, compasses and course recorders
Not monitoring engine controls; or indicators
Unresolved difference between ground speed and RPM

Not matching speed to sea conditions
Measuring by single technique or measuring by inappropriate technique
Unresolved cross-track error
Not monitoring visibility
Not briefing the lookout
Not searching visually
Searching solely by radar
Not taking compass bearings
Not making a radar/ARPA/plot
Making decisions on inadequate knowledge of target behavior
Not displaying lights or sounding signals
Not monitoring VHF/Medium Frequency (MF) radio
Wrongly applying the COLREGS and being unaware of any local regulations and signals
Omitting to monitor the protection system's bridge-located displays and controls
Omitting to inspect the ship
Omitting to monitor the location of passengers and location and working of the crew
Mistaking the correct identification of a light, landmark or navigational aid either visually, on radar or on the chart.

How can errors be avoided?

It has to be stated that errors and mistakes cannot totally be prevented from happening. However, the effects of mistakes can be corrected before they affect the safe running of the ship and this can be achieved through four golden rules:-

1. Plan ahead and know what to expect
2. Develop safe routines and habits to ensure most safe practices are covered under normal operations, whilst leaving time and energy to solve difficult problems
3. Apply self checking habits to all activities on the bridge
4. Check and monitor others and expect others to check and monitor you

Planning ahead

If the OOW does not know where the ship expects to be then he cannot know whether the position is right, reasonable or wrong. An OOW should always plan the watch before taking over by establishing the estimated position at the end of the watch. The OOW should then note any items to be encountered during the watch, as well as noting the Master's orders.

In pilotage waters the OOW should have an idea of ETAs and the approximate times when key navigational marks will be reached. Similarly, the main provision of the passage plan should be studied to ensure an understanding of sea room and situational awareness.

Routines to prevent undetected errors

Routines are useful to provide a means of verifying the status of equipment and the safety of the vessel. No individual can maintain a state of constant alertness for more than periods of about half an hour. The OOW, therefore, should develop the technique of allowing routines to pick up undetected errors so that full concentration can be given to resolving collision risks, solving problems, navigating and maintaining the integrity of the whole watch system.

Routines must be appropriate for the conditions which exist. For example — position fixing in coastal waters must be such that the ship cannot be put into danger between each fix. Fixing in coastal waters will therefore be more frequent than deep sea. Routines must not be followed to the exclusion of common sense and awareness of a developing situation which must take precedence. They are, however, useful in providing a means of picking up undetected errors and an example is given below.

ROUTINES

Maintain a situational awareness at all times

- at short intervals
  - look out visually --- consider ship's position
  - check radar display --- reset alarms if fitted
- at intervals not exceeding 1 hour
  - check compass
  - check engine revolutions
  - check heading
  - check general ship status
- during each watch
  - calibrate instruments
  - verify compass input & alignment
  - verify the compass error and record it in the deviation book
  - check the radar performance
  - check auto /hand steering transfer
  - observe the weather and read weather reports
- at watch handover
  - check the track/heading
  - read any standing orders
  - become familiar with the traffic situation
  - consider the weather
  - on leaving, write up the log
  - carry out a visual inspection of the ship
- at daily intervals
  - obtain time checks and synchronise clocks
  - update draught and trim
  - update charts and publications
  - test alarms
  - test navigational lights and whistle
  - test radio equipment distress auto alarms
  - alternate the steering system

NOTE: *ALL ROUTINES MUST BE APPROPRIATE TO THE PREVAILING CIRCUMSTANCES AND ARE SECONDARY TO THE APPLICATION OF GOOD SEAMANSHIP.*

Self checking

Humans are constantly checking and correcting themselves. However, errors can be made which, if they go undetected, could lead to an accident because the outcome can not be seen, smelt, heard or felt unless precautions are taken.

Taking precautions or self checking must become the normal working practice of all OOW's as follows:-

Check workings after first results have been obtained
Formulate approximate results before working out detailed calculations
Plan ahead — for example estimate, at the time of taking over the watch, the position in which the ship will be at the end of the watch
Check the distances between fixes to verify that the speed of the vessel is as expected
Adopt practices which are self-checking — for example taking more than two position lines with each fix
Check a parallel index with a position fix to verify that the range chosen was not in error
Do not rely on one method of fixing when additional methods are available
Use the echo sounder to verify the expected depth of water when approaching land, to augment other navigational information
Verify the compass bearing of an approaching vessel, either visually or on radar, at least three times
Use check lists
Monitor that any action taken is having the desired effect

Error chains

Accidents seldom happen as a result of a single event. They are almost always the result of a series of acts or omissions which lead to confusion and loss of situational awareness. The aim of error management, therefore, is to adopt practices which minimise the risk of a one man error having disastrous consequences.

Checking with and by others

It will now be evident that if two people can check each other the risk of making an error is reduced still further. The OOW can assist in the process by monitoring the helmsman, pilot or Master. Similarly the pilot and Master will be monitoring the OOW and the helmsman.

Mistakes of habit are best identified when there is discontinuity or a change of watch. This is the time to verify the information given by the outgoing OOW and check the course, speed, position, track and estimated position with fresh eyes. Similarly a refreshed OOW coming on watch must assess the traffic situation and identify any vessels which might cause a risk of collision.

Finally it is relevant to discuss the relationship between the OOW and the Master. The Master will want to encourage the OOW to think ahead, check workings, and verify information at the change of a watch.

These professional habits have to be learned and applied diligently. This discipline also has to be taught because it does not come naturally to the inexperienced watchkeeper.

Keeping alert

Every watchkeeper soon seams that time passes quickly during a busy, active coastal watch where there is plenty to occupy the mind.

However, deep sea there is less stimulus and the body responds by becoming less active. To counteract this effect every OOW must make a positive effort to keep alert.

Movement is the most helpful stimulus. Pacing up and down the bridge keeps the body exercised and alert whilst also enabling the OOW to keep an all round look out and all the equipment monitored.

Increasingly, ships are being fitted with watch alarms which require a positive setting by the OOW at regular intervals. The more sophisticated alarms are movement sensitive and reset themselves whenever there is movement on the bridge. This is a good design feature.

If this chapter has demonstrated the principles for good watchkeeping behavior then it will have served its purpose.

Summary

- □ Be aware of what can go wrong
- □ Be aware of human mistakes
- □ Understand how errors occur
- □ Discipline yourself each watch to:-
- □ Plan ahead
- □ Set up safe routines
- □ Check yourself
- □ Check and monitor others
- □ Start each watch by adopting the above principles
- □ Avoid becoming too preoccupied with a particular instrument, particularly radar
- □ Maintain an outward vision and 'situational awareness'
- □ Be prepared to admit a mistake, learn from the incident and work out a way to avoid repeating it in future
- □ Keep alert during ocean passages by moving around the bridge

Chapter 12 — SAQs

SAQ 16. What are the main types of error that humans are prone to make?

SAQ 39. What error avoidance methods can be applied to prevent equipment errors?

SAQ 45. What are the principles of self-checking?

SAQ 89. When should checking by others occur?

SAQ 4. Why is the keeping of records necessary as a strategy for error avoidance?

SAQ 54. What could you do if you suspected that an error had been made on the chart?

SAQ 91. Would you expect to have your errors corrected? If so, why?

BRIDGE WATCHKEEPING

Chapter 13 — COLLISION AVOIDANCE

Purpose

On completion of this chapter you will be aware of the need to have a complete knowledge of the rules. The four methods of operation will be explained and you will have an understanding of the underlying principles involved. Note that this is an advisory chapter only. The subject is given fuller treatment in the references. This chapter does not replace the need for experience in the practical interpretation of the rules.

General observations

A major and essential part of the OOWs duties is to manage collision avoidance situations correctly and safely in accordance with internationally agreed rules which form the only basis for common understanding amongst mariners of all nationalities.

The rules are produced in the languages of all maritime nations to provide the framework in which to make decisions. They have to be known in detail and their application practised so that when a difficult situation arises the correct action can be taken.

WHEN A CRITICAL SITUATION DEVELOPS THERE IS NO TIME TO CONSULT THE RULES AND THERE IS NO GUARANTEE THAT A VHF CALL TO AN UNIDENTIFIED VESSEL WILL BE ANSWERED.

The first requirement of all trainee watchkeepers is to be able to demonstrate:-

A detailed knowledge of all the rules

An understanding of how to apply the rules

A number of text books, computer based training material and videos have been developed specifically for this purpose and references are provided in Annex 7.

What follows are a number of notes relating to the steering and sailing rules which continue to cause difficulties because OOWs, by their action or inaction, lose their ability to CONTROL THE SITUATION.

Methods of control in compliance with the rules

The International Regulations for Preventing Collisions at Sea are divided into five parts and four annexes, as listed in Annex 6. Within this the OOW has to decide which strategy to adopt, depending upon the visibility, the type of ships encountered, and the situation of the vessel in separation schemes and narrow channels.

The rules referring to this are:

1. Those to be followed by vessels in sight of one another (Rules 11-17). These divide each encounter into "the vessel which must give way" and "the vessel which should maintain its course and speed"
2. Those for vessels in fog or reduced visibility (Rule 19) where a vessel shall take avoiding action irrespective of the intentions of the other vessel
3. The responsibilities between vessels such that a power driven vessel will keep out of the way of others unable to do so (Rule 18)
4. Navigation in narrow channels and separation schemes (Rules 9 and 10).

Additionally, the rules provide valuable guidance on safe speed (Rule 6)/ how to assess risk of collision (Rule 7) and practical advice on action to avoid collision (Rule 8).

Some notes on collision avoidance

The rules are designed to establish a code of conduct for ships at sea so that lights and signals are identifiable manoeuvres to avoid collision conform to a predictable pattern; and vessels are navigated in such a way that reasonable safety precautions are taken.

The rules apply on the high seas and all waters connected to them used by seagoing vessels. Port and river authorities frequently add special requirements for safe navigation such as rules of conduct in a tidal river where priority of access to a bridge arch is given to the vessel proceeding with the current. Detailed instructions are provided in Pilot Books, Harbour By-Laws and special notices. They should be studied in advance of arrival and be available for reference in the chart area.

When assessing risk of collision it is essential to take a series of compass bearings or bearings from the radar. As can be seen from the figures A and B, the use of relative bearings (lining up a stanchion on the bridge wing for example) must not be used to assess risk. The need to take compass bearings or bearings from the radar is illustrated below. In Fig. A the relative and true bearings are coincidentally similar. In Fig. B it is the compass bearing which is constant and indicates risk of collision.

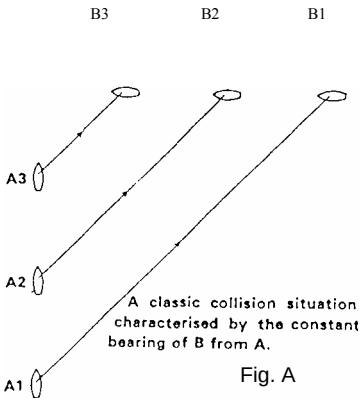


Fig. A

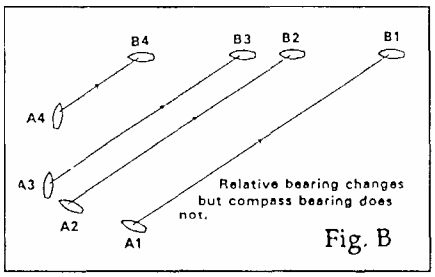


Fig. B

When using radar it is seldom practical for one person to plot more than five targets at a time. Use should be made, therefore, of ARPA, or a reflection plotter if fitted. If the work load gets too high the OOW must be encouraged to seek assistance and consider reducing speed.

Practical watchkeeping skills

It requires good judgement to determine how far an object is away from the ship. To acquire this skill trainees and junior officers should be encouraged to assess visual distances. This can be done by calculating the distance to the horizon using height of eye. This distance can be divided up mentally to give an approximation of intermediate distances. The accuracy of the assessment can be tested against the radar range until realistic results are regularly obtained.

This is generally not possible at night when the horizon is not visible and due to the variation in the intensity of ships lights, the brighter ones will appear closer.

A useful way of assessing the CPA from changes in compass bearing is given here:

Closest Point of Approach

Change in range (estimated)	
5 to 3 NM	Twice the amount of the bearing change gives CPA in cables
3 to 2 NM	The amount of bearing change gives CPA in cables
2 to 1 NM	Half the amount of the bearing change gives CPA in cables

For example, if a vessel is observed bearing 045° at 3NM and then 047° at 2 NM, the bearing has changed by 2° therefore the CPA is 2 cables.

From a major study carried out into casualties in European waters from 1978-1982 the average number of incidents per year were:-119 vessels involved in end on collisions

66 vessels involved in crossing situations

26 vessels involved in overtaking situations

COLREG Rule 14

Head-on situation

(a) When two power-driven vessels are meeting on reciprocal or nearly reciprocal courses so as to involve risk of collision each shall alter her course to starboard so that each shall pass on the port side of the other.

(b) Such a situation shall be deemed to exist when a vessel sees the other ahead or nearly ahead and by night she could see the masthead lights of the other in a line or nearly in a line and/or both sidelights and by day she observes the corresponding aspect of the other vessel.

(c) When a vessel is in any doubt as to whether such a situation exists she shall assume that it does exist and act accordingly.

Meeting and End On situations

From the statistics on the previous page it can be seen that meeting situations are the most dangerous, and the first Traffic Separation Schemes (TSS) were introduced because the majority of accidents occurred where vessels were meeting end on, or nearly end on, such as in the Straits of Dover.

These situations can be very critical. Take, for instance, a vessel at 3 degrees on the bow at a distance of 3 miles, and on a reciprocal course. If no action is taken by either vessel the passing distance will only be between 0.1 and 0.2 miles abeam. In open waters this passing distance is positively dangerous, and action should be taken as soon as possible to increase it.

In order to reduce the effects of random errors when plotting, several observations must be taken at regular intervals. This is clearly illustrated in the following example by A.N. Cockcroft from the book listed in (Annex 7).

Consider a target ten degrees on the starboard bow on a steady bearing. If bearings are taken at a distance of 12 miles and again at 10 miles, and an error of -1° is made in the first bearing followed by an error of +1° in the second bearing, the target would appear to be on a parallel and opposite course, and might be expected to pass clear to starboard with a nearest approach of over 2 miles. A reversal of these errors would make the target appear to be crossing, and passing clear to port at a distance of over 2 miles.

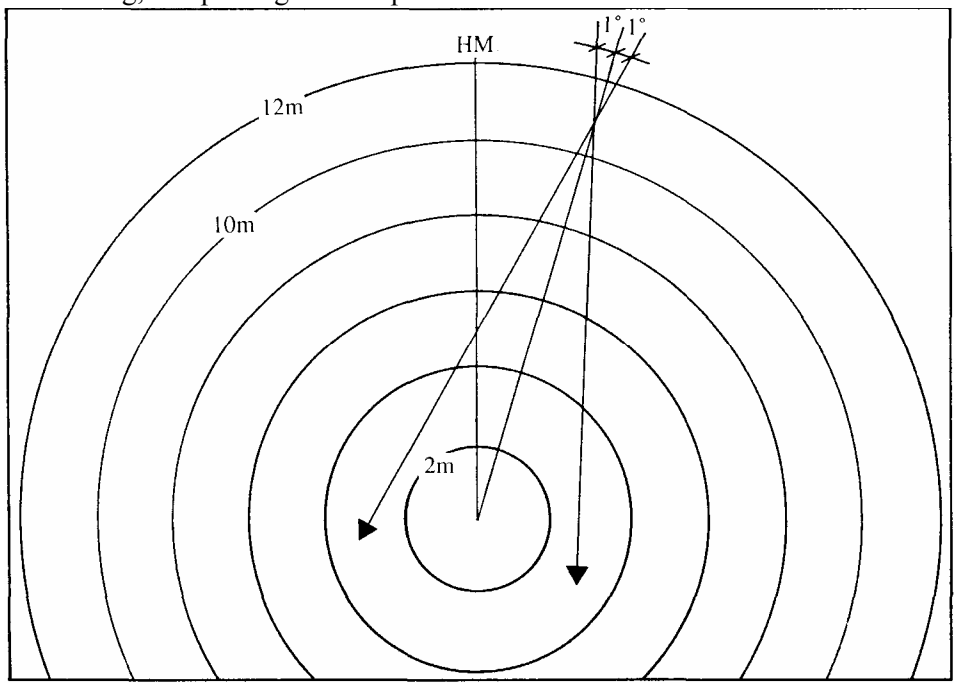


Diagram to illustrate the need for regular plotting in end-on situations

Many collisions have occurred where one vessel has acted under COLREG 14 (end on)/ whilst the other vessel has treated it as a crossing situation. Much anxiety could be taken out of these situations if more vessels took notice of para (c) of COLREG 14, which states that if there is ANY DOUBT about the situation, assume it to be head on and act accordingly. In other words, both vessels should make an identifiable alteration to pass at a safe distance/ and continue to monitor the situation until safely clear. In close proximity where there could be the slightest doubt, communication with the other vessel by way of whistle signals should be made.

COLREG Rule 15
Crossing situation

When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

Crossing situations

Crossing situations are relatively straightforward, and yet still contribute to a large percentage of collisions. Giving way in good time to vessels on the starboard side, by making a substantial alteration of course, will avoid a close quarters situation. The stand-on vessel has more difficulty. Vessels crossing from port to starboard need careful watching to make sure they give way in time. If they do not do so, the stand-on vessel must take action before getting too close.

In the event that a 'give way' vessel fails to do so, the 'stand on' vessel has to consider the time available to undertake an evasive manoeuvre. It will depend upon the time and distance it takes to turn own ship with the time available to CPA. A long, deep, heavy vessel will require more time to turn than a short, shallow-draught, twin screw, variable pitch propeller vessel. For this reason officers operating highly manoeuvrable vessels should never 'embarrass' less manoeuvrable vessels by standing on until the last moment. Good seamanship demands that the give way vessel should do so before the stand on vessel needs to consider taking evasive action.

Problems can arise when rounding a headland. Courses should be plotted sufficiently far off to allow room for giving way to other traffic. Crossing Traffic Separation Schemes (TSS) can present a dilemma. When giving way to several ships on the starboard side, it may be necessary to consider other forms of action to prevent going against the general flow of traffic.

COLREG Rule 13
Overtaking

(a) Notwithstanding anything contained in the Rules of Part* B, *Sections I and II, any vessel overtaking any other vessel shall keep out of the way of the vessel being overtaken.

(b) A vessel shall be deemed to be overtaking when coming up with another vessel from a direction more than 22.5 degrees abaft her beam, that is, in such a position with reference to the vessel she is overtaking, that at night she would be able to see only the stemlight of that vessel but neither of her sidelights.

(c) When a vessel is in any doubt as to whether she is overtaking another, she shall assume that this is the case and act accordingly.

(d) Any subsequent alteration of the bearing between the two vessels shall not make the overtaking vessel a crossing vessel within the meaning of these Rules or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

Overtaking situations

The overtaking vessel is obliged by the COLREGS to keep out of the way of the overtaken vessel until finally clear. The overtaken vessel, however, should continuously monitor the situation and be ready to act if something goes wrong. It may also be necessary for the overtaken vessel to keep out of the way of other traffic. When she is being overtaken on the starboard side this will mean either a reduction of speed or a course alteration to port. If the vessels are on converging courses, little confusion arises when the overtaking vessel is on the overtaken vessel's port side, as irrespective of how the overtaking vessel views the situation, she is obliged to keep out of the way. It is when she is 'coming up' on the starboard side that some doubt could arise as to whether she was crossing or overtaking. COLREG 13 states that if the overtaking vessel is more than 2 points abaft the beam she shall keep out of the way. Here again, para (c) forms the basis of decision making in uncertain circumstances, that is if there is ANY DOUBT the overtaking ship should keep out of the way.

Overtaking in a narrow channel requires a good deal of care. Firstly, the intention to overtake must be communicated to the other vessel. When this has been agreed, sufficient distance must be allowed between the two vessels to prevent interaction.

Actions to be taken in reduced visibility

This brings into focus the issue of safe speed. The rules provide sensible factors upon which to base a decision. Before radar was widely used, a speed

comparable to a stopping distance of half the visibility was considered a guide. Now the situation is more complex. Speed enables effective evasive manoeuvres to be made. On the other hand, potentially dangerous situations can develop more quickly if ships continue to press on in reduced visibility or in conditions of high traffic density. To resolve these issues increases the work load on the OOW and the first priority may well be to ask for extra bridge assistance by posting a lookout and calling the Master.

Rule 6 states:-

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

In determining a safe speed the following factors shall be among those taken into account:

(a) By all vessels:-

(i) the state of visibility;
(ii) the traffic density, including concentrations of fishing vessels or any other vessels;
(iii) the manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;
(iv) at night the presence of background light such as from shore lights or from back scatter of her own lights;
(v) the state of wind, sea and current, and the proximity of navigational hazards;
(vi) the draught in relation to the available depth of water.

(b) Additionally, by vessels with operational radar:-

(i) the characteristics, efficiency and limitations of the radar equipment;
(ii) any constraints imposed by the radar range scale in use;
(iii) the effect on radar detection of the sea state, weather and other sources of interference;
(iv) the possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range;
(v) the number, location and movement of vessels detected by radar;
(vi) the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity.

As was mentioned in the introduction the action to be taken by vessels to avoid collision is not necessarily the same as that taken in clear visibility.

Rule 19 states:-

(a) This Rule applies to vessels not in sight of one another when navigating in or near an area of restricted visibility.

(b) Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel shall have her engines ready for immediate manoeuvre.

(c) Every vessel shall have due regard to the prevailing circumstances and conditions of restricted visibility when complying with the Rules of Section I of this Part.

(d) A vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and/or risk of collision exists. If so, she shall take avoiding action in ample time, provided that when such action consists of an alteration of course, so far as possible the following shall be avoided:

(i) an alteration of course to port for a vessel forward of the beam, other than for a vessel being overtaken;

(ii) an alteration of course towards a vessel abeam or abaft the beam.

(e) Except where it has been determined that a risk of collision does not exist, every vessel which hears apparently forward of her beam the fog signal of another vessel, or which cannot avoid a close-quarters situation with another vessel forward of her beam, shall reduce her speed to the minimum at which she can be kept on her course. She shall, if necessary, take all her way off and in any event navigate with extreme caution until danger of collision is over.

Rule 19 was added to the COLREGS at the last revision and recognises that, in restricted visibility, radar will be used for collision avoidance. As discussed earlier in this chapter, when vessels are in sight of one another in clear visibility there are duties placed on both vessels. The stand on vessel should maintain its course and speed whilst the give way vessel must avoid a close quarters situation.

In restricted visibility, when carrying out collision avoidance from radar information, the rules state that every vessel shall take avoiding action in ample time. This means that there is no stand on vessel and an OOW must take an initiative in every situation where there is risk of collision. Because the OOW cannot predict what the other vessel is going to do in restricted visibility there is more uncertainty and therefore a greater need to take avoiding action early.

It must also be remembered that the only information the other vessel receives following a change of course or speed is the change in the echo on the other vessel's radar. It is therefore necessary to convey an intention by making a **bold alteration** of course or a **significant reduction** in speed.

Rule 19 states that when action is taken to avoid a close quarters situation the following shall be avoided:-

(a) an alteration of course to port for a vessel forward of the beam, other than a vessel being overtaken

(b) an alteration of course towards a vessel abeam or abaft the beam.

Having taken evasive action it is essential to ensure it is having the desired effect and this can only be done by monitoring the relative position of the other vessel on the radar. This should be done positively either with a target marker or manually with a chinagraph plotting pencil.

On a busy bridge where the OOW may be concerned with navigation, communications and other traffic, a plotting record becomes essential. It ensures that threatening targets are positively identified so that attention can be given to other problems.

Limitations

The presence of other vessels and/or lack of sea room may impose limitations on the manoeuvres which can be made, but it must be emphasised that small changes of course and/or speed are unlikely to be detected.

WHEN ACTION HAS BEEN TAKEN TO AVOID A CLOSE QUARTERS SITUATION IT IS ESSENTIAL TO ENSURE THAT ANY ACTION TAKEN IS HAVING THE DESIRED EFFECT.

The value of experience

No trainee should expect to leave college with only a theoretical knowledge of the rules and be responsible for a watch at sea.

Understanding and implementing the provisions of the collision regulations requires experience and judgement. All vessels in visual range should be positively identified as to (i) their type; (ii) course, speed and heading; and (iii) time and distance to the nearest point of approach.

As a general rule, unless specified in the Master's standing orders, never plan to pass closer than one mile to other vessels and fixtures in open sea conditions.

To obtain this experience and judgement the trainee should expect to inform the Master or OOW of every vessel approaching with a CPA of 2 miles.

In so reporting the trainee will be able to advise the senior officer on the action believed to be appropriate. This is a safe and practical way to build up experience.

The use of VHF for collision avoidance

The International Regulations for Preventing Collisions at Sea make no mention of the use of VHF for collision avoidance. The rules have been designed to enable decisions to be made without communication. The first requirement therefore is to know the rules and understand how to apply them.

The use of VHF can cause confusion and uncertainty. The unwanted effects can increase the risk of collision for three reasons. Firstly, there is no way positively to identify the receiving ship. Secondly, even if communication is established there is no guarantee the message will be understood and thirdly, time spent making contact and communicating could be better used avoiding a close-quarters situation earlier. The advice of The Nautical Institute Council is NOT to use VHF for collision avoidance unless required by local regulations.

There are, of course, occasions when the use of VHF is helpful. For example, where ships are operating in pilotage waters and there is direct identification with other ships; then, messages can be passed from pilot to pilot in a common language with certainty. However, as a general rule, if there is no positive identification of the other ship do not use VHF for collision avoidance.

Summary

- □ Know your obligations in clear weather
- □ Know your obligations in reduced visibility
- □ Know your obligations when meeting hampered vessels
- □ Know your obligations in narrow channels
- □ Know your obligations in a traffic separation scheme
- □ Apply the principles of good seamanship
- □ Call the Master as early as possible if you believe a critical situation is developing
- □ Ensure an effective lookout. If necessary post an additional lookout
- □ Avoid the use of VHF for establishing risk of collision unless prescribed for use by the coastal authorities.

SAQ 28. How does the OOW assess risk of collision?

SAQ 1. You are the OOW of a vessel constrained by her draught in a traffic separation scheme in fog, and the Master has left the bridge temporarily. An unidentified vessel is approaching so as to incur risk of collision and a potentially dangerous situation is developing. What would you do?

SAQ 42. You are the OOW of a power driven vessel. Of which vessels must you keep out of the way?

SAQ 80. You are OOW of a vessel in fog and you notice a vessel approaching on a collision course 40° on the port bow. What would you do?

SAQ 8. What is the difference between navigating in a narrow channel and in a traffic separation scheme?

SAQ 60. You are on a 20 knot ship. At what distance would you expect to see the masthead light of a small sailing vessel ahead? If the vessel was stationary, how long would it take to travel that distance?

SAQ 72. What are the dangers of using VHF for collision avoidance?

BRIDGE WATCHKEEPING

Chapter 14 — RECORD KEEPING

Purpose

On completion of this chapter you will have an understanding of why it is necessary to maintain accurate records. The log book in particular will be discussed and practical advice on filling in record hooks is given.

Why keep records?

There are three related reasons for keeping records which all revolve around human memory and the availability of information. Everybody has a long-term memory for remembering things which have been learned and a short-term memory which enables limited items of information to be remembered for short periods, like a bearing: then it is forgotten.

The sort of detail to be entered into log books — the state of the sea, the course and compass error — are items which are quickly forgotten. Indeed it is desirable that they are forgotten once recorded because it would be impossible to retain all the information for accurate recall several years later.

The purpose of log books and records

They are provided to keep an accurate record of key events from which, with a seaman's knowledge, a situation can be reconstructed.

Records of items like compass variation and deviation are necessary to establish trends from which the Master can decide if the magnetic compass needs correcting or the gyro compass needs servicing.

Internally, many calculations depend upon information contained in the log. Specifically, speed and distance steamed from noon to noon will be used to verify fuel consumption and engine efficiency and to monitor the resistance of the hull.

Sometimes mistakes are made and frequently it is useful to refer back to an original source of material.

Ship records are the first items to be studied after an incident. If there is a stranding and an insurance claim, or an investigation by the flag State, inspectors will take the chart and log books, examine the standard of navigation and attempt to reconstruct the incident before deciding who is to blame or how much compensation to pay.

Good record keeping in a well run ship is a defence against unfounded claims. In a recent case a ship docked in a Korean port and the first people onboard were officials who took the Master ashore and put him in prison

claiming that the ship had just run down a fishing vessel. Fortunately, the up to date log and explicit chartwork proved beyond doubt that the ship was at least eleven miles away from the fishing vessel at the time of the collision. The Master and the ship were then released.

Falsifying information (apart from being unlawful) is most unwise, as modern techniques for detecting erasures are reliable and a falsified document will put OOW or Master at a severe disadvantage in court.

If there is collision or cargo damage at sea, the ship's log will be scrutinised in detail, as it describes the ship's activities and is a window into the efficiency of the bridge team.

The ship's log is always consulted when there are claims by the charterers that the ship did not meet the speed standards originally contracted. Alternatively, the charterers may be paying for fuel and will make a claim against the shipowner if the fuel consumption is more than was stated in the charter party.

Maritime arbitrators deciding these cases can cite numerous incidents where the ship's log has recorded adverse weather force 4 and above for distances as long as Suez to Rotterdam!

This falsifying of the records can easily be challenged by meteorological records or shore stations and, of course, satellite weather maps.

Records are necessary:-

To unclutter the mind of the OOW, allowing concentration on watchkeeping priorities

To keep an accurate record of events

To establish trends

To provide evidence in the event of an incident

Some practical tips on record keeping

Most log book entries are time dependent. When there is time it is sensible to write up the log book during the watch as events take place. It is always easier to do these tasks "little and often". When the OOW is very busy, writing up the log could be a distraction. In this case, keep a note book and write up the log after being relieved.

All log entries should be neat and tidy. Entries are made for others to read. If you make a mistake, cross out the entry with a single line, enter the corrected data above it and initial the correction.

What should be entered in the log?

Most log books are laid out in columns and time, weather, sea state, track, course steered, compass error, speed and positions are likely to have

columns of their own. The narrative section should be thought about from the point of view of a legal advisor who wants to reconstruct what happened following an incident.

In narrow waters time of departure will be followed with entries like:-1015 Cleared breakwater; 1100 No4 Lt Buoy abeam to starboard; 1125 No 1 Lt Buoy 032°T x 2 miles Pilot away; 1140 Ram head 071 °T x 6 miles set course 023°T Full away.

Thereafter, accurate alter course times, positions and new courses will need to be recorded. For further advice consult the Master and company guidelines. See Annex 9.

The log should then record any unusual event, for example 1115 entered fog, called Master, radars on, engines on standby, COLREGS observed. Similarly, entries for rain, heavy seas, and ice should be made.

The bell book or movement book should include when the ship is underway and ceases to be underway, the name of the pilot, the name of the tugs, when they made fast and let go, all engine movements, mooring status, use of anchors and any other unusual occurrences like a sudden squall, shipping water, navigating in reduced visibility, reduced speed in heavy weather and ship movement.

Many ships now have data loggers which will only keep a record of engine movements. Invariably the paper record runs out at a critical period so the OOW should always have a note book to jot down the movements until after manoeuvring is complete and the recorder paper can be changed.

Lawyers have observed how many collisions occur when there was no paper in the course recorder! Whilst this may have been ″a deliberate accident", each watch the paper should be inspected and particularly when the bridge gear is checked prior to sailing. The same advice applies to the depth recorder.

A record of the times the radar is operational should be kept. This will provide added evidence in the case of an incident and will also be useful for meeting the requirements for planned maintenance.

Some ships are now being fitted with 'black boxes' which record times, speed, rudder, the radar picture and voice communications. This considerably simplifies the OOW task of recording.

When entering data the OOW should be guided by the following:-

The aim of collecting this data is to recreate an accurate "picture" of what happened.

Other record books

There is a legal requirement to keep a compass record book in which compass courses and errors are recorded.

The compass error should be checked each watch and on every new course. The purpose of the record is to establish trends in deviation on various courses in different positions.

Should the gyro(s) fail, this information will be used to set courses by the magnetic compass. It is noteworthy that many modern coasters only have magnetic compasses.

The ship may be a designated meteorological observing ship. Filling in the weather log requires time because instruments have to be read and observations made. This is of secondary importance to any threatening situation and must be left to the end of the watch if necessary.

Some ships have a variety of status reports to be recorded each watch, such as hold temperatures and humidity. Others have heated tanks and temperature dependent cargoes which need to be recorded each watch. Often this has to be done on deck, after the watch, or by phoning the control room.

It is evident that more and more record keeping requirements are being put on ships, whilst their watchkeeping manning is diminishing. Record keeping can occupy a considerable time. The OOW must plan for this, aiming to do it little and often whilst never allowing it to become a distraction from the main task — which is to ensure the safe conduct of the vessel.

Summary

- □ Have the log book open in a convenient position and fill it in little and often
- □ In critical situations note times and priorities in a note book, to be entered into the log at the end of the watch
- □ Write neatly and correct properly. Do not rub out or erase
- □ Ensure all logs and data loggers have paper and ink
- □ Keep the compass error book up to date
- □ Postpone the general record keeping until after critical situations or until relieved

Chapter 14 — SAQs

SAQ 24. Where would you find guidance on what to enter in the ship's log?
SAQ 63. Why is record keeping a necessary part of watchkeeping?
SAQ 49. Faced with heavy traffic and difficult navigation, how would you write up the log?

BRIDGE WATCHKEEPING

Chapter 15 — AUTOMATED BRIDGES

Purpose

On completion of this chapter you will appreciate that whilst an automated bridge will assist in carrying out routine functions, you need to understand the design capabilities and limitations of the system, to monitor it effectively, and to plan ahead to verify that the ship is not subject to systems induced errors.

Levels of automation

Until recently, developments have taken place to improve the performance of specialised items of bridge equipment. For example, target plotting on radar has been done by computers and the new radars provide daylight viewing.

Similarly, improvements have been made in the design of autopilots, some with predictive systems incorporated. Navigational systems based upon GPS include route planning with way points and a computational capability to show distance off track, new course to steer and distances to go to alter course positions.

Engine room control and monitoring equipment has been put on the bridge of many ships and the OOW can monitor speed, consumption, temperatures and many other parameters.

Some ships on dedicated short runs have the chart interfaced on the radar. There are other systems where the radar is superimposed on the chart.

The next major development is likely to be the Electronic Chart Display and Information System (ECDIS) which will be stored in the bridge computer.

After that it is likely that navigational systems will be developed in three dimensions with the information from the depth recorder or sonar making sure that the ship's under keel clearance is monitored at all times whilst GPS maintains position accuracy at sea.

With reduced manning, there has been a tendency to put communication equipment on the bridge including VHF, SatComs and GMDSS equipment, together with fax and telex.

As with all highly automated equipment there are two distinct phases. First, when the equipment is fully functional and secondly when there is a fault.

When equipment is fully operational the OOW will have more of a monitoring role than a controlling role. However, when there is a fault it is likely to be more complicated to solve the problem because so many items of equipment may be integrated that the fault is more difficult to isolate.

A separate book on advanced systems is being prepared by The Nautical Institute. Nevertheless, it must be emphasised that a good watchkeeping discipline is the basis of safe operational systems. The OOW must acquire the ability to maintain an active awareness if he is to prevent a situation of uncontrollable risk arising.

BRIDGE WATCHKEEPING

CONCLUSION

Aim

The primary aim of the OOW must be to ensure the ship reaches its destination in a safe and timely manner. In do so doing, the ship should never be put into a situation of uncontrollable risk.

Means

This study guide is based on the understanding that the OOW has a proper knowledge of navigation, of the International Regulations for Preventing Collisions at Sea and has some bridge experience. Where this is not so, additional references are supplied in Annex 7.

From this background the guide demonstrates HOW to become more proficient through the application of four principles and WHY they are necessary. They can be summarised as follows:-

1. Checking
   - — equipment
   - — errors
   - — yourself
   - — others

2. Monitoring
   - — the movement of instruments in response to commands
   - — the navigation of the pilot
   - — the activities of the Master when he is in control of the ship
   - — the weather and the sea state
   - — the activities of the crew

3. Controlling
   - — safe navigation
   - — collision avoidance
   - — the threat, by deciding priorities
   - — the response, by calling for assistance when needed

4. Recording
   - — log books
   - — record books
   - — error books

"Bridge watchkeeping is the single most important activity conducted at sea. Upon the watchkeeper's diligence rests the security of the ship and all who sail on board.

"It is a demanding activity, frequently undervalued, which needs support, encouragement, motivation, self discipline and high standards of professionalism."

The Nautical Institute on Bridge Watchkeeping, 1993

TheNautical Institute Bridge Watchkeeping Group hope that this guide has helped you to become a better watchkeeper and in time we hope you will pass on your knowledge and experience for the benefit of others.

Captain D.G.T.GreenhaIgh MNI

Project Co-ordinator

NAUTICAL •Briefin

Supplement to

SEAWAYS

The Journal of The Nautical Institute

BRIDGE WATCHKEEPING

The Nautical Institute Council

FOREWORD

THE AIM of bridge watchkeeping is to ensure the safe, timely departure, transit and arrival of ships. It is the underlying discipline of the nautical profession. Nobody else but ourselves has this responsibility and it is up to us to make sure that a ship is never put into a situation of uncontrollable risk. Bridge watchkeeping when it is well organised and properly conducted can give the impression that it is simply a matter of routine. This, however, belies the depth of knowledge, training, management, and command skills which go towards effective practices.

Like all human endeavour, the intention to set good bridge watchkeeping standards has to start at the top—that is the chairman of the company or the commander-in-chief. If they are in the shipping business they must give support to the process which most protects their assets. It is foolhardy and irresponsible not to.

Secondly, the marine managers have an obligation to formulate viable policies to provide competent personnel and adequate navigational support to their ships. Thirdly, the masters and commanding officers have to take the initiative to ensure that bridge watchkeeping practices and procedures are maintained in accordance with their requirements.

There is no alternative to this chain of command, for it must be remembered that a ship is more than private property. The actions or inactions of those on board affect other people. In this sense the ship is most definitely acting in the public interest. The stranding which leads to pollution or the collision which causes loss of life and damage to cargo, are matters of public concern. Every maritime casualty shames our profession and we must find a positive response to reverse the decline in standards which members have identified to be taking place at sea today.

It is for this reason that the Council of The Nautical Institute has provided their nautical briefing, to reaffirm the essential nature of good watchkeeping practices. In so doing, it has produced a document directed to senior ships' staff but for discussion in the board room and the officers' mess.

There can be no doubt that the predominant response from flag States, port States and management to the impact of marine accidents has been towards more legislation, inspection and penalties. However, I must emphasise that bad practices cannot be improved by regulations alone.

The process starts at the other end with a commitment to improving professionalism both ashore and afloat by providing support and motivation, which we all know demands considerable energy. It is then necessary to correct bad practices and give recognition to good performance. The expanded aim must now be 'to encourage pride in the safe and timely departure, transit and arrival of ships' and this is something to which we can all contribute.

Captain P. Boyle, FNI, President, The Nautical Institute; April 1993.

Introduction

BRIDGE WATCHKEEPING is the single most important activity conducted at sea. Upon the watchkeeper's diligence rests the security of the ship and all those on board. It is a demanding activity, frequently undervalued, which needs support, encouragement, motivation, self-discipline and high standards of professionalism.

The purpose of this briefing is to discuss factors which affect standards of bridge watchkeeping and to address practical problems that need to be overcome in order to achieve reliable performance. Whilst individual points covered in this briefing may appear evident to many, problems can arise when key personnel change so that, without an established routine, omissions and misunderstandings leading to errors can occur.

This nautical briefing therefore addresses the subject of bridge watchkeeping by considering the principles required by law and offering advice to improve individual performance.

Aim

The aim of this briefing is to provide advice and guidance to those responsible for bridge operations, primarily masters. It is set in the context of **The Basic Principles to be Observed in Keeping a Navigational Watch** as specified in the International Convention on Training and Certification of Seafarers (STCW) 1978.' It is intended to provide guidance on the supervision of watchkeeping activities in order to achieve higher common standards.

Scope

This briefing assumes a knowledge of the International Regulations for Preventing Collisions at Sea (ColRegs), coastal navigation and the use of radar. It is designed to improve operational skills, and is supplemented by a training manual and supporting training videos aimed at junior watchkeeping officers.

The Basic Principles to be Observed in Keeping a Navigational Watch are centred on the page in bold followed by practical comments and observations.

General requirements

1. Parties shall direct the attention of shipowners, ship operators, masters and watchkeeping personnel to the following principles which shall be observed to ensure that a safe navigational watch is maintained at all times.

The effective implementation of safe navigational practices requires a co-ordinated approach between the company and those on board. This is established through formal communication, company instructions and master's standing orders, and informal support through superintendence and briefings.

This section is further reinforced by the *IMO Guidelines for the Management of Safe Ship Operation and Pollution Prevention* which requires companies to provide a safety and environmental policy.

Specifically as part of this, **the navigational policy** must specify:

(i) Responsibilities for navigation and the allocation of watchkeeping duties.

(ii) The bridge procedures to be followed (which may embrace the provisions of *The Bridge Procedure* Guide[121] issued by the International Chamber of Shipping).

(iii) Bridge administration.

The company has the responsibility to provide competent personnel who can communicate with each other and speak maritime English for bridge watchkeeping duties. There will remain doubts unless the company specifies the way passage planning is to be conducted, the way charts and nautical publications are to be kept up to date, the procedures to be followed for ensuring that essential navigational equipment is available, calibrated and supported with manuals in the language of the officers who have to use them. Additionally the company will require the proper keeping of records and this must be specified to include log books, masters standing orders, supplementary orders, and the provision of essential navigational warnings and information.

It is the company's responsibility to ensure that all personnel are properly trained for the tasks they are expected to perform and a reporting system should be used to identify training needs.

It is usual for a company's instructions to lay down the practices and procedures which are to be followed throughout the fleet and it should be common practice to supply general standing orders so that masters need only amend them in writing to suit the particular circumstances of the ship and the voyage.

When considering bridge manning, companies must ensure that bridge design, equipment, systems, personnel, procedures and ergonomics are properly evaluated[131].

Masters' responsibilities

2. **The master of every ship is bound to ensure that watchkeeping arrangements are adequate for maintaining a safe navigational watch. Under the master's general direction, the officers of the watch are responsible for navigating the ship safely during their periods of duty when they will be particularly concerned with avoiding collision and stranding.**

3. The basic principles, including but not limited to the following, shall be taken into account on all ships.

To implement the provisions of this section the master of every ship is required to issue standing orders in writing to be formally acknowledged and signed by each navigating officer prior to the commencement of the voyage.

Time has to be made available to see each navigating

officer and discuss the provisions of the standing orders in detail to ensure that they are properly understood and will be acted upon. There is a clear requirement for all newly-joined officers to be made familiar with the bridge equipment, company instructions and master's standing orders before being permitted to take a watch. A frequent difficulty is convincing the officer about the need to call the master when required. This may require firm follow-up action.

Standing orders should cover:

(i) A general statement that the safety of the ship must take precedence. No consideration of programme convenience or previous instructions justify taking any risk which may place the ship in danger.

(ii) Measures to be taken before sailing and arrival:
- Testing the gear, advising the engineroom.

(iii) Activities and routines to be followed at sea:
- General navigational standards expected.
- Taking over the watch.
- Checking instruments.
- Keeping logs and records.
- Use of check lists.
- Use of navigational equipment.
- Keeping an effective lookout.
- When to call the master.
- Changing from hand to automatic steering.
- Use of engines.
- Emergencies.
- Compliance with the ColRegs.
- What to do in reduced visibility.
- Standards of navigation to be followed.
- Clear instructions on use of VHF and that it should not normally be used for collision avoidance.
- Use of up-to-date charts and publications and withdrawal of obsolete publications.
- Special communication requirements.

(iv) Activities and routines to be followed at anchor:
- Checking the position.
- Ensuring appropriate navigation lights, shapes and sound signals.
- Being prepared to warn other ships passing too closely.
- Establish the position of the anchor at the time it was let go and the swing circle.
- Tell the master if a ship anchors too closely and be prepared to move.

(v) Activities and routines to be followed in port:
- Provide safe access.
- Keep ship alongside and mooring ropes firm.
- Call assistance if needed.
- Maintain security.

(vi) Activities and routines to be followed when taking or disembarking a pilot:
- Provision of pilot gear.
- Those who must be in attendance.
- Information to be given to the pilot.
- Navigation with the pilot on board.

In addition to these general items, specific sections will need to be added for special circumstances.[141] At night the master must write in the night order book specifically what he expects of the watchkeeping officer(s). These orders must be signed by each officer when going on watch.

Statements like 'when in doubt call me' or 'call me if any vessel approaches too closely' should never be used as they can lead to confusion and differences of opinion.

Instead clear statements amplifying relevant parts of the standing orders should be used and special requirements spelt out precisely — e.g. 'Call me when the vessel crosses the 150 metre line', 'Call me if any ship is to pass with a CPA of less than 2 miles'.

This approach will remove any inherent difference of opinion in the written orders. Masters should at all times encourage watchkeepers to call them if assistance is needed or when they have doubts about intentions or developing situations.

Once the written orders have been discussed, masters can then introduce a number of measures to monitor compliance. These should include positive reporting concerning the availability and listing of equipment; accurate and up-to-date record keeping which can be verified; briefings concerning the passage plan and expected navigational problems and concerns.

At sea, the marking of estimated positions on the chart provide an opportunity for the master to enter into a dialogue with the watchkeeping officer concerning allowances and errors. The exercise also encourages watchkeeping officers to think ahead, and provides an opportunity to give encouragement for accurate navigation.

Similarly with collision avoidance, the master can discuss particular situations or provide scenarios to evaluate 'whatever would happen if . . . ?' This technique can be used to prepare for emergencies and encourage defensive navigational and collision avoidance practices to minimise risk.

Checklists should be used where appropriate and the procedures for their use be included in masters standing orders. They can be useful when, for example, carrying out pre-sailing tests or setting up instrumentation. The aviation industry uses the double-check method whereby one officer reads out the item to be checked and the second officer gives the status. Which ever system is used, the appropriate officer should sign the check-list and be accountable to the master when complete, and when deficiences are found. Examples of check lists are given in the /CS *Bridge Procedure Guide.*

The master's management responsibilities

Less easy to define but implied in this section is the requirement for masters to plan ahead, delegate, control the navigation of the vessel, lead and motivate all bridge personnel, optimise the use of resources, encourage team work, and support training.

Management can be broken down into four concepts:[5]

1 Clarity of purpose.
2 Delegation of authority.
3 Motivation.
4 Economy of effort.

Economics demand a cost effective passage time but safety demands that corners should not be cut. *Clarity of purpose* implies preparing for the future and obtaining the best information available to enable decisions to be made so that a proper appraisal can be made without compromising safety standards.

Delegation is by no means straightforward. Some confusion exists in traditional roles and relationships on board and they can vary from ship to ship. The master

is responsible for the safe navigation of the vessel and he delegates authority to the officer of the watch who may delegate part of that authority to a lookout. In delegating authority to an officer the master must satisfy himself that the tasks and resources have been assigned to that person and that a means of monitoring performance are also put in place.

Motivation is not only difficult to define but depends upon personality, conditions, communications and rewards. It is necessary to be realistic in what can be achieved in a given situation. However, some general guidance can be given. In the first instance it is the company's management which is responsible for creating the conditions which will encourage motivation in seagoing personnel. The master is then able to apply his energy to this all important aspect of ship management without having to resort to apologetic compromise.

Secondly, it is always easier to motivate people by involving them when planning ahead rather than only complaining if jobs have not been done properly.

Economy of effort implies that the master uses the resources available to the best advantage. Typically 80 per cent of a voyage will be in areas of low activity and 20 per cent in areas of high activity. These ratios are reversed for vessels in the coastal trades. Voyage planning must therefore take into account the need for back-up bridge personnel in fog, or where there is high traffic density. Although planning is exacting, being prepared saves time and effort in the long term.

Putting management into practical questions can also help create clarity of purpose.

- *The present:* Have I got the right information coming forward so that I can plan ahead and harmonise activities on board?
- *The future:* Have I anticipated and planned for the future so that I can optimise the resources at my disposal?
- *Relationship with the company:* Are my actions supporting the company's objectives? Do I need clarification on specific issues?
- *Relationships with the crew:* Does everybody know the ships' itinerary? Are all crew members informed of progress? Do all on board know what is expected of them?

To improve management performance The Nautical Institute administers a series of management modules to be followed through distance learning. Each module is laid out in such a way that the purpose is explained and individuals are asked to relate the new skills acquired to their own work situation. Relevant modules are 'Setting Objectives and Planning; Controlling;
Delegating; and Leading and Motivating Staff'[16].

Watch arrangements

4. (a) The composition of the watch shall at all times be adequate and appropriate to the prevailing circumstances and conditions and shall take into account the need for maintaining a proper lookout.

(b) When deciding the composition of the watch on the bridge which may include appropriate deck ratings, the following factors, *inter alia,* shall be taken into account:

(i) At no time shall the bridge be left unattended;

(ii) Weather conditions, visibility and whether there is daylight or darkness;

(iii) Proximity of navigational hazards which may make it necessary for the officer in charge of the watch to carry out additional navigational duties;

(iv) Use and operational condition of navigational aids such as radar or electronic position-indicating devices and any other equipment affecting the safe navigation of the ship;

(v) Whether the ship is fitted with automatic steering;

(vi) Any unusual demands on the navigational watch that may arise as a result of special operational circumstances.

This clear unambiguous section needs little further comment and provides practical guidelines for the master to decide on appropriate bridge manning.

It is appreciated that there are many other demands put upon crew for maintenance, hatch cleaning, tank washing and so on. However, the overriding principle must apply that the safe navigation of the vessel must have precedence over other routine operations.

Fitness for duty

5 The watch system shall be such that the efficiency of watchkeeping officers and watchkeeping ratings is not impaired by fatigue. Duties shall be so organised that the first watch at the commencement of a voyage and the subsequent relieving watches are sufficiently rested and otherwise fit for duty.

The joint IMO/ILO working group examining the subject concluded: 'Fatigue can be induced by prolonged periods of mental and physical activity, inadequate rest, adverse environmental factors and physiological stress or other psychological factors.'
The obvious effect of fatigue is that the individual becomes so tired he cannot properly carry out his duties;
the danger of mental fatigue is that it can creep up on individuals without them being aware of it. Research has shown that fatigue causes an individual to focus attention more and more on what are perceived to be the most important tasks. In doing so peripheral warnings are likely to go unnoticed. This applies particularly to vigilance which may be considerably reduced.

Although not specifically mentioned above it is often the master who becomes the most fatigued person on board. In this context proper guidance from the company should be provided.

These principles demonstrate however that the master does have the authority to take such measures as are necessary to avoid fatigue.

Typical guidance might be given as follows:

The officer required to take the first navigational watch after sailing must have adequate rest prior to sailing. When it is possible to vary watch times during passage, a change of programme may be used, in suitable circumstances, to ensure key officers have sufficient rest.

Navigation

6 (a) The intended voyage shall be planned in advance taking into consideration all pertinent information and any course laid down shall be checked before the voyage commences.

(b) During the watch the course steered, position and speed shall be checked at sufficiently frequent intervals, using any available navigational aids necessary, to ensure that the ship follows the planned course.

(c) The officer of the watch shall have a full knowledge of the location and operation of all safety and navigational equipment on board the ship and shall be aware and take account of the operating limitations of such equipment.

(d) The officer in charge of a navigational watch shall not be assigned or undertake any duties which would interfere with the safe navigation of the ship.

Navigational equipment

7 (a) The officer of the watch shall make the most effective use of all navigational equipment at his disposal.

(b) When using radar, the officer of the watch shall bear in mind the necessity to comply at all times with the provisions on the use of radar contained in the applicable regulations for preventing collision at sea.

(c) In cases of need the officer of the watch shall not hesitate to use the helm, engines and sound signalling apparatus.

Passage planning is to be the subject of a further *Nautical Briefing* and so a few notes only are included. The plan needs to be drawn up from berth to berth, including pilotage waters, and prior to sailing will need to be updated from the latest navigational warnings.

A well prepared plan can help to remove doubts about the most appropriate action to take. For example, how far is it possible to deviate from the track without exceeding the safety margins? What is the initial course to steer allowing for set and drift? In the event of an emergency or a black out, how far can the ship drift safely before dropping the anchor? What is the best time to arrive at the next port? On what VHF channel is the next pilot station?

Whatever the situation it must be made explicitly clear to all watchkeepers that the keeping of the planned schedule is of secondary importance to the safe navigation of the ship.

Monitoring

The bridge watchkeeper has the responsibility to ensure the safe conduct of the ship along the planned track. This is achieved through monitoring and directing the navigation of the ship in relation to the availability of safe water and the movement of other vessels.

Track control in confined waters can be achieved through pilotage techniques which include the use of headmarks, transits and radar parallel index methods.

The use of parallel index techniques enable cross-track error to be monitored from the radar work station. This technique has particular value in times of reduced visibility, but needs to be practised and applied where appropriate radar conspicuous targets are available.

Whenever a master or officer of the watch detects that the vessel is deviating from the track it is essential to question the possible cause. This is most likely to be due to set, wind and current, but it may be due to an instrument error, degradation of the radar, misalignment of the heading marker or other related cause.

The need to confirm the ship's position frequently is a statement which needs further examination. A fix should be taken whenever the vessel completes a turn on to a new track and at regular intervals thereafter. The fix interval should be such that the vessel can not be set appreciably off track or into danger by the anticipated effects of tidal stream, wind or currents in the period between successive fixes. As the ship approaches confined waters the fix interval becomes shorter. When appropriate navigational marks have been identified pilotage techniques should be used.

A routine which requires considerable attention is the changing of charts, the transfer of position and the relationship between scale and navigational instruments in use.

Checking

Although not specifically stated in the **Principles,** checking is an essential part of navigational practice. The /CS *Guide* states that 'in order to achieve a sound and efficient bridge organisation procedures should be established to minimise the risk that an error made by one person will have disastrous and inevitable consequences.' It must become normal practice to check one's own workings and the workings of others.

Checking starts with training and when trainees do something wrong, they should be asked to resubmit the correct working. This enables the exercise to end on a positive note and also provides an occasion to demonstrate the value of checking.

The officer laying off tracks on the chart should expect to have them checked; the master who makes an unscheduled alteration of course should expect to be checked and queried; the pilot's helm orders need to be verified and checked; engine movements need to be checked against revolutions; and instrument errors need to be checked regularly and the results recorded to ascertain trends.

Radar can become detuned and the heading marker can become misaligned. Instruments like radar which rely on a variety of sensors for input will also be affected by gyro errors, log errors and calibration errors. Radio navigation aids will be affected by propagation errors and may be affected by a disruption in power supplies.

When fixing the ship, additional errors can occur through the wrong identification of a landmark and through making a mistake when transposing radar or

bearing information onto the chart. Whenever possible three bearings should be used and a range and bearing taken from the radar should be confirmed by at least an extra bearing or an extra range.

Whenever there is any doubt, additional information should be sought from the depth recorder and other aids. Many strandings could have been averted if information from the depth recorder had been available.

Increasingly the Global Positioning System (GPS) is being adopted as the primary navigational source on board. This system has global coverage 24 hours a day with a position update approximately every second and a claimed accuracy of 100 metres. By using differential GPS involving a land-based receiver/transmitter it is possible to obtain accuracies of 6-7 metres. However, errors can occur both in transmission propogation and reception and the simplicity of the readout should not be taken as infallible. Also, satellite transmissions are sometimes interfered with. Alternative navigational practices must be available to back up all electronic equipment.

Implicit in the use of GPS is the mapping arrangement used by the satellite and the position of the land as provided on the chart. It is essential to verify the ship's position against a known land datum before using Satnav in conjunction with supporting methods for coastal navigation.

Navigational systems are sometimes linked to a system of way points through the automatic pilot. It is essential that the co-ordinates of way points are double checked and that the track between way points is checked from the chart. Alteration of course must in all circumstances be positively accepted by the watchkeeping officer, who must verify that the alteration is safe and that there are no other ships likely to be affected in the vicinity.

Frequent checks should be made between bridge compasses and an external verification of compass errors through an azimuth or transit should be made once a watch. The results should be properly recorded to detect any error tendencies.

Navigational duties and responsibilities **8 (a) The officer in charge of the watch shall:**

(i) Keep his watch on the bridge which he shall in no circumstances leave until properly relieved;

(ii) Continue to be responsible for the safe navigation of the ship, despite the presence of the master on the bridge, until the master informs him specifically that he has assumed that responsibility and this is mutually understood;

(iii) Notify the master when in any doubt as to what action to take in the interest of safety;

(iv) Not hand over the watch to the relieving officer if he has reason to believe that the latter is obviously not capable of carrying out his duties effectively, in which case he shall notify the master accordingly.

(b) On taking over the watch the relieving officer shall satisfy himself as to the ship's estimated or true position and confirm its intended track, course and speed and shall note any dangers to navigation expected to be encountered during his watch.

(c) A proper record shall be kept of the movements and activities during the watch relating to the navigation of the ship.

Traditionally the master has 'taken over' the watch when approaching 'difficult' situations. However, provided the vessel is not in immediate danger, a good case can be argued for the master to oversee the situation whilst leaving the watchkeeping officer to deal with it. This allows the master to take a broader view and it is easier for him to question the activities of the watchkeeping officer than it is for the watchkeeping officer to question the master.

A junior officer will tend to be reluctant to question the master's actions. So the master acting in a supporting role can strengthen the bridge team, add to safety and give the watchkeeping officer more confidence.

The master must make it clear in unambiguous language when he is taking over the control of the ship and when he is handing it back.

A master should encourage the watchkeeping officer to give him a brief description of his intended actions. Under these circumstances the master can consider the intentions, can amend them and still allow the watchkeeping officer to keep the initiative and implement the appropriate manoeuvres.

The importance of handing over the watch to ensure continuity requires commitment by both the relieved and relieving officer. The officer being relieved should have a handover position on the chart, a clear picture of traffic and hazards in the area, verified equipment, and a status report concerning the ship and engines, work being carried out and so on. To avoid misunderstanding any course alterations should be completed before handing over.

At night the relieving officer should have time to adapt to night time vision and at all times he should make a point of checking the information and status supplied by the officer being relieved. In this way the change of watch can be considered as an act of verification rather than as an act of discontinuity.

Matters relating to the keeping of records are mentioned elsewhere but it can be noted in 8(b) 'the relieving officer shall satisfy himself as to the ship's estimated or true position and confirm its intended *track,* course and speed'. But in 6(b) it states that 'the course steered, position and speed shall be checked at sufficiently frequent intervals, ... to ensure the ship follows the planned *course'.*

Here is just one example of how traditional words assume a variety of meanings which can become confusing because of their multiple interpretations. To avoid confusion the Council of The Nautical Institute defined navigational terms[17]:

Track is the path followed or to be followed between one position and another.

Course is the intended heading as related to the compass.

Lookout

***9.* In addition to maintaining a proper lookout for the purpose of fully appraising the situation and the risk of collision, stranding and other dangers to navigation, the duties of lookout shall include the detection of ships or aircraft in distress, shipwrecked persons, wrecks and debris. In maintaining a lookout the following shall be observed:**

(a) The lookout must be able to give full attention to the keeping of a proper lookout and no other duties shall be undertaken or assigned which could interfere with that task.

(b) The duties of lookout and helmsman are separate and the helmsman shall not be considered to be the lookout while steering, except in small ships where an unobstructed all-round view is provided at the steering position and there is no impairment of night vision or other impediment to the keeping of a proper lookout. The officer in charge of the watch may be the sole lookout in daylight provided that on each such occasion:

(i) The situation has been carefully assessed and it has been established without doubt that it is safe to do so;

(ii) Full account has been taken of all relevant factors including, but not limited to:

- **State of weather.**
- **Visibility.**
- **Traffic density.**
- **Proximity of danger to navigation.**
- **The attention necessary when navigating in or near traffic/separation schemes;**

(iii) Assistance is immediately available to be summoned to the bridge when any change in the situation so requires.

An analysis of the reports received by the Institute over the past 20 years indicates that in open waters the predominant cause of collision was failure to maintain a proper lookout. In some cases the ships, fishing vessels or yachts were not seen or even *detected* at all and in other cases they were detected too late to avoid a close-quarters situation.

Masters must ensure that watchkeeping officers understand that the keeping of a vigilant lookout is essential.

The use of radar and ARPA as aids to collision avoidance particularly in poor visibility must not detract from the requirement that a visual lookout is kept.

To ascertain risk of collision it is necessary to establish whether or not the compass bearing is changing. At sea ships move relative to each other but when navigating, the watchkeeping officer also has to be aware of how the ship is moving relative to the ground.

Watchkeeping and maintaining a proper lookout demands a balanced assessment between outside view, radar and chart.

Experienced watchkeepers are constantly seeking to verify the situation, and part of the reason for this is that it is not possible to predict with certainty what other vessels are going to do based upon past observations.

When conducting a visual lookout, the eye is most likely to detect new targets when they break the line of the horizon. Targets can also be obscured in blind arcs and unless the bridge is particularly well designed the watchkeeping officer will need to move to obtain a clear view of the surrounding sea.

The following table provides a comparison between the merits of visual and radar observation which can be used when deciding look-out priorities. It must not be forgotten that the watchkeeping officer also has to be vigilant concerning activities onboard and the effect of weather on the ship, crew and equipment.

TABLE I

ADVANTAGES OF THE EYE
Reliable
Sensitive to colour
Can assess aspect
Can identity small targets
Can see light configurations
Can assess ship types
Can identify conspicuous marks
Can identify flashing lights
Has better discrimination
Can see changing weather patterns
Can see effect of sea on vessel
Not affected by blind arcs (if observer moves)

LIMITATIONS OF THE EYE Poor at assessing distance (worse at night) Subject to night adaptation Degradation through glare (worse with age) Gets tired searching
Binoculars needed for early identification (particularly on high speed vessels)

ADVANTAGES OF RADAR
Generally reliable
Does not get tired
Accurate range information
Stable bearing platform
Simplifies the overview
Can penetrate fog
Better penetration in rain and snow
Useful for predictive collision avoidance
Predictive navigation (parallel index)
Can have longer range (height of aerial)
Can have low down port approach aerial to minimise clutter

LIMITATIONS OF RADAR
Misses small targets
Can miss substantial targets in clutter
Can de-tune
Prone to inherent and input errors
Targets need transponders for positive identification
Is prone to interference
Cannot discriminate as well as the eye
Cannot identify ship types or operations
Cannot assess aspect immediately
Bearings less accurate than compass

When a lookout is posted the watchkeeping officer should brief him so that he will be involved and encouraged to take an interest in the situation and develop more effective lookout practices.

Navigation with pilot embarked

10 Despite the duties and obligations of a pilot, his presence on board does not relieve the master or officer in charge of the watch from their duties and obligations for the safety of the ship. The master and pilot shall exchange information regarding navigation procedures, local conditions and the ship's characteristics. The master and officer of the watch shall co-operate closely with the pilot and maintain an accurate check of the ship's position and movement.

Pilots are engaged for a variety of reasons depending upon circumstances which include pilotage based upon local knowledge, liaison, ship handling and bridge support.

The duty of a pilot is to direct the navigation of the ship, and to conduct it so far as the course and speed of the ship is concerned. He liaises with the VTS, organises the use of tugs and advises on the use of moorings and towing lines.

The position of the pilot on board a vessel is .aptly summarised by the Canadian Royal Commission on Pilotage, Ottawa 1968, as follows:

> ... 'to *conduct a ship' must not be confused with 'being in command of a ship'. The first expression refers to action, to a personal service being performed; the second to a power. The question whether a pilot has control of navigation is a question of fact and not of law. The fact that a pilot has been given control of the ship for navigational purposes does not mean that the pilot has superseded the master. The master is, and remains, in command; he is the authority aboard. He may, and does, delegate part of his authority to subordinates and to outside assistants whom he employs to navigate his ship—i.e., pilots. A delegation of power is not an abandonment of authority, but one way of exercising authority.*

Preparations to embark and disembark a pilot and the rigging of the pilot ladder are important considerations which require careful attention to avoid accidents and danger to life.

When a pilot boards he joins the bridge team. Ideally a card will be made up which will include all the information that a pilot is likely to need, such as call sign, draught, tonnages, dimensions, engine and propeller details, manoeuvring speeds, steering and thruster details, anchors and cable lengths, air draught and details of bridge equipment. Also to be reported should be compass errors and any radar heading errors.

The Nautical Institute is encouraging pilots to provide a pilotage plan to enable the master and/or officer of the watch to form a bridge team together with the pilot. The pilot also has a role to play in informing 'the bridge' about relevant information from the shore VTS.

The officer of the watch should ask the pilot about his intentions and support him by checking his actions.

Increasingly sea pilots are confronted with language difficulties and find themselves alone on the bridges of ships for considerable periods. Their ability to call the crew or cope with an emergency under these circumstances is dangerously limited, and they must never be left unattended.

In spite of a clear statement of roles and responsibilities, there is considerable uncertainty in the master/pilot relationship. It concerns the questions 'Who is in charge of the navigation of the ship' and 'What levels of interference will be tolerated by those on the bridge at the time?'

The principal causes are:'[8]'

- Unclear regulations.
- Lack of communication between master and pilot.
- Navigation of the vessel is completely handed over to the pilot.
- Master monitoring the pilot subjectively.
- Watch officer reluctant to question the pilot.
- Insufficient appraisal and planning of the pilotage passage.
- Errors and omissions by the pilot detected too late to avoid an accident.

Being aware that these omissions may lead to an undetected error is the basis for working out company policies and operational procedures to remedy the situation.

The problem is a serious one and has been quantified in the *Analysis of Claims 1992* conducted by the UK P&I Club'[9]', During the year the Club had 156 property damage claims totalling $ 160 million comprising 11 per cent of claims by number and 20 per cent by value.

The report goes on to say: 'There is a need to improve communication between the master and pilot and for there to be a clear understanding between them as to who is responsible for what task at each stage in the manoeuvring of the ship.' The report stresses the need for appropriate training in this area.

Protection of the marine environment

11. The master and officer in charge of the watch shall be aware of the serious effects of operational or accidental pollution of the marine environment and shall take all possible precautions to prevent such pollution, particularly with the framework of relevant international and port regulations.

Whilst Section 11 provides a statement of intent which all mariners will wish to support, Marpol has made it a requirement for all ships to have their own oil spill response plan, the provisions of which are not included in this briefing.

Environmental protection is an important consideration in voyage planning and masters approaching areas of special environmental sensitivity, where an accident might cause irreparable damage, should take appropriate measures to ensure that there is a safe fall back

position from which to anchor or seek assistance.

Emergencies

It is noteworthy that the Convention Principles do not include a requirement to prepare for emergencies and practise emergency drills. This may explain why so few ships practise for manoverboard and why so many watchkeeping officers are unprepared when an emergency does occur.

The cause of a navigational emergency is most likely to be equipment or machinery failure or failure of the main engines or failure of the steering gear.

The consequences of each type of failure can be analysed and the appropriate action established. In this respect the /CS *Bridge Procedure Guide* contains useful checklists. However, the sequence of response is not prioritised.

It must be conveyed to watchkeeping officers that in the event of an emergency they must initiate any required action to minimise the consequences and then seek assistance. To do this they must be prepared and practised.

Key considerations must be:

- Appropriate remedial action taken and verified as soon as possible.
- Notification of all those who need to know of the failure.
- The external signs and signals and action required.
- Essential checks to be carried out prior to changeover.
- Sequencies to be followed if a remote control station has to be used.
- Checks to be carried out on completion.

Manoverboard

It must be emphasised that in the event of a manoverboard the actions taken by the officer of the watch are likely to make the difference between life and death. Appropriate action must include the following:

- Release a bridge wing smoke marker float immediately.
- If possible make sure the man remains in sight by posting a lookout.
- Log time/Note the position of the ship in case a search is needed.
- Put engines on 'Stand By'.
- Sound three long blasts—hoist '0' flag if it is likely to be effective.
- Turn the vessel to facilitate recovery by the most appropriate method.

Communications

This subject is also omitted from the Convention Principles but the VHF radio-telephone is now installed on all ships and has become an essential piece of bridge equipment.

The contact and emergency Channel 16 is so overworked that strict discipline must be applied in limiting transmissions to a minimum prior to changing channels.

The use of VHF as an instrument to assist in collision avoidance between two or more unknown vessels must be avoided. There is no substitute for the correct application of the ColRegs. The dangers implicit in the use of VHF for this purpose are mis-identification of the target vessel and problems of understanding. Trying to establish communication can waste valuable time which should be used to avoid a close-quarters situation. Also there can always remain some uncertainty about the other vessel's actions following VHF communication.

When approaching port or proceeding with a pilot on board the communications workload can be considerable and can distract either the pilot or officer of the watch from essential navigational duties. Under these circumstances additional personnel may need to be made available.

Engine and cargo awareness

Most ships operate with unmanned machinery spaces particularly at night. Watchkeeping officers therefore need to have a working knowledge of the ship's engines and the procedures necessary for responding to alarms of different priorities.

Similarly the operations necessary to change from normal full away deep-sea to stand-by conditions of readiness needs to be appreciated. This will often entail knowing which engineer to call and how much time it takes to prepare the engines for manoeuvring.

A full appreciation of the steering system on board will assist in making the correct response when changing from manual to automatic steering and this should be practised daily and the autopilot tested each watch.

Fire detection and cargo care and control equipment is also so arranged that key information is displayed on the bridge. Masters need to ensure that watchkeeping officers have the opportunity to learn about the ship systems. It is the duty of the watchkeeping officers to understand the principles by which the systems operate and monitor them accordingly,

Training on board

To encourage and promote good watchkeeping practices amongst trainees, and to enhance watchkeeping skills amongst junior officers the Institute is jointly preparing with Videotel Marine International training videos on

(i) Bridge procedures.
(ii) Passage planning.
(iii) Master/Pilot relationships.

Attached to the videos and available separately will be an on-board training manual to familiarise the trainee with watchkeeping duties during a typical voyage.

The scheme will emphasise the correct observance of the Collision Regulations, the principles of passage planning and the role of the watchkeeping officer in monitoring and directing the navigation of the ship.

Conclusion

Watchkeeping is the single most important activity conducted at sea. Upon the watchkeeper's diligence rests the security of the ship and all those on board. It is a demanding activity, frequently under-valued, which needs support, encouragement, self-discipline and competence.

Bridge watchkeeping is by no means an easy discipline to acquire. The watchkeeper needs to be proficient in navigation, have a fluent understanding of the ColRegs, know how to use the radar and ARPA, be

familiar with bridge instruments, know the ship and its routines, be able to respond in an emergency, handle communications, be able to work as a member of a team, and maintain records correctly.

This *Nautical Briefing* has focused on a number of areas where standards of bridge watchkeeping can be improved through better planning, enhanced awareness and effective practices.

Efficient ship operations demands team work and that has to start with the company providing comprehensive instructions and expected standards of operation for all tasks carried out on board.

The master has the responsibility of interpreting the company's instructions with respect to his own ship and establishing working practices which are effective and mutually supporting through standing orders and management.

When it is felt that additional training is needed, a training scheme, developed by The Nautical Institute and supported by videos, is being provided to enhance the knowledge and skills of inexperienced watchkeepers and trainees. By using these training materials and by encouraging an interest in good watchkeeping practices based upon this *Nautical Briefing,* masters will be able to instil a sense of pride in doing the job well. Once this aim is achieved, high standards can be maintained. Q

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M 845 Dangers in the use of VHP radio in collision avoidance.

M 854 Navigation safety and passage planning.

M 1102 Keeping a safe navigational watch.

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M 1348 Navigation in fog.

M 1158 Radar collision avoidance and parallel index techniques.

These M Notices can be obtained from HMSO. Telephone orders 071-873 9090.

BRIDGE WATCHKEEPING

Annex 2— IMO BRIDGE WATCHKEEPING REQUIREMENTS

RECOMMENDATION ON OPERATIONAL GUIDANCE FOR OFFICERS IN CHARGE OF A NAVIGATIONAL WATCH

The IMO Convention on Standards of Training Certification and Watchkeeping 1978 Regulation II/l and Resolution 1

Introduction

1. This Recommendation contains operational guidance of general application for officers in charge of a navigational watch, which masters are expected to supplement as appropriate. 11 is essential that officers of the watch appreciate that the efficient performance of their duties is necessary in the interests of the safety of life and property at sea and the prevention of pollution of the marine environment.

General

2. The officer of the watch is the master's representative and his primary responsibility at all times is the safe navigation of the ship. He should at all times comply with the applicable regulations for preventing collisions at sea (see also paragraphs 22 and 23).
3. It is of special importance that at all times the officer of the watch ensures that an efficient lookout is maintained. In a ship with a separate chart room the officer of the watch may visit the chart room, when essential, for a short period for the necessary performance of his navigational duties, but he should previously satisfy himself that it is safe to do so and ensure that an efficient lookout is maintained.
4. The officer of the watch should bear in mind that the engines are at his disposal and he should not hesitate to use them in case of need. However, timely notice of intended variations of engine speed should be given where possible. He should also know the handling characteristics of his ship, including its stopping distance, and should appreciate that other ships may have different handling characteristics.
5. The officer of the watch should also bear in mind that the sound signalling apparatus is at his disposal and he should not hesitate to use it in accordance with the applicable regulations for preventing collisions at sea.

Taking over the navigational watch

6. The relieving officer of the watch should ensure that members of his watch are fully capable of performing their duties, particularly as regards their adjustment to night vision.
7. The relieving officer of the watch should not take over the watch until his vision is fully adjusted to the light conditions and he has personally satisfied himself regarding:

(a) standing orders and other special instructions of the master relating to navigation of the ship;
(b) position, course, speed and draught of the ship;
(c) prevailing and predicted tides, currents, weather, visibility and the effect of these factors upon course and speed;
(d) navigational situation, including but not limited to the following:
    (i) operational condition of all navigational and safety equipment being used or likely to be used during the watch;
    (ii) errors of gyro and magnetic compasses;
    (iii) presence and movement of ships in sight or known to be in the vicinity;

(iv) conditions and hazards likely to be encountered during his watch;
(iv) possible effects of heel, trim, water density and squat* on underkeel clearance.

8. If at the time the officer of the watch is to be relieved a manoeuvre or other action to avoid any hazard is taking place, the relief of the officer should be deferred until such action has been completed.

Periodic checks of navigational equipment

9 Operational tests of shipboard navigational equipment should be carried out at sea as frequently as practicable and as circumstances permit, in particular when hazardous;
conditions affecting navigation are expected; where appropriate these tests should be recorded.

10. The officer of the watch should make regular checks to ensure that:

(a) the helmsman or the automatic pilot is steering the correct course;
(b) the standard compass error is determined at least once a watch and, when possible, after any major alteration of course; the standard and gyrocompasses are frequently compared and repeaters are synchronized with their master compass;
(c) the automatic pilot is tested manually at least once a watch.
(d) the navigation and signal lights and other navigational equipment are functioning properly.

Automatic Pilot

11. The officer of the watch should bear in mind the necessity to comply at all times with the requirements of Regulation 19, Chapter V of the International Convention for the Safety of Life at Sea, 1974. He should take into account the need to station the helmsman and to put the steering into manual control in good time to allow any potentially hazardous situation to be dealt with in a safe manner. With a ship under automatic steering it is highly dangerous to allow a situation to develop to the point where the officer of the watch is without assistance and has to break the continuity of the lookout in order to take emergency action. The changeover from automatic to manual steering and vice-versa should be made by, or under the supervision of, a responsible officer.

Electronic navigational aids

12. The officer of the watch should be thoroughly familiar with the use of electronic navigational aids carried, including their capabilities and limitations.

13. The echo-sounder is a valuable navigational aid and should be used whenever appropriate.

Radar

14. The officer of the watch should use the radar when appropriate and whenever restricted visibility is encountered or expected, and at all times in congested waters having due regard to its limitations.

15. Whenever radar is in use, the officer of the watch should select an appropriate range scale, observe the display carefully and plot effectively.

16. The officer of the watch should ensure that range scales employed are changed at sufficiently frequent intervals so that echoes are detected as early as possible.

17. It should be borne in mind that small or poor echoes may escape detection.

18. The officer of the watch should ensure that plotting or systematic analysis is commenced in ample time.

19. In clear weather, whenever possible, the officer of the watch should carry out radar practice.

Navigation in coastal waters

20. The largest scale chart on board, suitable for the area and corrected with the latest available information, should be used. Fixes should be taken at frequent intervals; whenever

circumstances allow, fixing should be carried out by more than one method.
21. The officer of the watch should positively identify all relevant navigation marks.

Clear weather

22. The officer of the watch should take frequent and accurate compass bearings of approaching ships as a means of early detection of risk of collision; such risk may sometimes exist even when an appreciable bearing change is evident, particularly when approaching a very large ship or a tow or when approaching a ship at close range. He should also take early and positive action in compliance with the applicable regulations for preventing collisions at sea and subsequently check that such action is having the desired effect.

Restricted visibility

23. When restricted visibility is encountered or expected, the first responsibility of the officer of the watch is to comply with the relevant rules of the applicable regulations for preventing collisions at sea, with particular regard to the sounding of fog signals, proceeding at a safe speed and having the engines ready for immediate manoeuvres. In addition, he should;

(a) inform the master (see paragraph 24);
(b) post a proper lookout and helmsman and, in congested waters, revert to hand steering immediately;
(c) exhibit navigation lights;
(d) operate and use the radar.

It is important that the officer of the watch should know the handling characteristics of his ship, including its stopping distance, and should appreciate that other ships may have different handling characteristics.

Calling the Master

24. The officer of the watch should notify the master immediately in the following circumstances;

(a) if restricted visibility is encountered or expected;
(b) if the traffic conditions or the movements of other ships are causing concern;
(c) if difficulty is experienced in maintaining course;
(d) on failure to sight land, a navigation mark or to obtain soundings by the expected time;
(e) if, unexpectedly, land or a navigation mark is sighted or change in soundings occurs;
(f) on the breakdown of the engines steering gear or any essential navigational equipment;
(g) in heavy weather if in any doubt about the possibility of weather damage;
(h) if the ship meets any hazard to navigation, such as ice or derelicts;
(I) in any other emergency or situation in which he is in any doubt.

Despite the requirement to notify the master immediately in the foregoing circumstances, the officer of the watch should in addition not hesitate to take immediate action for the safety of the ship, where circumstances so require.

Navigation with pilot embarked

25. If the officer of the watch is in any doubt as to the pilot's actions or intentions, he should seek clarification from the pilot; if doubt still exists, he should notify the master immediately and take whatever action is necessary before the master arrives.

Watchkeeping personnel

26. The officer of the watch should give watchkeeping personnel all appropriate instructions and information which will ensure the keeping of a safe watch including an appropriate lookout.

Ship at anchor

27. If the master considers it necessary, a continuous navigational watch should be

maintained at anchor. In all circumstances, while at anchor, the officer of the watch should:

(a) determine and plot the ship's position on the appropriate chart as soon as practicable; when circumstances permit, check at sufficiently frequent intervals whether the ship is remaining securely at anchor by taking bearings of fixed navigation marks or readily identifiable shore objects;
(b) ensure that an efficient lookout is maintained;
(c) ensure that inspection rounds of the ship are made periodically;
(d) observe meteorological and tidal conditions and the state of the sea;
(e) notify the master and undertake all necessary measures if the ship drags anchor;
(f) ensure that the state of readiness of the main engines and other machinery is in accordance with the master's instructions;
(g) if visibility deteriorates, notify the master and comply with the applicable regulations for preventing collisions at sea;
(h) ensure that the ship exhibits the appropriate lights and shapes and that appropriate sound signals are made at all times, as required;
(i) take measures to protect the environment from pollution by the ship and comply with applicable pollution regulations.

**Squat: The decrease in clearance beneath the ship which occurs when the ship moves through the water and is caused both by bodily sinkage and by change of trim. The effect is accentuated in shallow water and is reduced with a reduction in ship's speed.*

NAUTICAL Briefing

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PASSAGE PLANNING

The Nautical Institute Council

FOREWORD

PASSAGE PLANNING is a way of minimising the risk of navigational errors. With tighter schedules, reduced manning, faster turn-rounds and more intense operations, the requirement for pre-planning becomes even more necessary.

The aim of passage planning is to prepare for the navigation of a ship so that the intended passage can be executed from berth to berth in a safe manner in respect of both the vessel and protection of the environment, as well as ensuring positive control of the vessel at all times. Without planning, the time to process essential information may not be available at critical times when the navigator is occupied confirming landmarks, altering course, avoiding traffic and carrying out other bridge duties such as communications. Under these circumstances mistakes can be made and errors go undetected.

A particular benefit of planning is that it enables the appropriate navigational methods to be used at different phases of the voyage. In narrow or confined waters it becomes more important to concentrate on forward-looking pilotage techniques. However, before they can be applied it is necessary to provide detailed guidance in advance.

Passage planning can be time consuming and therefore carries a cost in terms of human resources, expertise and supporting administration.

The value of passage planning is difficult to quantify. If it is done well, and the ship's navigation is consistently reliable, then there is no cost penalty against which to assess its relative merits to the company. However, if it is not practised, the costs of navigational incidents can be significant.

Some guidance is provided in the STCW Convention concerning 'Basic Principles to be Observed in Keeping a Navigational Watch' which states that:

> ***'The intended voyage shall be planned in advance taking into consideration all pertinent information and any course laid down should be checked before the voyage commences'.***

However, this statement needs further amplification if it is to be meaningful. This briefing, therefore, is designed to focus on the principles of passage planning and the plan's execution, and to provide a document which can be discussed both at sea and ashore to encourage a professional commitment.

Captain LA. Holder, ExC, MPhil, FNI, FRIN, FCIT, President, The Nautical Institute, January 1994.

PASSAGE PLANNING

Aim

THE AIM of this briefing is to demonstrate to governments, marine management, masters, pilots and deck officers that passage planning from berth to berth is an essential navigational discipline and that it must be supported, encouraged and applied as part of bridge team management.

Scope

This Nautical Institute briefing outlines the principles of berth-to-berth passage planning. It covers the subject within the context of coastal navigation;
however, ocean passages must also be planned in detail. It assumes a knowledge of navigation and the use, and limitations, of radar and other aids to navigation.

Planning

The purpose of passage planning is to ensure positive control over the safe navigation of the ship at all times. To achieve this purpose, the ship's track to be made good, once it has been finally put on to the chart, will become the focus of attention.

For ferries, liners and other vessels engaged on regular passages, the passage plan will have been established for normal operating conditions and only the variable items like weather and tidal information will need to be updated. If, however, the vessel changes route or the officers change, then thorough briefings will need to take place.

For the majority of ships visiting different ports, the process of planning must be given due consideration. Early advice about an intended voyage may come from a variety of sources and frequently the master will need to provide a voyage itinerary quickly, covering distances, times and restrictions for provisional cargo bookings. Once the intended voyage has been confirmed, planning will commence in detail, The master should discuss an outline route with the navigation officer. The appraisal process will then take place, during which all relevant information will be collected from sources such as those listed in Table 1, while bearing in mind those parameters listed in Table 2.

This information will then be used in preparing the plan, along with guidance from the master concerning, for example, the clearing distances which he considers appropriate. The navigating officer will ensure that the ship can always be navigated in safe waters, that critical parts of the voyage are identified, voyage timings are checked and that the appropriate navigational techniques required for each part of the voyage are highlighted. It has to be stressed that the plan must be complete, from berth to berth. **The plan must also include those parts of the voyage during which it is expected that a pilot will be on board.**

The construction of a passage plan encourages all those concerned to think ahead, to foresee potential problems and plan a strategy to minimise risk. Contingency plans must be made, such as identifying deep-water escape routes from turns, possible alternative routes and emergency anchorages. The plan must take into account the expected traffic flow and be flexible enough to allow for collision avoidance in line with the International Regulations for Preventing Collisions at Sea.

TABLE 1

Information sources for passage planning include:

1. **Chart catalogue.**
2. **Navigational charts.**
3. **Ocean passages for the world.**
4. **Routeing charts, pilot charts and IMO Ship's Routeing.**
5. **Sailing directions and pilot books.**
6. **Light lists.**
7. **Tide tables.**
8. **Tidal stream atlases.**
9. **Notices to Mariners (Navareas, Hydrolants, Hydropacs).**
10. **Radio signal information (including VTS and pilot service).**
11. **Climatic information, meteorological and oceanographic data. Weather, seastate and tee forecasts.**
12. **Leadline chart.**
13. **Distance tables.**
14. **Electronic navigational systems information.**
15. **Radio and local warnings.**
16. **Owner's and other unpublished sources.**
17. **Manoeuvring data.**
18. **Personal experience.**
19. **Mariner's Handbook.**
20. **Guide to Port Entry.**

TABLE 2.

Vessel's status reports needed for passage planning include:

1. **Main propulsion system.**
2. **Steering gear.**
3. **Navigational equipment.**
4. **Anchors.**
5. **Thrusters.**
6. **Auxiliaries.**
7. **Trim and draught of vessel and air draught.**
8. **Transverse stability.**
9. **The availability of manpower.**

Preparing the plan

When preparing the plan the navigating officer will need to take account of the following

- Adequate underkeel clearance at all times, including allowances for squat, pitch, roll, swell, predicted tidal height and possible increase of draught due to heel and trim.
- Safe distances off dangers, allowing for weather, tidal stream, anticipated traffic, reliability of survey data, availability of safe water and navigational systems in use.
- Alter-course positions which can be monitored conveniently by means of radar or by visual bearings.

• Management of chart changes, which should not occur at critical points of the passage.
• Traffic Separation Schemes, and the requirements of Rule 10.
• Predicted tidal information, leading to the pre-working of allowances for set. Tidal constraints limiting ETD/ETA at locks, etc.
• Visibility of lights, rising/dipping distances, arcs and colours of light sectors.
• Safe speeds along the route, leading to a speed plan, and an ETA plan, making due allowance for possible reduced visibility. A plan for reducing speed under control should be considered.
• Selection of depths for comparison with the echo-sounder, taking note of the predicted height of tide.
• Reporting points, VHF frequencies, VTS requirements, areas of special concern and pilot stations. Points for taking tugs.
• Abort positions and contingency plans in case of accident or emergency or bad visibility.
• The primary and secondary systems of navigation to be used.

Requirements for any electronic chart systems. All charts and publications available are up to date. Equipment status.

Margins of allowable error, safety clearing bearings and ranges.

The making up of a bridge, or conning, notebook. Choice of ocean route (circle, composite or rhumb line).

• Choice of ocean route to avoid weather/ice.

The master must satisfy himself that the passage plan meets all his requirements and he must then ensure that all watchkeeping officers are properly briefed; and that the plan is kept amended and up to date for the intended passage.

Monitoring the passage plan

It is common practice on merchant ships to fix the ship's position and then make an allowance for set and drift depending upon offset from the previous fix. This approach to navigation is REACTIVE, being based upon past observations. If either of these is wrong, then any predictions using them will be erroneous. When using fixes in this way, it is usually better to make the fixes at regular intervals. This enables a simple check to be made with respect to speed. It also helps the quick and effective calculation of short-term EPs (Estimated Positions), using the latest course and speed made good, to warn of any immediate problems developing.

However, in narrow waters, techniques need to be used which enable the navigator to maintain a forward outlook, that is to be PROACTIVE, whilst monitoring the deviation from the intended track being made good. Frequent, hurried visits to the chart table to fix the vessel's position may not be the most effective use of the time available. Also, whilst doing this the overall sense of awareness can be interrupted and it is easy during critical phases to become disorientated. It is worth remembering to monitor the echo-sounder. This instrument can often provide the first warning signs that the vessel is standing into danger, since in almost all situations the nearest land is beneath the vessel.

Passage planning therefore should be a preparation for effective piloting by selecting, and marking in advance, those relevant navigational techniques which will lead to safe control of the ship and adherence to the plan.

This point was emphasised in the *Nautical Briefing on Bridge Watchkeeping,* when the Council of The Nautical Institute observed that:

'The need to confirm the ship's position frequently is a statement which needs further examination. A fix should be taken whenever the vessel completes a turn on a new track and at regular intervals thereafter. The fix interval should be such that the vessel cannot be set appreciably off track or into danger by the anticipated effects of tidal stream, wind or currents in the period between fixes. As the ship approaches confined waters the fix interval becomes shorter. When appropriate navigational markers have been identified, pilotage techniques should be used.'

There can be a reluctance amongst some officers to accept pilotage techniques as valid methods of navigation. This inhibits their use and application, so depriving the bridge team of predictive information when it is most needed.

Limiting danger lines (no-go areas)

Charts supplied to ships are the same for everyone, whether for use on board a VLCC at 25 metres draught or on a coaster sailing at 3 metres draught. It is therefore imperative that the chart is made suitable for the specific condition of the vessel on which the chart is being used. This should be done by marking the 'limiting danger lines' - often referred to as marking out the 'no-go areas.'

These are valuable safety limits to any plan, be it for coastal or ocean passage. Lines must be drawn on the chart to highlight where the vessel cannot go. Proper allowance must be made for maximum draft and predicted tidal height and any other limiting condition. The concept of marking no-go areas has the following benefits:

- It forces consideration of the factors affecting under keel clearance, which is always the high risk element,
- It forces a concentrated study of the chart, rather than just a glance.
- It immediately highlights to **anyone** who looks at the chart the, often large , areas that **must** be avoided.

It is not enough to depend on, say, a printed depth contour line. The lines have to be prominent in order to highlight the immediate danger quickly and effectively at any time under any light condition.

It is important to draw the no-go boundaries as accurately as possible. They should show, for example, that the vessel can pass the wrong side of a mark, in an emergency, although this may not normally be desirable. It can be seen from the study of some recent incidents that had this information been immediately available, then a grounding or collision would most probably not have occurred. In this context passing the wrong side of a buoy is nothing compared with the consequences of even a minor incident.

Transits (ranges)

Transits (known as ranges in some areas) - i.e., the line on the chart upon which an observer would see two identifiable objects in line - can be used to give the OOW a quick indication of his position. Although a transit is only a single position line, it has the advantage that it does not require the use of special equipment. For accuracy the distance between the observer and the nearer object should be no more than three times the distance between the objects observed, though transits at distances greater than this can be used to advantage.

Transits are sometimes printed on charts of inshore waters, but good use can be made of natural or clearly identifiable transits found at the planning stage and drawn on the chart. Transits can be used effectively as cues within the passage plan, and also as limiting danger lines.

Leading lines

Leading lines are transits which form a track line to be made good to ensure that the ship passes clear of danger. By observing the leads, the navigator is continuously monitoring progress along the planned track.

Transits also show the observer which way to go to regain track, and with experience and care, the amount off track. The prudent officer will ensure that a leading line is safe for his vessel size, and that following it does not contravene the provisions of the International Regulations for Preventing Collisions at Sea, such as keeping to the right of the fairway as prescribed in Rule 9, or crossing the Traffic Separation Schemes correctly as prescribed in Rule 10.

Clearing bearings and clearing ranges

Clearing marks can be used to ensure that a ship is remaining within a safe area or is not approaching a danger. A small amount of pre-planning means that a single bearing or range can quickly give effective information about the proximity of the ship to danger.

Head marks

Often a ship is required to follow a track in narrow waters without the benefit of a leading line. In this case a suitable head marker should be selected. This should be a readily identifiable conspicuous object, which lies on the projection of the relevant track to be made good. As long as the bearing of the head marker, corrected for errors and preferably taken with a centreline bearing repeater, remains constant (i.e., the same as the required track), the ship will remain on track. It should be noted that the ship need not necessarily be heading directly at the object, only that it is on the line of the required track. In most cases the ship's head will need to be offset to allow for the tidal stream or leeway.

Parallel indexing

This is the simplest and quickest pilotage technique that gives continuous monitoring of the track that the ship is making good. Parallel indexes should be planned for every part of a coastal passage.

Like all radar techniques, parallel indexing should be practised in clear weather during straightforward passages so that personnel become thoroughly familiar with the technique before attempting to use it in confined or difficult passages, at night or in restricted visibility.

Great care should be taken in identifying and confirming reference points on the chart and on the radar; and also in verifying the radar range when using the parallel index.

Altering course

Course changes should be chosen so that their position can be easily established and the turn can be monitored. In pilotage waters the ship's manoeuvring data must always be considered, and wheelover positions must always be planned. It has become customary to plan this wheelover position at a convenient beam bearing. It is better to use a lead bearing that is approximately parallel to the next course; such a lead will act as a self-correcting mechanism to ensure that the ship turns correctly on to the new track even if off-track on the previous leg. The wheelover position can be prepared on the understanding that a constant rudder angle will be applied from which advance and transfer can be

calculated and allowances made for set and drift.

Alternatively, if a rate-of-turn indicator or a rate autopilot are fitted, then constant-radius turns can be planned based upon the relationship that, for a given speed, the rate of turn is proportional to the radius. Again, set and drift can be offset before the turn commences to ensure the ship ends the turn on track. When planning turns in confined waters, it is good practice to prepare the turn with a reference point on the new course. This enables the end of the turn to be monitored to ensure the ship is properly aligned to the new track.

Picking-up pilots

Prior to approaching a pilot boarding point, time must be spent planning the speed and heading required to ensure the best lee possible. Transfer of personnel is always a high-risk event, and this risk must be assessed and minimised. Pilot cutters often operate offshore near sandbanks, and an assessment should be made of available sea room in case there is an emergency.

Anchorages

Approaches into, as well as departures from, anchorages must be planned, taking account of manoeuvring data, as well as possible current or tidal effect. A speed plan should also be drawn up;
anchoring at the wrong speed is a major cause of ship damage. Alternative anchoring positions must be planned on to the chart. When the vessel has to approach a busy anchorage it may not be possible to preplan the anchorage position. Instead, the safe depth in the anchorage area must be verified and the anchorage position selected in relation to the other ships already anchored.

Contingency plans

By preparing in advance for possible contingencies, a quick and effective response can be made when the unexpected happens. Plans should be considered for coping with, amongst other things, main engine failure, steering loss, port or channel closures, radar failure, reduction in visibility, heavy traffic at crucial points, movement or closure of a pilot station, or any of the accidents and emergencies that can occur to a ship on passage.

Emergency anchorages, abort points and alternative routes should be selected and marked on the chart. Only then will every member of the bridge team be able to take best advantage of such planning, when it is needed most.

Error management

It is human nature to make mistakes. Experienced people can make mistakes, usually through slips or lapses caused by preoccupation or distraction, through short cuts in procedures or through applying 'standard' routines unthinkingly in unexpected or unusual circumstances.

Inexperienced people are more likely to make mistakes through lack of knowledge, lack of training, not using safe procedures, or through over confidence.

Similarly, everyone can make mistakes through fatigue, or as a result of ambiguous information. Rarely is an accident caused by a single error. Usually small errors build up into an error chain. In most situations the correction of any single one of the small errors in the error chain will lead to the safe resolution of the situation. People should organise their actions to minimise the possibility of an error chain developing sufficiently to lead to an accident.

This should be done by adopting self-checking procedures such as always verifying position with more than two position lines, monitoring the depth recorder or checking the track and compass course particularly after an alteration of course. Similarly, navigational systems must not be relied upon implicitly and one system must be checked against another regularly.

The strength of a passage plan is that it can be checked before implementation, and provides a basis for monitoring the passage. Encouraging the habit of obtaining an independent check by another member of the bridge team prior to executing any action set out in the passage plan will minimise the risk of errors going undetected. An unexpected deviation from the plan may indicate the development of an error chain. Any such deviation, for whatever reason, should alert the bridge team to the possibility of equipment failure, a human error or an unexpected current. When the deviation might arise from a variety of causes then the plan provides the best framework for resolving the problem.

Summary

Passage planning can be considered as a management activity where the relevant controls have been thought about in advance. The steps can be summarised as follows:

- **Collect relevant information.**
- **Mark out accurate 'No-Go' areas.**
- **Decide the navigational techniques to be used and prepare safe tracks.**
- **Verify that the navigational instruments needed are available and that errors are checked.**
- **Ensure that the ship's passage along required track can be monitored effectively.**
- **Provide for the effective monitoring of turns.**
- **Prepare for contingencies.**
- **Show clearly currents, special points of concern, VHP frequencies, planned ETAs, speeds and reporting points.**
- **Highlight pilot ladder and anchor party requirements, crew standby times and points at which the bridge team may need to be enlarged.**
- **Communicate the plan in a consistent way so that it can be followed by all the bridge team including a pilot, if used.**
- **Ensure that the officers are proficient in the skills necessary to execute the plan, and if necessary institute training or guidance programmes to this end.**

The navigating officer given responsibility for drawing up the plan must expect discussion and amendment as better ways of laying down the plan develop. If the passage is a complicated one, it may be advisable to prepare a draft, to discuss it and then prepare the final version. The level of planning has to be relevant to the circumstances.

Once the passage plan has been executed, it is good practice to 'debrief at some later stage. In this way any lessons that need to be taken into account in future planning can be learnt.

This Nautical Briefing is designed to discuss the concepts of passage planning. For a more detailed guidance on the practical steps which should be taken in preparing the passage plan, consult the book *Bridge Team Management.* The chapters cover the following subjects: Bridge Team Management - The Background; Passage Appraisal; Passage Planning; Plan Execution; Monitoring the Ship's Progress;
Teamwork; Navigating under Pilotage; and the Automation of Bridge Systems.

This book is also linked to a training video which covers: the documents required, 'no-go' areas, marking the track, margins of safety, fixing the ship, parallel indexing, alter-course positions, ship's speed and ETA, and abort points.

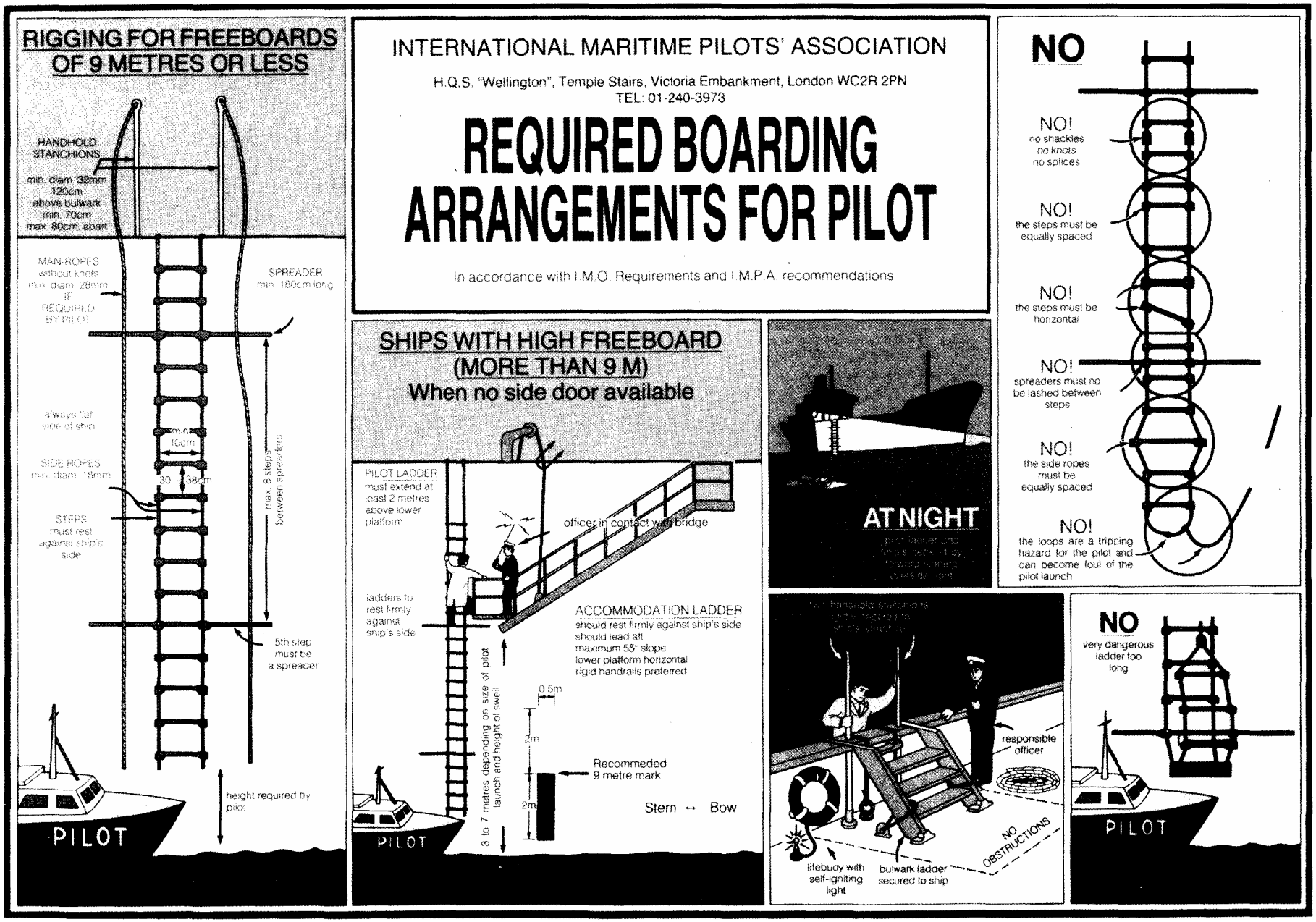
See back page for details of the book and video.

Background reading

1. *The Management of Safety in Shipping,* The Nautical Institute, 1991.
2. *The Nautical Institute on Command,* 1986.
3. *Collisions and their Causes,* R.A. Cahill, Fairplay, 1983.
4. *Strandings and their Causes,* R.A. Cahill, Fairplay, 1985.
5. *A Guide to the Collision Avoidance Rules,* A.N. Cockcroft and J.N.F. Lameijer, Fourth Edition 1990, Heinemann Newnes.
6. *The Admiralty Manual of Navigation,* Vol 1, HMSO.
7. *Watchstanding Guide for the Merchant Officer,* Meurn, Cornell Maritime Press.
8. *Passage Planning,* DOT, HMSO (now out of print).
9. *Parallel Indexing Techniques,* Smith & Mulroney, available from Warsash Nautical Bookshop.
10. *Merchant Shipping Notices,* UK Department of Transport.
    - M845 Dangers in the use of VHF radio in collision avoidance.
    - M854 Navigation safety and passage planning.
    - M1102 Keeping a safe navigational watch.
    - M1263 Keeping a lookout.
    - M1348 Navigation in fog.
    - M1158 Radar collision avoidance and parallel index techniques.
    - M Notices can be obtained from HMSO London 071-873 9090.

References

1. IMO STCW Convention 1978.
2. *ICS Bridge Procedure Guide,* Second Edition 1990.
3. Navigation Safety M Notice 854 HMSO.
4. *Pilotage and Shiphandling,* The Nautical Institute.
5. *Nautical Briefing, Bridge Watchkeeping,* The Nautical Institute, April 1993.
6. *Bridge Team Management,* A.J. Swift, The Nautical Institute, 1993.


RIGGING FOR FREEBOARDS OF 9 METRES OR LESS
HANDHOLD STANCHIONS
min. diam. 32mm
120cm above bulwark
min. 70cm
max. 80cm apart
MAN-ROPES
without knots
min. diam. 28mm
IF REQUIRED BY PILOT
SPREADER
min. 180cm long
always flat side of ship
min. 40cm
30 - 38cm
SIDE ROPES
min. diam. 18mm
STEPS
must rest against ship's side
max. 8 steps between spreaders
5th step must be a spreader
height required by pilot
PILOT
INTERNATIONAL MARITIME PILOTS' ASSOCIATION
H.Q.S. "Wellington", Temple Stairs, Victoria Embankment, London WC2R 2PN
TEL: 01-240-3973
REQUIRED BOARDING ARRANGEMENTS FOR PILOT
In accordance with I.M.O. Requirements and I.M.P.A. recommendations
SHIPS WITH HIGH FREEBOARD (MORE THAN 9 M)
When no side door available
PILOT LADDER
must extend at least 2 metres above lower platform
officer in contact with bridge
ladders to rest firmly against ship's side
ACCOMMODATION LADDER
should rest firmly against ship's side
should lead aft
maximum 55° slope
lower platform horizontal
rigid handrails preferred
0.5m
2m
Recommeded 9 metre mark
2m
3 to 7 metres depending on size of pilot launch and height of swell
Stern ↔ Bow
PILOT
AT NIGHT
NO
NO! no shackles no knots no splices
NO! the steps must be equally spaced
NO! the steps must be horizontal
NO! spreaders must no be lashed between steps
NO! the side ropes must be equally spaced
NO! the loops are a tripping hazard for the pilot and can become foul of the pilot launch
two handrail stanchions
responsible officer
NO OBSTRUCTIONS
lifebuoy with self-igniting light
bulwark ladder secured to ship
NO
very dangerous ladder too long
PILOT

BRIDGE WATCHKEEPING

Annex 7 — REVIEW OF REFERENCES including TRAINING VIDEOS

This study guide on Bridge Watchkeeping is part of The Nautical Institute Bridge Watchkeeping Programme, which includes books and videos.

Books

BRIDGE TEAM MANAGEMENT: by Captain A.J. Swift, MNI, a shipmaster who has spent 15 years training bridge teams on the simulator at the Maritime Operations Centre at Warsash

This practical guide is designed to enhance standards of bridge team management with the purpose of demonstrating effective practices which are necessary to avoid navigational errors. The book covers team management; error chains; casualties and their causes; groundings and their causes; bridge organisation; passage planning; plan execution; monitoring the ship's progress; teamwork; navigation under pilotage; and navigational technology and the human interface.

The book is published by The Nautical Institute. ISBN 1 870077 14 8

Videos

The Nautical Institute has supported the production of three training videos made by Videotel Marine International.

BRIDGE WATCHKEEPING PROCEDURES: This video is designed to reinforce good bridge Watchkeeping practices.

PASSAGE PLANNING: This video is designed to demonstrate the need to prepare passages in advance, berth to berth, with the overall objective of giving the Watchkeeping officer a plan to follow and sufficient information to enable him to do that easily.

THE MASTER/PILOT RELATIONSHIP: This video recognises that the Master and pilot are two professionals with a common purpose. It discusses responsibilities, the exchange of information and ways of ensuring the best basis for a safe passage through busy, confined and sometimes hazardous waters.

Information concerning these three videos can be obtained directly from Videotel Productions, 1-2 Ramilles Street, London W1V 1DF, United Kingdom; Tel: (071) 439-6301.

Additional References

As stated in the introduction this study guide on bridge Watchkeeping assumes that the officer of the watch or trainee has a proper knowledge of navigation, of The International Regulations for Preventing Collisions at Sea, and some bridge experience. Many books exist to cover these subjects. The following references have been chosen as books which provide practical advice.

MODERN CHARTWORK: by Captain H.W. Squaire, Extra Master, FNI

A handy sized book which embraces traditional chartwork with instrument navigation. Terms, concepts and principles are clearly explained and there are numerous examples and working charts for the student to practice.

The book is published by Brown, Son and Ferguson. ISBN 0 85174 548 2

WATCHSTANDING GUIDE FOR THE MERCHANT OFFICER: by R.J. Meum, Master Mariner

A useful reference book and practical guide. The book covers responsibilities, bridge equipment, voyage planning, compliance with the Rule of the Road, emergencies, shiphandling, arrivals and departures, and simulator training, and concludes with case studies.

The book is published by Comell Maritime Press.

ISBN 0 87033 409 3

RADAR AND ARPA MANUAL by A.G. Bole, Extra Master, FRIN FNI and W.O. Dinley, Extra Master, MPhil

Has been written not only as a comprehensive practical reference for mariners on board ship but also to provide essential information for candidates studying electronic navigation systems, radar observer and other professional qualifications. The book covers radar principles, operational principles, target detection, automatic radar plotting aids, operational controls, plotting, navigational techniques using radar and ARPA, ARPA accuracy and errors and references.

The book is published by Butterworth Heinemann. ISBN 0 7506 0818 8

COLLISION AVOIDANCE RULES: Fourth Edition by A.N. Cockcroft, FNI, and J.N.F. Lameijer

This useful book provides an account of the changes which took place to revise the 1960 Rules to embrace the more widespread acceptance of radar, the introduction of traffic separation schemes and the increase in size and speed of ships. There is an introductory section followed by a discussion relating to each of the 1972 Rules, which came into force in 1977. The bookiswell illustrated and provides valuable practical advice on the implementation of the Rules at sea. The book also contains the outcome of a study undertaken by The Royal Institute of Navigation to advise mariners on the appropriate action to take when vessels are detected on radar in fog in accordance with the provisions of Rule 19.

The book is published by Butterworth Heinemann. ISBN 0 7506 0522 7

BRIDGE PROCEDURES GUIDE: by the International Chamber of Shipping

The first edition of this guide, published in June 1977, was intended to develop a more widespread awareness of good operating practice and the regular use of sound bridge procedures. The basic guidance it contained is still relevant today, but this second edition has been expanded to cover recognised practices concerned with passage planning, the use of radar, master/pilot information exchange, the availability of manoeuvring data and ship characteristics on the bridge, steering gear test routines, the use of VHP, and ship reporting procedures.

The book is published by Witherby & Co. Ltd.

ISBN 0 948691 42 5

BRIDGE WATCHKEEPING

Annex 8 — GLOSSARY OF TERMS

1 General

Air draught	Height of highest point of vessel's structure above waterline, e.g. radar, funnel, cranes, masthead.
Anchor position	Place where a specific vessel is anchored or is to anchor.
Bell book	Manoeuvring book.
Calling-in-point (CIP)	(see way point)
"Correction"	An error has been made in this transmission, the corrected version is...
Dragging (of anchor)	An anchor moving over the sea bottom involuntarily because it is no longer preventing the movement of the vessel.
Dredging anchor	Vessel moving, under control, with anchor moving along the sea bottom.
Draught	Depth from waterline to vessel'sbottom, maximum/deepest unless otherwise specified.
Established	Brought into service, placed in position.
ETA	Estimated time of arrival.
ETD	Estimated time of departure.
Fairway	Navigable part of waterway.
Fairway speed	Mandatory speed in a fairway.
Foul (anchor)	Anchor has its own cable twisted around it or has fouled an obstruction.
Foul (propeller)	A line, wire, net, etc. is wound round the propeller.
Hampered vessel	A vessel restricted in her ability to manoeuvre by the nature of her work.
Icing	Formation of ice on vessels.
Inoperative	Not functioning.
Mark	General term for a navigational mark, e.g. buoy, structure or topographical feature which maybe used to fix a vessel's position.
Offshore installation	Any offshore structure (e.g. a drilling rig, production platform, etc.) which may present a hazard to navigation.
Receiving point	A mark or place at which a vessel comes under obligatory entry, transit, or escort procedure (such as for port entry, canal transit or icebreaker escort).
Reporting point	(see way point)
Vessel crossing	A vessel proceeding across a fairway/traffic lane/route.
Vessel inward	A vessel which is proceeding from sea to harbour or dock.
Vessel leaving	A vessel which is in the process of leaving a berth or anchorage. (When she has entered the navigable fairway she will be referred to as an outward, inward, crossing or turning vessel.)
Vessel outward	A vessel which is proceeding from harbour or anchorage to seawards.
Vessel turning	A vessel making a LARGE alteration in course, such as to stem the tide when anchoring, or to enter, or proceed, after leaving a berth, or dock.
Under Keel Clearance UKC	The depth of water allowed for, under the keel for safe navigation.
Way point	A mark or place at which a vessel is required to report to establish its position. (Also known as reporting point or calling-in point.)

2 Terms used in ships' routeing

Attention is drawn to the following terms which are regularly used in communications regarding ships' routeing and are denned in the General Provisions on Ships' Routeing *(Assembly resolution A.572(14)):-*

- Routeing system
- Traffic separation zone
- Separation zone or line
- Traffic lane
- Roundabout
- Inshore traffic zone
- Two-way route
- Recommended track
- Deep water route
- Precautionary area
- Area to be avoided
- Established direction of traffic flow
- Recommended direction of traffic flow

3 Abbreviations used in this guide

ARPA	Automatic Radar Plotting Aid
COLREGS	Collision Regulations
CPA	Closest Point of Approach
ECDIS	Electronic Chart Display and Information System
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
ICPCS	International Convention for Preventing Collisions at Sea
ICS	International Chamber of Shipping
IMO	International Maritime Organization
MARS	Marine Accident Reporting Scheme
MF	Medium Frequency
OOW	Officer of the Watch
SatComms	Satellite Communications
SatNav	Satellite Navigation
SAQ	Self Assessment Question
SEASPEAK	Standard phrases in the IMO Standard Marine Navigational Vocabulary
SOLAS	Safety of Life at Sea Convention
TSS	Traffic Separation Scheme
VHP	Very High Frequency
VTS	Vessel Traffic Service
3/O	Third Officer

BRIDGE WATCHKEEPING

Annex 9 — LOG BOOK ENTRIES

Instructions for keeping the Deck Log Book — a company example.

1) An original numbered page is never to be removed from this book as, in the event of any proceedings, legal or otherwise, it is the only Log Book which will be accepted as evidence.
2) Only those abbreviations shown in paras 12 and 13 below, page (iii) of this log book and H.O. 5011 may be used.
3) When at sea and in port, the Deck Log is to be written at the end of each Watch and is to be initialled.
4) When at Anchorage, Harbour or Port, particulars of the Berth occupied are to be inserted in Columns (1) to (4) inclusive.
5) Details such as Gyro Errors, Pilot Names, Tugs, Times of True and Statistical Arr./ Dep., Anchor Bearings, R.P.M. if appropriate. Log if appropriate. Radar Watch maintained, 2 hourly D.R. Positions, should be inserted in column (11).
6) If there is insufficient space in the Remarks section, insert a gummed paper strip.
7) All bearings and courses are to be expressed in Degrees (True).
8) Completion of the headed columns and spaces together with concise remarks must be such that it will always be possible to form an accurate appreciation of all that took place. From navigational entries, it must also be possible to calculate the ship's position at any given time.
9) The following emergency exercises, drills and instructional sessions should be recorded on pages (iv) at the beginning of the log book:-All equipment tests as required by Fleet Regulation C19 Accident Boat Exercises Boat Lowering Exercises
General Emergency Drills for Passengers/Crew Safety
Instruction of Newly Joined Crew Watertight Door Instruction
10) Both at SEA and in HARBOUR, particulars of the following are to be recorded under "Remarks":-
Ballast Tanks, emptying and filling of Berths
Bridge Equipment and Steering Gear, testing of Bunkering
Operations
Burial of the Dead, name, description, sex and age of deceased. Ship's position if at sea. If landed, where ashore Casualties
Clocks, synchronisation of Bridge and Engine Room Deaths, name, cause, description, sex and age of deceased. Ship's position if at sea Double Bottom Tanks, emptying and filling of (incl. Bunkering times) Emergencies
Emergency Drills, showing time and nature of drill. (Full details should be written in summary on page (iv)
Incidents of Importance or of an Unusual Nature Lookouts, time of posting
when anchored in restricted visibility Notice to Engine Control Room for
Stand By Engines Rounds, record of visiting by Fire Patrol/OOW Opening
and Securing of Shell Doors, ship side openings Weather and Sea State
particulars
11) WHEN AT SEA AND WHEN ENTERING AND LEAVING HARBOUR, particulars

of the following in addition to those referred to in para 9 are to be recorded:-
Arrival and Departure, a narrative covering all salient points
Anchor Bearings
Anchoring, time of. Details of anchor used, cable veered and depth of water. Time of weighing anchor
Average speed and distance between ports
Bearings of Navigational marks and features
Engine Movements, principal orders unless automatically recorded, R.P.M. ordered
Inspection of Quayside, Fleet Regulation ... refers
International Regulations, compliance with in restricted visibility
Pilots, times of embarkation/disembarkation, advice taken. Pilotage charge
Positions, method of obtaining (e.g. Sat, Radar, Decca, Obs.)
Restricted Visibility, time of encountering, precautions and actions taken
Speed adjustments other than normal manoeuvres, (e.g. Embarking Pilots, passing dredgers, ships alongside, etc.)
Stations for entering and leaving harbour, times of
Stopping of Main Engines and reduction of programmed speed for any reason
Tugs, times of securing, letting go or in attendance
Visibility, time of deterioration and improvement
Watertight Doors, times of opening and closing, operational mode

12) With reference to para 2, the following abbreviations are approved for use either singly or together:-

ROE Rang on full speed

A/C	Altered Course	F	Fahrenheit	RPM	Revolutions per minute (ME)
Ahd	Ahead	FP	Fore Peak Tank	R/T	Radio Telephone
Ampi	Amplitude	FW	Fresh Water	Sat	Satellite position
AP	After Peak Tank	Fwd	Forward	SBB	Stand by below (ME)
An-	Arrival/Arrived	FWE	Finished with Engines	SD	Safety of Dock
Av	Average	GM	Distance between the meta-centre & the centre of gravity	SP	Speed
Ast	Astern				*Ahead Movements*
Az	Azimuth	HMS	Her Majesty's Ship	Full Sp	Full speed
Bar	Barorneter/s	hms	Hours, minutes, seconds	½ Sp	Half speed
Brg	Bearing (True)	IFO	Intermediate Fuel Oil	Slow	Slow
BT	Ballast Tank	KG	Height or centre of gravity	DS	Dead Slow
BW	Breakwater	LB	Lifeboat		*Astern Movements*
By	Buoy	LT	Local Time	Full Ast	Full Speed Astern
C	Centigrade	Max	Maximum	½ Ast	Half Speed Astern
c	Cable/s C/i°s of nautical ml)	m	Metres	SlwAst	Slow Astern
CI	Clutched in	MDO	Marine Diesel Oil	DSAst	Dead Slow Astern
Co	Course (True)	ME	Main Engine	SS	Steamship
(D)	Decca fix	MFO	Marine Fuel Oil	Stbd	Starboard
DB	Double-bottom tank	Min	Minimum	T	True Course
Dec	Declutched	MS/MV	Motor Ship/Motor Vessel	TK	Tank
Dep	Departure/Depart	NT	New Time (after an alteration of docks	VMO	Various to Master's Orders
Disch	Discharge, Discharged, Discharging	Obs	Observations	(VMO	Various to Master's
Displ	Displacement tonnage	Obsd	Observed	(& PA	Orders & Pilot's Advice
Dist	Distance	PA	Position Approximate	WB	Water Ballast
DR	Dead Reckoning	PDS	Piped down stations	WTD	Watertight Door
ER	Engine Room	(R)	Radar (eg (R) Brg 105° = Radar bearing 105°	Z	GMT
E/S	Echo Sounder				

13) In addition to the abbreviations laid down in para 12, the following signs and symbols may be used:-

	Abeam (Port or Starboard as indicted by arrow)
	Anchor
°	Degree of Arc or Temperature
'	Foot/Feet, Mile (Nautical), Minutes of Arc as indicated in context
"	Inch/es or second/s of Arc
$^{45}/_{15}$	The upper figure shows length of cable veered. The lower indicates depth of water obtained by sounding at time of anchoring

NOTE: a) Astronomical observations in the Nautical Almanac may be used
b) Navigational abbreviations as prescribed in the Mariner's Handbook N.P. 100 and B.A. chart 5011 may be used

14) Prior to departure from each port, positive reports are to be made to the Captain in accordance with Fleet Regulations:-

REGULATION NO.	REPORT	REPORTING OFFICER
	Navigation and bridge equipment	Officer of the Watch
	Stability condition	Deputy Captain
	Safety equipment	Chief Officer
	Main and auxiliary machinery	Chief Engineer
	Securing of shell doors/openings	Nominated Officer/CPO
	Hatches, scuttles, deadlights	Senior Officer of the Watch
	Passenger and crew numbers	Purser

Times of receipt of the above reports are to be entered in the appropriate columns on page 2 together with any pertinent comments in the remarks column and initialled by the Captain in column viii prior to true departure confirming receipt of these reports.

These guidelines are published courtesy of P & 0 Cruises (UK) Ltd.

BRIDGE WATCHKEEPING

SAQ ANSWERS

1. This is possibly the most dangerous situation under the Rules. In fog the other vessel cannot know that I am constrained by my draught and I have very little room in which to manoeuvre. I would call the Master, set up a careful watch on radar and work out the best manoeuvre in the water available, sounding the fog horn
   When the Master comes to the bridge I would brief him on the situation with own course and speed and the course and speed of the target vessel. If the Master was unable to come to the bridge and if risk of collision existed at, say, 15 knots, I would reduce the speed of the ship as quickly as possible by stopping the engines, applying helm hard a starboard, hard a port to assist speed reduction within the channel limits and watch the other vessel closely.

2. Notify the pilot IMMEDIATELY, re-ring the telegraph and call the engine control room. If there was no response I would expect the Master and pilot to use the emergency stop and use the anchors if necessary. I would record the time in the manoeuvring book

3. As OOW I have a duty to query any unexpected deviation from the pilotage plan. I would therefore:-
   Ask the pilot if the action was intended
   If appropriate ask the pilot to check the heading at the steering position to verify any compass error
   If I was concerned about any deviation from the plan or the safety of the ship I would call the Master

4. Records are necessary to establish trends. Without records it is not possible to know when an instrument has an error, if I have made a mistake or if the ship is out of position or steering a wrong course

5. The course alteration should take place at a time when it is safe in terms of the position of the ship and the traffic in the area. If the OOW is in doubt as to when he can accomplish this course alteration he should inform the Master of the circumstances

6. Monitoring ground speed and revolutions

   Warning that the tide is changing

7. The gangway was up and clear of obstructions
   The vessel was singled up
   No pipes, hoses, nets, telephone lines or cables were connected to the shore
   Cranes, chicksans, derricks, gantries and other cargo related equipment was clear

8. Rule 9 states that a vessel proceeding along the course of a narrow channel or fairway should keep as near to the outer limit of the channel or fairway, which lies on the starboard side, as is safe and practicable. Other small vessels shall not impede my passage but I would keep a vigilant lookout to avoid collision in a crossing situation. Rule 10 states that I shall proceed in the appropriate traffic lane in the direction of traffic flow for that lane. If there is crossing traffic I must comply with the rules for vessels in sight of one another, or in fog comply with Rule 19

9. The Rules requires fog signals to be sounded
   It is quite common for ship's radars to break down and there are many small vessels

and leisure craft which do not have radar and may not be seen on my radar. Sounding the whistle or fog horn is the only way they can detect our presence

10. This varies from ship to ship in still water but the information for your ship should be available on board. It is usually much further than originally thought. Having obtained the answer, note it in the answer column and compare it with other ships.

11. If there was an emergency I would call the Master to the bridge immediately and explain the situation when he arrived. For routine items I would be prepared in advance giving a summary of the circumstances for making the call

12. Note down what the International Convention states in Article 27 Annex 2

13. Gyro Course 092°, Compass Course 098°

14. Only in real emergencies where there is no time to telephone or sound the whistle. The most likely times to sound the alarm would be when the OOW needs urgent assistance or when the vessel is in immediate danger and when other methods of calling personnel are inadequate

15. The helmsman or the automatic pilot is steering the correct course
The standard compass error is determined at least once a watch and, when possible, after any major alteration of the course; the standard and gyro compass are frequently compared and repeaters are synchronized with their master compass
The automatic pilot is tested manually at least once a watch
The navigation and signal lights and other navigational equipment are functioning
fix the ship's position
The change-over from automatic to manual steering and vice-versa should be made by, or under the supervision of, a responsible officer
The alertness of the lookout
Changes in the weather and barometric pressure
Weather forecasts

16. Slips and lapses, knowledge based mistakes, violations of rules and instructions and incorrect responses due to cultural conditioning

17. I would call the Master in accordance with instructions. I would post a lookout to assist with searching for other vessels and fishing vessels in the vicinity
I would have the depth recorder running and the maximum number of radars running
I would ensure that the GPS was working. If there was a problem with other equipment I would consider using the radio direction finder
I would follow the policy on the closing of water tight doors

18. Getting local navigation warnings

19. By familiarising myself with the intended pilotage passage and the tracks laid down on the chart in accordance with the pilot's briefing
I would then know the intended courses to be steered and I could then establish the ship's speed and monitor progress
I would independently fix the ship's position and note the times of passing buoys
I would note the distance off radar conspicuous land
I would monitor the depth recorder against the chart
I would observe traffic

20. The STCW Convention resolution on Bridge Watchkeeping (Annex 2) Company navigational instructions

Master's Standing Orders
Master's Night Orders
Master's verbal orders

21. To read, understand and sign the Master's standing orders
To check the ship's position, course planned and the course being steered, by gyro and magnetic compass
To check the errors of the compasses
To verify the speed and draught of the ship
To observe prevailing weather and sea conditions, visibility, sea-state and tides
To understand the operational state of all navigation equipment
To be made aware of the presence and movement of all traffic in the vicinity
To be informed of the conditions and hazards likely to be encountered during the watch
To be aware of the effects of heel, trim, water density and squat on the under keel clearance
To understand the state of internal ship systems, engine and cargo monitoring, communications and crew availability
To ensure that the required lookout and helmsman, as appropriate, are on duty, alert and properly instructed

22. I would call the Master in accordance with his Night Orders which would probably include any alter course or way points
His requirements for being told about vessels with a CPA of less than (one) mile
If the weather deteriorates
Any potentially dangerous situation which might develop
Any significant equipment failure

23. My first action would be to change over the steering gear and call the Master. If changing the steering gear was not effective I would consider stopping the engines I would then hoist two black spheres by day and two red lights at night to warn other ships. I would also broadcast the emergency on Channel 16 and consider using the aldis to send • • — Uniform to advise ships if they were standing into danger

24. I would look for guidance in the company's instructions and the inside cover of the log book. I would consult the Master and other senior officers on the items to be entered, their frequency and layout and consult Annex 9

25. I would note the ship's position and work out where I would expect the ship to be at the end of the watch
I would examine the track and note that it correctly 'followed on' over any chart changes
I would verify the track and the compass courses covering my watch
I would note buoys, lights or any other conspicuous navigational mark that
I would expect to see in the next half hour
I would note the expected tidal set
I would look to see what night orders the Master had provided and mark on the chart when he requests a call

26. Encountering restricted visibility
Traffic/collision situation
Difficulty in maintaining course
Failure to sight land/navigation mark at ETA
Land/navigation mark sighted unexpectedly
Breakdown of engines/steering gear
Encountering heavy weather/damage

Unexpected hazards such as ice or derelicts
Any emergency situations

27. Until land is sighted and navigational landmarks or lights are properly identified there will be doubt about the ship's position relative to land I would work out the ETA for the expected landfall

28. By taking a compass bearing of the approaching ship or by taking a radar bearing from a compass stabilised radar

29. Supervising the rigging of the pilot ladder and embarkation of the pilot

30. The handing over of the bridge watch must be deferred until the action is completed and the vessel is in a safe condition for the relief of the watch to take place

31. Calling channels can be found as follows:-
The Admiralty List of Radio Signals
Guide to Port Entry
The chart
The VTS manual
Local notices
Company Instructions
If in doubt I would call on Channel 16 and transfer

32. The eye has the following advantages:-

Reliable
Sensitive to colour
Can assess heading
Can identify small targets
Can see light configurations
Can assess ship types
Can identify conspicuous marks
Can identify flashing lights
Has better discrimination
Can see changing weather patterns
Can see effect of sea on vessel
Not affected by blind arcs (if observer moves)

33. The draught (forward and aft), the non-availability of equipment, the date, port and displacement and any defects which might affect the navigation of the ship

34. On large ships this is necessary to reduce the free fall speed (the anchor is lighter in water and there is more resistance). Also it avoids damaging the bulbous bow if fitted. It also ensures that the cable is free in the cable locker. Lowering the anchor out of the hawse pipe is particularly important in confined anchorages

35. Pre-planning the turn
Noting the wheel over position on the chart Advising
the pilot at the wheel over position Monitoring the
helmsman's actions

36. Convincing the OOW of the need to call the Master when required

37. In the IMO Standard Marine Vocabulary bearings are always given FROM the vessel. So my ship is 135° from the pilot vessel at a distance of two miles I would therefore expect to see the pilot vessel on a reciprocal bearing of 315° FROM my ship at a distance of two miles

38. The compasses and bridge equipment generally The briefing of the look out and the ship's routine Also, in coastal waters, I would control the navigation of the ship

39. Equipment error checks. Where possible I would compare one instrument with another to identify an error, that is check the gyro with the standard compass, the GPS with a radar or celestial fix

40. I would make a quick lookout around the ship to ensure the ship was not at risk. I would then inform the Master and next alert the leader of the emergency response team and the designated medical officer

41. Check that the largest scale chart is available, corrected up to date with the passage plan details and that future charts are stored in the right sequence Record tidal information for the time of departure The latest weather forecast should be available The log books, chart equipment and other relevant publications are ready for use All bridge recorders have adequate paper and are ready for use All time related activities are updated from the time of departure The pilot card is completed with up to date information Bridge and Engine Room clocks are synchronized

42. Rule 18 states that I must keep out of the way of:-A vessel not under command A vessel restricted in her ability to manoeuvre A vessel engaged in fishing A sailing vessel

43. Warning the pilot cutter of the ETA

44. An overside arc light and a torch

45. There are three principles:-
First — plan ahead — so that a situation can be compared with an estimate. This applies to navigation and calculations
Second — Cross check with additional information — for example I would always try to use more than two position lines to establish my position with certainty. If there was a large 'cocked hat' I would choose the position nearest to danger until I could obtain a more accurate position
Third — Ensure any action taken is having the desired effect — for example I would monitor an alter course or the effect of an alter course to avoid another vessel

46. The long range from time to time
Also I must verify the range each time I examine the screen in case the Master has changed it from a previous setting
Also I would check the speed input, particularly if this is being fed in manually

47. (a) The regular interval between fixes such that if an error has occurred there will be time to correct it before the ship might run aground. The fix interval is more frequent in confined waters
(b) The combined speed of wind and tide is about 1 plus 3=4 knots. The distance to the sand bank is one mile. To cover the worst situation, the fix interval would be 15 minutes, or in practice 10 minutes to give time to correct any adverse effects.

Once the fix interval got below 10 minutes I would use pilotage techniques

48. This varies with size, but typically for a VLCC or Super Container Ship a speed of 1 knot should not be exceeded

49. It is important not to become distracted when busy. I would therefore make notes of times and positions in my notebook and write up the log at the end of my watch, after I was relieved. I understand that a notebook used for this purpose may be required as admissible evidence in court. I would therefore keep it tidy and only use it for this purpose.

50. By checking the plan, asking the pilot and consulting the Admiralty Guide to Radio Signals if the information was not available elsewhere

51. Small wooden and glass reinforced plastic vessels are very bad for reflecting radar waves and may not return a strong enough echo. Where an echo is weak it can easily be lost in clutter and cannot, therefore, be detected.

52. A brief description of the most critical threat and my intended actions followed by a general summary of the situation

53. Getting warning of tidal streams and measuring tracking with radar parallel indexing Adjusting course for set

54. I would check it again to confirm my own suspicion. If it was a critical error, for example a wrong track in confined waters, I would point it out to the Master and pilot, ask them to verify the error, and then correct it

55. A lot depends upon which side to. For example, the gangway has to be turned out, the moorings prepared and the cargo manifolds or gantries aligned. Also, the preparations to take bunkers and a fresh water lighter may need to be considered as well as power and communication lines Preparing to berth a ship on one side and then having to change arrangements to the other, causes extra work and is inconvenient.

56. When the pilot is picked up or disembarked an officer must be in attendance with radio communication to the bridge. A second crew member should also be in attendance in case of an emergency

57. On hearing the general alarm all crew members should proceed immediately to their emergency stations

58. The watch system shall be such that the efficiency of watchkeeping officers and ratings is not impaired by fatigue

59. I would post a look out:-
In accordance with standing orders
When the visibility deteriorates
When I need to be occupied with bridge work which requires special attention
Whenever extra assistance is required
If there was an emergency, like man overboard

60. The lights are visible two miles. At twenty knots I would expect to see them just 6 minutes before reaching the sailing vessel

61. Visual and radar searching for ships

Getting warnings of ship movement and measuring prospect of collision

62. Azimuth of the sun
Amplitude of the sun
Azimuth of the moon
Amplitude of the moon
Azimuth of the planet
Azimuth of the star
Azimuth of the Pole Star

63. To free the mind
To keep an accurate record of events
To establish trends
To provide evidence in the event of an incident

64. If the bottom of the ladder was in the water it would be caught by the movement of the sea, particularly if the ship was moving through the water. This would be dangerous and could cause the pilot to be thrown from the ladder

65. I would:-
Monitor communications
Comply with the COLREGS for a vessel at anchor
Maintain a security watch

66. Call the Master and the appropriate officer forward. Maintain steering (there is usually an emergency system). If the internal communication system had failed I would use hand held radios to communicate with the foc's'le. I would then switch on two red lights on emergency power

67. By taking transits or verifying heading marks by a compass bearing

68. Discuss the plan
Provide bearings and distances
Control and monitor the engines
Monitor the steering
Keep a good look out for other ships moving
Relay messages

69. Each department will have work to do prior to arrival:-
1 would advise the engineers who will want to prepare for manoeuvring
Inform the Officer forward who will want the anchors and mooring arrangements fully operational
The Master will want the pilot ladder in readiness and there may be cargo operations to consider
Comply with coastal State reporting scheme
Advise the pilots
Report to the VTS if appropriate
Check the bridge and navigational equipment.

70. I would immediately release the bridge wing smoke marker floats Sound the general alarm
Try to ensure the man stays in sight by posting lookouts Turn the vessel to facilitate recovery
Log the time and note the position of the ship in case a search is needed Mark the waypoint on the SatNav if fitted Put the engines on stand by

Be ready to brief the Master when he comes on the bridge
Broadcast a MAYDAY MAYDAY MAYDAY message
Sound three long blasts "O" to warn other ships if they are in the vicinity

71. Warn the crew in time to secure tugs

72. There is uncertainty about the identification of the approaching vessel, particularly in multiple ship encounters at night, and in conditions of poor visibility. The OOW on the other ship may not be able to understand my language I might waste a lot of time trying to establish contact when I could have taken action in accordance with the Rules earlier, the time spent establishing contact might itself cause a close quarters situation

73. Positive reporting means reporting personally in response to an order.
When positive reporting is required by the Master I must carry out the duty and report back verbally to the Master personally to assure him that I have actually undertaken and completed the required task.

74. The Master of every ship is required to issue standing orders in writing, to be formally acknowledged and signed by each navigating officer prior to the commencement of the voyage

75. The following information is usually required by the Master at noon:-

The most accurate position of the ship

The day's run

The daily average speed

The total distance sailed

The general average speed

The distance to go to the next port

The ETA

76. In coastal waters, clear of obstructions, collision avoidance must take priority as this provides the most immediate threat. It is desirable to have a regular fix interval as this makes the estimation of the next fix position easier — but this is not essential

77. Warning the pilot cutter of approach and speed, and which side the ladder is rigged

78. Call the Master and ask for clarification

79. If I thought the ship might be put into danger from a situation I could not control, for example:
A give way vessel standing on
A sudden increase in traffic density
Deteriorating visibility
The malfunction of any essential navigational equipment, e.g. radar, steering gear
Reported problems with the engines
Any emergency onboard
I would, of course, call the Master in accordance with his instructions

80. Undertake to plot the vessel with at least three observations and take appropriate evasive action, informing the Master if appropriate. In this case the most likely action would be a bold alteration of course to starboard having first checked this would not endanger other vessels or risk putting the ship aground. When I had made sure that the alteration had achieved the desired effect and that there was no further danger I would resume my course

When appropriate, the controllable pitch propeller control system is verified and the thrusters operational.

93. Sound the whistle, flash the aldis and try calling on VHF to get the other ship to recognise it was standing into danger. Use the engines or use the rudder to create a sheer. Call the Chief Officer to go forward urgently to let go the brake. Inform the Master as early as possible

94. Record the information contained in the MAYDAY or PAN message, try to establish contact with the source and then call the Master. I would endeavour to plot the position of the casualty and the ship's position in preparation for any follow-up action

95. Under no circumstances is the OOW to sign the Master's orders until he fully understands the Master's instructions. If in doubt, I would call the Master for clarification of the orders

96. The steering system works on the principle of a control system When steady the system is stable When the helmsman puts on, say, 10° of starboard rudder the signal is sent to the steering gear and to an additional piece of equipment called the hunting gear. This detects when the rudder is situated 10° to starboard and feeds back this information to the steering motor which stops turning the rudder Without the feedback or corrective mechanism provided by the hunting gear the rudder would be uncontrollable

97. Monitoring the weather Monitoring the radar
Verifying ship's position by other means

BRIDGE WATCHKEEPING

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THE NAUTICAL INSTITUTE

THE NAUTICAL INSTITUTE is an international professional body for qualified mariners whose principal aim is to promote a high standard of knowledge, competence and qualifications amongst those in charge of seagoing craft.

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